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Saint-Gobain NorPro’s (formerly Norton Chemical Process Products Corporation) dedication to providing state-of-the-art mass transfer equipment has resulted in major developments with packed tower internals. Liquid distribution has long been regarded as the key to precise packed tower performance. Saint-Gobain NorPro made the commitment to determine what factors are really important toward “perfect” liquid distribution. We installed a 10 ft [3 m] diameter by 40 ft [12 m] tall hydraulic simulation column at our research facility. With this column, we study the effects of various liquid and vapor flow rates. The result: Saint-Gobain NorPro confidently designs internals for any size tower from the beginning without the need to test each internal before shipping, although such testing is available on request.

We recognize that not all packed towers require state-of-the-art liquid distribution uniformity. For those towers, we still offer our traditional style internals. The traditional style internals have been used for many years in services that require materials ranging from carbon steel to zirconium, thermoplastics, fiberglass, graphite and ceramics.

This guide is intended to assist in the selection of appropriate tower internals for use in packed towers. The wide range of applications does not allow us to cover all the choices and variation Saint-Gobain NorPro offers. As always, we offer our expertise in custom design of proper equipment for your exact requirements. Call on our application experience to help solve your mass transfer needs.
**Introduction**

Liquid distributors are used in packed towers above each bed of packing. The liquid distributor is located above the bed, usually 6 to 8 in. (150 – 200 mm) above the packing. This provides sufficient space for the gas to disengage from the bed before it passes through the distributor.

An ideal distributor possesses the following attributes, each with a specific effect on the overall performance of a packed tower:

- Uniform liquid distribution
- Resistance to plugging or fouling
- Proper turndown capability
- Low gas pressure drop
- Minimal distributor height to allow more packed bed heights
- Cross-mixing capability

The introduction of high performance tower packings in the early 1980s accentuated design deficiencies of distributors available at the time. In response, Saint-Gobain NorPro introduced distributors with attributes designed to correct these deficiencies. These attributes are well-understood by us and have been incorporated in NorPro™ Intalox® distributors.

We offer two major categories of liquid distributors to meet the requirements of specific applications. In determining which category to choose, it is necessary to know how sensitive the tower performance is to distribution uniformity. Will a slight variation of distribution quality significantly affect the tower performance?

**As a rule:**

- **NorPro Intalox distributors...**
  Used primarily for distillation services, typically where a high-efficiency packing (IMTP® random packing, Intalox® wire gauze or Intalox® structured packing) is used. Deep beds of any type of packing require Intalox® distributors to maximize performance.

- **NorPro traditional distributors...**
  Used for most absorption, stripping, and heat transfer services. Services where a traditional packing (Pall rings, Hy-Pak® packing, Intalox® saddles, Raschig rings, etc...) is used will usually use these less costly distributors.

Redistributors share the same mechanical design characteristics as distributors, but they also include gas riser covers and possibly wall wipers to collect all liquid raining down from the packing above. The question of when to redistribute liquid is not easy to answer.

There are four reasons to have more than one bed of packing in a tower: feed introduction, liquid cross-mixing, distribution correction and product side-draws. Introduction of a feed (liquid or vapor) into a tower with packing above and below nearly always requires a split in the beds for a redistributor.

An important factor to keep in mind with the introduction of an external feed is that of mixing (homogenization of composition or temperature). Mixing of liquid should be considered when:

- A tower has deep beds or;
- A feed is sub-cooled more than 30° F [17° C] or;
- A feed composition differs from the internal flow

Cross-mixing is an optional feature on most of our trough-type redistributors. By eliminating the need for liquid collection in a separate collector plate, the cross-mixing option saves equipment and frees tower space for more packing.

Based on our operating experience, a conservative rule-of-thumb to use when determining maximum depth is: A packed bed should be no higher than 15 times the tower diameter and contain less than 20 theoretical stages. With proper attention to initial distribution uniformity, bed depths may be greater. However, we do not recommend exceeding this limit without consulting a Saint-Gobain NorPro technical representative.
Distribution Quality

Perfect liquid distribution could be defined as providing equal liquid rate per unit area of the packed bed surface. Many practical factors restrict the achievement of this. Liquid can be applied by sprays, weirs, or orifices. Sprays can almost totally wet the surface of a packed bed, but the point-to-point flow variation is high. Weir distributors provide discrete streams but flow variation is difficult to control. Orifice distributors direct liquid to packing in discrete streams. “Perfection” requires an infinite number of streams each of equal flow. However, orifice size, fouling considerations, and mechanical construction details prevent high unit area point count from being achieved.

Intalox distributors aim toward “perfection”:

(a) Orifices are laid out on a triangular pattern, (preferred) or on a square pattern, uninterrupted by gas chimneys or mechanical supports, properly spaced to the vessel wall.

(b) Liquid flow from each orifice is nearly equal to all others.

NorPro “traditional” distributor patterns are not as good as Intalox patterns. The number of distribution points per unit area is generally below that of an Intalox distributor. Flow variations among the distribution points are greater than allowed for Intalox distributors. However, the traditional distributors have been used successfully for many years in a wide range of processes.

Saint-Gobain NorPro developed a distributor rating system for quantifying distribution quality, or performance. We rate distribution uniformity as a percentage, where 100% indicates ideal uniform distribution and low percentage ratings indicate that parts of the tower receive a liquid flow significantly different from other parts. For more information regarding our rating system, request a copy of the publication, “Liquid and Gas Distribution in Commercial Packed Towers.”

The significance of our distribution quality rating system is that the distributor rating correlates with tower performance. A tower containing deep beds of high-efficiency packing is sensitive to liquid distribution quality, whereas a tower containing shallow beds of a traditional packing is less sensitive to distribution quality.

![TOWER PERFORMANCE CORRELATES WITH DISTRIBUTION QUALITY](chart)

Intalox distributors are always recommended in:

- High purity product distillation services
- Distillation services operating close to minimum reflux
- Heat transfer services with close temperature approach
- Services with high stage count per bed
**Liquid Distributors**

**Point Count**
The number of distribution points per unit area has an influence on the efficiency of the uppermost part of a packed bed. When using larger packings, with relatively low efficiency, the effect of the number of distribution points is insignificant. However, the effect can be considerable when using smaller, high-efficiency packings.

Saint-Gobain NorPro has established guidelines for Intalox distributors with high-performance packings as shown below.

In practice, a lower number of distribution points per unit area may be the only way of achieving acceptable orifice diameters. The number of distribution points per unit area can be designed as required; however, mechanical considerations usually limit the number to about 18.6 pts/ft² [200 pts/m²].

**Cross Flow**
As the liquid rate on a distributor is increased, its cross flow capability and its primary (pre) distribution system become more important.

The cross flow capability of a distributor reflects its ability to balance liquid from one part of the distributor to another. It is important to balance liquid on all gravity-fed distributors. However, at high specific liquid rates the liquid cross flow capacity must be large to correct for system imperfection.

The primary distribution of liquid into a distributor has been shown to have a significant effect on overall distributor performance. It is important that the feed system meters flow to one or more appropriate points without excessive turbulence or horizontal velocity. This is achieved by use of feed pipes and/or parting boxes. The design of the primary distribution system becomes increasingly complex as the specific liquid rate and the column diameter increase.

**Fouling**
If a distributor is to perform correctly it is important that metering devices (orifices or weirs) do not become fouled, since fouling significantly reduces packing performance.

There are several mechanisms of distributor fouling: polymerization, sedimentation, coking, scale, debris, etc. All precautions to eliminate fouling outside the column should be adopted since external strainers are far easier to clean than distributors. Regardless, the distributor should be considered for its degree of fouling resistance.

V-shaped weirs are less prone to blockage than orifices; orifices in a side wall are generally less prone to blockage than orifices in the bottom of a distributor; orifices protected by an orifice strainer are less prone to blockage by a particulate material than unprotected orifices. Orifice strainers are not recommended in systems that tend to coat surfaces.

NorPro Intalox distributors with bottom orifices are not normally recommended for orifice sizes of 0.25 in. (6 mm) or less due to their fouling propensity. Intalox distributors designed with weirs may have flow variation outside the high-performance range.

The list below ranks the fouling resistance of the various metering arrangements at any given flow rate (most resistant - top, to least - bottom):
- "V" weir/spray
- Slotted weir
- Side wall orifice with orifice strainer
- Side wall orifice
- Bottom orifice with orifice strainer
- Bottom orifice

Orifice strainers can protect a distributor from fouling with particulate matter such as wall/pipe scale. Each orifice's flow passes through a higher-surface-area strainer before approaching the metering orifice. However, orifice strainers are not effective when fouling material pastes, coats or sticks to metal. Other effective methods of protecting distributors from fouling include using sidewall orifices (positioned up from the bottom of the distributor) or using weirs.

### Intalox Distributor Point Count

<table>
<thead>
<tr>
<th>IMTP Packing No. 25/40/50/60/70</th>
<th>IMTP Packing No. 35</th>
<th>Intalox Structured Packing 1T</th>
<th>Intalox Structured Packing HS-10 / HS-20</th>
<th>Intalox Wire Gauze Packing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6 - 7.5 pts/ft² 60 - 80 pts/m²</td>
<td>5.6 - 9.3 pts/m² 60 - 100 pts/m²</td>
<td>7.9 - 10.2 pts/ft² 85 - 110 pts/m²</td>
<td>9.3 - 11.1 pts/ft² 100 - 120 pts/m²</td>
<td></td>
</tr>
</tbody>
</table>
Operating Range
A distributor will generally give its best performance at liquid rates close to 100% of design flow, with the performance deteriorating as the liquid rate is reduced. At 100% design flow, NorPro Intalox distributors usually give a flow variation at any point of the distributor of better than ±5% and at minimum rates better than ±8%. This will generally give an operating range of 2:1 for a single-level orifice distributor. If the minimum rate specification is such that a wider flow variation can be accepted, then a wider operating range is possible.

NorPro “traditional” distributors operate with much higher flow variations over a typically broader range of operations than Intalox distributors.

Figure 2 shows the flow variation for the flow through a single-level orifice. The use of a multi-level orifice enables the flow variation for the Intalox distributor to be maintained over a very wide operating range.

Special designs of Intalox distributors can be made for processes requiring lower flow variations. Designs of better than ±3% at 100% design rate and better than ±5% at a 2:1 turndown are feasible. These designs will generally include special primary distribution systems (feed pipes, parting boxes, etc.).

Orifice Size
In gravity-fed orifice distributors, the orifice size is dependent mainly upon the hole count, the specific liquid rate and the liquid head. For Intalox distributors with an operating range of 60 to 120% of the design flow, the approximate orifice size is indicated in Figure 3.
A specific Intalox distributor is chosen by considering tower diameter, flow rate, turndown ratio, available height and fouling resistance. Each distributor style features design options which adapt it to a particular application.

The table to the right provides a preliminary choice of a distributor suitable for your service conditions. A detailed description that will enable a final selection to be made is given on the following pages. Consult your Saint-Gobain NorPro representative for assistance or for final confirmation.

### SELECTING AN INTALOX DISTRIBUTOR

<table>
<thead>
<tr>
<th>Column Diameter in. [mm]</th>
<th>Specific Liquid Rate [gpm/ft², m³/h•m²]</th>
<th>System Characteristics</th>
<th>Suggested Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 - 36 [250 - 900]</td>
<td>&lt;0.3 gpm/ft² [0.75 m³/h•m²]</td>
<td>Low/High</td>
<td>136 Special</td>
</tr>
<tr>
<td></td>
<td>0.3 - 2 gpm/ft² [0.75 - 5 m³/h•m²]</td>
<td>Low/High</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>2 - 12 gpm/ft² [5 - 30 m³/h•m²]</td>
<td>Low/Medium</td>
<td>106</td>
</tr>
<tr>
<td></td>
<td>&gt;12 gpm/ft² [30 m³/h•m²]</td>
<td>Low/Medium</td>
<td>136 Special</td>
</tr>
<tr>
<td></td>
<td>&gt;0.8 gpm/ft² [2 m³/h•m²]</td>
<td>High</td>
<td>136 with weirs*</td>
</tr>
<tr>
<td>&gt; 36 [900]</td>
<td>&lt;0.3 gpm/ft² [0.75 m³/h•m²]</td>
<td>Low/High</td>
<td>186 Special</td>
</tr>
<tr>
<td></td>
<td>0.3 - 2 gpm/ft² [0.75 - 5 m³/h•m²]</td>
<td>Low/High</td>
<td>166</td>
</tr>
<tr>
<td></td>
<td>2 - 12 gpm/ft² [5 - 30 m³/h•m²]</td>
<td>Low/Medium</td>
<td>136 or 186</td>
</tr>
<tr>
<td></td>
<td>&gt;12 gpm/ft² [30 m³/h•m²]</td>
<td>Low/Medium</td>
<td>166</td>
</tr>
</tbody>
</table>

*Flow variation will be outside normal Intalox distributor parameters.*
The pan-type construction of the Model 106 Intalox distributor and Model 107 Intalox redistributor is designed for towers less than 36 in. [900 mm] ID with minimum liquid rates in excess of 2 gpm/ft² [5 m³/h·m²]. Lower rates can be accommodated but the Models 136/137 should be considered first. This distributor can be leveled. In towers less than 24 in. [600 mm] ID, one-piece construction, for installation through a body flange, is standard. A special multi-piece construction is available upon request.

Orifices in the pan bottom are arranged to provide optimum distribution quality, with gas risers set between the orifices. Small diameter pans may not have gas risers as gas passage is provided in the gap between the pan and the vessel wall. When used for higher flow rates, this distributor will have large orifices that will not tend to foul. For lower flow rates, orifice strainer caps or the Model 136/137 should be considered if the system is fouling. The standard turndown range is 2:1.

For single-phase liquid feeds to the distributor, a feed pipe to control feed velocity to the deck is required. Two-phase liquid and vapor feeds require a flashing feed device to adequately separate phases and assure proper liquid feed velocity. Refer to “Liquid/Vapor Feed Devices,” Section B, for selection assistance.

 Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
**Model 116/117 Intalox Deck Distributor/Redistributor**

- **Diameters greater than 36 in.** [900 mm]
- **Liquid rates above 12 gpm/ft²** [30 m³/h•m²]
- **Orifices in deck**

The Model 116 Intalox distributor and Model 117 Intalox redistributor are for towers with minimum liquid rates in excess of 12 gpm/ft² [30 m³/h•m²]. Lower rates can be accommodated by Models 126/127 or 136/137.

The deck-type construction allows good liquid cross-flow between gas risers which are set between orifices specifically spaced for distribution quality. Because this plate normally handles higher liquid flow rates, the orifices are usually large and do not tend to foul. The standard turndown range is 2:1.

For single-phase liquid feeds to the distributor, use a feed pipe to control feed velocity. Two-phase liquid-vapor feeds require a flashing feed device to adequately separate phases and assure proper liquid feed velocity. Refer to “Liquid/Vapor Feed Devices,” Section B, for selection assistance.

**Construction Details**

The Models 116/117 are available in any weldable sheet metal. Carbon steel is not recommended except for very high liquid rates where orifice corrosion will not significantly affect distribution quality. FRP construction is available, although it reduces distribution quality.

The Models 116/117 distributor are clamped onto an annular ring that is seal-welded to the tower wall, with clamps provided. Hence, distributor levelness is determined by the ring levelness; we consider levelness tolerances in the 116/117 design. All joints are gasketed. See Section G for ledge and material requirements.

The standard design for a Model 117 redistributor includes gas riser covers to collect and redistribute liquid raining from above.

**Design Options**

- Orifice strainers
- Anti-migration bars in gas risers
- Non-standard point count (See Page A-3)

**Model 116**

**Model 117**

Height varies with turndown.

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 126 Intalox distributor and Model 127 redistributor are designed for towers greater than 36 in. [900 mm] ID with minimum liquid rates in excess of 2 gpm/ft² [5 m³/h•m²]. Lower rates can be accommodated but the Models 136/137 should be considered first. For systems with liquid rates in excess of 12 gpm/ft² [30 m³/h•m²] the Model 116/117 should be considered first.

The trough-type construction allows easy liquid sealing and distributor leveling, which is essential in large diameter towers. Because this distributor normally handles intermediate liquid flow rates, the orifices are usually large enough to allow moderate fouling resistance. If the system is fouling and/or the orifices are small, orifice strainer caps or the Model 136/137 should be considered. The standard turndown range is 2:1.

For single-phase liquid feeds to the distributor, use a feed pipe to control feed velocity. Two-phase liquid-vapor feeds require a flashing feed device to adequately separate phases and assure proper liquid feed velocity. Refer to “Liquid/Vapor Feed Devices,” Section B, for selection assistance.

Standard design passes through 18 in. [450 mm] nominal manway.

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
- Diameters greater than 10 in. [250 mm]
- Side-wall orifices
- High turndown ratio
- Standard liquid rates between 0.3 and 12 gpm/ft² [0.75 - 30 m³/h•m²]

The Model 136 Intalox distributor and Model 137 Intalox redistributor are for towers greater than 10 in. [250 mm] ID with liquid rates between 0.3 and 12 gpm/ft² [0.75 - 30 m³/h•m²] where fouling protection and/or high turndown is required. Special designs can handle liquid rates from 0.08 to 0.3 gpm/ft² [0.2 - 0.75 m³/h•m²]; for these cases, the Model 120 strainer basket should be considered to protect the small flow orifices. Special designs can also handle liquid rates above 12 gpm/ft² [30 m³/h•m²].

The Models 136/137 are usually constructed as pans for diameters below 30 inches [750 mm] and as troughs for diameters above 30 inches [750 mm]. The standard turndown for a single sidewall orifice is 2:1; however, the turndown range can be extended by using two or three orifices at different levels of the same discharge point. Turndown ratios up to 10:1 are achievable. The liquid from each discharge point is conducted into the lower vapor velocity region below the distributor troughs. This results in low entrainment levels.

The resistance to fouling of this distributor is higher than that of deck-type distributors because it features a debris collection zone below the sidewall orifices. Weirs can be used as an alternative to orifices in high fouling systems. However, flow variation will be outside normal Intalox parameters.

For single-phase liquid feeds to the distributor, a feed pipe or a feed pipe/parting box combination is required to control feed velocity to the troughs. Two-phase liquid-vapor feeds require use of a flashing feed device to adequately separate phases and assure proper liquid feed velocity. Refer to “Liquid/Vapor Feed Devices,” Section B, for selection assistance.

The Models 136/137 are available in any weldable sheet metal. Carbon steel is not recommended except for very high liquid rates where orifice corrosion will not significantly affect distribution quality. Thermoplastic construction is available, although such construction reduces distribution quality.

The Model 136/137 rests on an annular ring or is suspended from beams or clips. All joints are gasketed. See Section G for ledger and material requirements.

All distributors and redistributors include overflow orifices which help prevent distributor flooding during liquid surges.

The standard design for a Model 137 redistributor includes a weld-on wall wiper on the vessel wall and gas riser covers to collect and redistribute liquid raining down from above.

### CONSTRUCTION DETAILS

### DESIGN OPTIONS

- Cross-mixing capability (in towers greater than 55 in. [1400 mm] ID)
- Orifice strainers
- Leveling screws
- Expandable and gasketed wall wiper (small Model 137)
- Non-standard point count (See Page A-3)

**Model 136**

**Model 137**

Height varies with turndown.
Diameters greater than 30 in. [750 mm]

Sidewall orifices with flow point multipliers

Liquid rates between 0.2 and 4.0 gpm/ft² [0.5 - 10 m³/h•m²]

The Model 166 Intalox distributor is for towers greater than 30 in. [750 mm] ID with liquid rates between 0.2 and 4.0 gpm/ft² [0.5 - 10 m³/h•m²]. The troughs on the Model 166 liquid distributor meter liquid accurately at 0.8 - 2 points per ft² [9 - 20 points per m²] through sidewall orifices. Because of the low point density, the sidewall orifices are as large as possible for fouling resistance. The conductor tubes from each metering orifice discharge the liquid to spreading plates or channels that greatly multiply the 0.8 - 2 points/ft² [9 - 20 points/m²] into many more drip points before the liquid is released onto the packing.

The standard turndown ratio of the Model 166 liquid distributor with single-level orifices is 2:1; however, the turndown range can be extended by using two or three orifices at different levels for each conductor tube.

For single-phase liquid feeds to the distributor, a feed pipe or a feed pipe/parting box combination is required to control feed velocity to the troughs. Two-phase liquid-vapor feeds require use of a flashing feed device to adequately separate phases and assure proper liquid feed velocity. Refer to “Liquid/Vapor Feed Devices,” Section B, for selection assistance.

Standard design passes through 18 in. [450 mm] nominal manway.

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
MODEL 186 INTALOX TROUGH DISTRIBUTOR

- Diameters greater than 36 in. [900 mm]
- Sidewall orifice
- Standard liquid rates between 0.3 and 8 gpm/ft² [0.75 – 20 m³/h•m²]

The Model 186 liquid distributor is for towers greater than 36 in. [900 mm] ID with liquid rates between 0.3 and 8 gpm/ft² [0.75 – 20 m³/h•m²] where fouling protection is required. Special designs can handle liquid rates from 0.08 to 0.3 gpm/ft² [0.2 – 0.75 m³/h•m²]; for these cases, the Model 120 strainer basket should be considered to protect the small orifices. The standard turndown range of the Model 186 is 2:1.

The Model 186 liquid distributor is similar to the Model 136 liquid distributor, with trough construction sidewall orifices, conductor tubes, and overflow orifices. Compared to the Model 136, however, the Model 186 distributor uses a parting box over the distribution troughs instead of a center trough at the same level as the lateral distribution troughs. The Model 186 distributor therefore requires more column height, but it is easier to seal and requires no gasket. Without the crossflow of a center trough, the parting box design is crucial to the Model 186 distributor performance.

For single-phase liquid feeds to the distributor, a feed pipe is required to control feed velocity to the troughs. Two-phase liquid-vapor feeds require the use of a flashing feed device to adequately separate phases and assure proper liquid feed velocity. Refer to Section B for selection assistance.

Standard design passes through 18 in. [450 mm] nominal manway.

CONSTRUCTION DETAILS

The Model 186 is available in any weldable sheet metal. Carbon steel is not recommended because of the effect of minor corrosion on orifice flow characteristics.

The Model 186 rests on an annular ring or is suspended from beams or clips. See Section G for ledge and material requirements.

All distributors include overflow orifices which help prevent distributor flooding during liquid surges.

DESIGN OPTIONS

- Orifice strainers
- Leveling screws
- Non-standard point count (See Page A-3)

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
NorPro traditional distributors are used in applications that are less demanding on packing performance, such as general heat transfer applications and absorption and stripping services with less than five transfer units per bed.

The traditional distributors generally have lower orifice count, less balanced liquid heads (lower liquid head with limited cross-flow capability) and less uniform distribution coverage than Intalox high-performance distributors.

Tower size is the first consideration in selecting a traditional distributor. Typically, towers less than 39.37 in. [1 m] ID use a pan-type distributor with orifices (Model 845) or with weirs for fouling services (Model 798).

Flow rate is the next consideration for distributor selection. Trough-type distributors (Model 806) are recommended for severely fouling services or low flow rate applications because sealing is more reliable. Deck-type distributors (Model 816/916) are best for high flow rates due to their high cross-flow capacity. Higher flow rates also minimize the adverse effects of leakage on overall performance.

We offer two enclosed-type distributors (Model 844 and Model 1044). The Model 844 is used in non-fouling services where height is limited in the feed zone and feed is liquid only. The Model 1044 with spray-style metering arrangement is used for fouling services where the tower's external feed is liquid only. Neither device has any redistribution capability. However, small amounts of uniformly-distributed liquid may fall through the distributor from packing above without hydraulic or efficiency problems.

The table shown gives the range of service conditions for each distributor model. Special designs may be possible if your conditions fall outside the parameters listed.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Column Diameter in. [mm]</th>
<th>Liquid Flow Rate gpm/ft² [m³/hr•m²]</th>
<th>Allowable System Fouling Tendency</th>
</tr>
</thead>
<tbody>
<tr>
<td>845</td>
<td>&lt; 48 [1200]</td>
<td>1.0 - 30 [2.5 - 75]</td>
<td>Low/Med</td>
</tr>
<tr>
<td>798</td>
<td>&lt; 48 [1200]</td>
<td>1.0 - 8.0 [2.5 - 20]</td>
<td>High</td>
</tr>
<tr>
<td>816/817</td>
<td>&gt; 12 [300]</td>
<td>0.8 - 50 [2.0 - 120]</td>
<td>Low/Med</td>
</tr>
<tr>
<td>916/917</td>
<td>All</td>
<td>0.8 - 10 [2.0 - 25]</td>
<td>High (Special)</td>
</tr>
<tr>
<td>806</td>
<td>&gt; 36 [900]</td>
<td>2 - 40 [5.0 - 100]</td>
<td>Low (Slotted) High (“V”)</td>
</tr>
<tr>
<td>1016/1017</td>
<td>&gt; 55 [1400]</td>
<td>1 - 20 [2.5 - 50]</td>
<td>Low/Med</td>
</tr>
<tr>
<td>844</td>
<td>&gt; 17 [430]</td>
<td>1.5 - 10 [4.0 - 25]</td>
<td>Low</td>
</tr>
<tr>
<td>1044</td>
<td>All</td>
<td>0.2 - 50 [0.5 - 120]</td>
<td>High (Special)</td>
</tr>
</tbody>
</table>

Note: Liquid flow rates vary depending on diameter and gas flow rates; rates shown are typical. Do not confuse rates above with turndown – see specific model number for turndown capability. Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
**Model 845 Pan Distributor**

- **Diameters up to 48 in. [1200 mm]**
- **Liquid rates between 1 and 30 gpm/ft² [2.5 - 75 m³/h•m²]**
- **Orifices in base**

The pan-type construction of the Model 845 traditional distributor is designed for towers less than 48 in. [1200 mm] ID with liquid rates between 1 and 30 gpm/ft² [2.5 - 75 m³/h•m²]. In towers less than 15 in. [400 mm] ID, one-piece construction, for installation through a body flange, is standard. A special multi-piece construction is available.

Orifices are located in the pan bottom with gas risers set between the orifices. At diameters less than 19.7 in. [500 mm], the gas passage may be provided in the gap between the pan and the vessel wall, rather than by gas risers.

The standard turndown range is 2.5:1.

For liquid-only feeds to the distributor, use a feed pipe to control feed velocity. Two-phase liquid-vapor feeds require a flashing feed device to adequately separate phases and assure proper liquid feed velocity. Refer to “Liquid/Vapor Feed Devices,” Section B, for selection assistance.

**Construction Details**

The Model 845 is available in any weldable sheet metal, thermoplastic or FRP material. PVC bolting is standard for multi-piece FRP pans, although there are alternatives.

The Model 845 distributor sits either on a full annular ring or lugs. Distributors with liquid rates below 4 gpm/ft² (10 m³/h•m²) are gasketed as standard. See Section G for ledge and material requirements.

This distributor is not recommended for liquid redistribution; consider using the Model 817 instead.

**Design Options**

- **Corrosion allowance (metal only)**
- **One-piece construction in columns greater than 18 in. [450 mm] in diameter**
- **Gasketing for higher flow rates**

![Model 845 Pan Distributor Diagram]

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
**Model 798 Pan Distributor**

- **Diameters 12 to 48 in.**
  [300 - 1200 mm]
- **Liquid rates between 1 and 8 gpm/ft² [2.5 - 20 m³/h•m²]**
- **Weir in riser**

The Model 798 “weir riser” distributor is used for highly fouling services in towers less than 48 in. [1200 mm] ID. Cylindrical risers with “V” weirs are used as liquid downcomers. A wide turndown range is possible due to the weirs, which allow greater flow as the liquid head increases. However, maximum liquid flow is severely limited by the gas flow since they compete for the same passage.

For liquid-only feeds to the distributor, use a feed pipe to control feed velocity. Two-phase liquid-vapor feeds require a flashing feed device to adequately separate phases and assure proper liquid feed velocity. Refer to “Feed Devices,” Section B for more information.

**Construction Details**

The Model 798 is available in any weldable sheet metal.

This distributor is supported either by a full ledge or lugs. Gasketing is standard on plates with flow rates less than 4 gpm/ft² [10 m³/h•m²].

This distributor is not recommended for liquid redistribution. Consider the Model 817 instead.

**Design Options**

- Corrosion allowance
- One-piece construction in columns greater than 18 in. [450 mm] in diameter

**Towers less than 18 in. [450 mm] ID require full diameter access. Distributors for larger towers pass through an 18 in. [450 mm] nominal manway.**

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
**MODEL 816/817/916/917 DECK DISTRIBUTOR/REDISTRIBUTOR**

- Diameters greater than 12 in. [300 mm]
- Liquid rates between 0.8 and 50 gpm/ft² [2.0 - 120 m³/h•m²]
- Orifices in deck

The Model 816 traditional distributors are for towers larger than 10 in. [250 mm] ID with liquid rates between 0.8 and 50 gpm/ft² [2.5 - 120 m³/h•m²]. The Model 817 traditional redistributor has identical features but is provided with gas riser covers to collect liquid raining from above.

The Model 916 distributor and 917 redistributor are similar to the 816/817, except that the distribution quality has been improved via better pattern and closer attention to point-to-point flow variation. Because of this, however, the height of the plate is not known in advance of design.

The deck-type construction gives liquid level balance around the periphery of the distributor and at large diameters additionally across the mid-span beam. The standard turndown is 2.5:1.

For liquid-only feeds, use a feed pipe and possibly a parting box. Two-phase liquid-vapor feeds require a flashing feed device to adequately separate phases. Refer to “Feed Devices,” Section B, for additional information.

---

**PLATE HEIGHTS (H₃)**

<table>
<thead>
<tr>
<th>Tower ID in. [mm]</th>
<th>Model 816 in. [mm]</th>
<th>Model 817 in. [mm]</th>
<th>Model 816 or 817 With Parting Box in. [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 47.25 [1200]</td>
<td>8.5 [215]</td>
<td>10.0 [253]</td>
<td>—</td>
</tr>
<tr>
<td>&gt; 47.25 [1200]</td>
<td>10.2 [260]</td>
<td>13.4 [340]</td>
<td>22.0 [560]</td>
</tr>
</tbody>
</table>

---

**CONSTRUCTION DETAILS**

The Models 816/817/916/917 are available in any weldable sheet metal, thermoplastic or FRP material. The distributor rests on an annular ring with tray clamps.

Distributors in services with liquid rates below 4 gpm/ft² [10 m³/h•m²] are gasketed as standard. See Section G for ledge and material requirements.

---

**DESIGN OPTIONS**

- Corrosion allowance (metal only)
- Cross-flow sump
- Parting boxes (second stage pre-distributor)

---

Towers less than 18 in. [450 mm] ID require full diameter access. Distributors for larger towers pass through an 18 in. [450 mm] nominal manway with standard construction.

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Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.

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Midspans may be required in towers larger than 10 ft [3000 mm] ID.
Model 806 Trough Distributor

- **Diameters greater than 36 in.** [900 mm]
- **Liquid rates between 2 and 40 gpm/ft²** [5 – 100 m³/h•m²]
- **Weirs in troughs**

The Model 806 is a weir-trough distributor for versatile liquid flow handling capability in towers larger than 36 in. [900 mm] ID. This distributor is particularly effective in handling high liquid flow rates in severely fouling services.

Model 806 distributors designed for the highest flow rates employ triangular weirs, also called “V” weirs. Distributors designed for lower flow rates employ vertical-sided weirs, also called slotted weirs, for better flow control.

Liquid is metered to the closed-end troughs by one or more parting boxes. The number of parting boxes depends on the tower diameter and liquid flow rate. The normal turndown ratio is 2.5:1. Higher turndown ratios can be achieved with special parting box design.

For liquid-only feeds, use a Model 719 feed pipe. Two-phase liquid-vapor feeds require a flashing feed device to adequately separate phases. Refer to “Feed Devices,” Section B, for additional information.

Standard design of the Model 806 distributor passes through 18 in. [450 mm] nominal manway.

**Construction Details**

The Model 806 distributor is available in any weldable sheet metal, FRP or thermoplastic material. The Model 806 rests on a full annular ring. See Section G for ledge and material requirements.

This distributor cannot be used as a redistributor. Consider using the Model 817 instead.

**Design Options**

- Corrosion allowance

- Towers larger than 146 in. [3700 mm] ID may require midspans for metal construction; the maximum span is smaller for other materials.
**MODEL 1016/1017 TROUGH DISTRIBUTOR/REDISTRIBUTOR**

- **Diameters greater than 55 in. [1400 mm]**
- **Liquid rates between 1 and 20 gpm/ft² [2.5 - 50 m³/h•m²]**
- **Orifices in troughs**

The Model 1016 distributor and Model 1017 redistributor are trough-type distributors for towers greater than 55 in. [1400 mm] ID. The standard turndown range is 1:8:1.

For liquid-only feeds use a feed pipe and possibly parting box construction. Two phase feeds (liquid and vapor) require a flashing feed device to adequately separate phases. Refer to “Feed Devices,” Section B, for more information.

**CONSTRUCTION DETAILS**

The Models 1016/1017 are available in any weldable sheet metal. Distributors with liquid rates below 4 gpm/ft² [10 m³/h•m²] are gasketed as standard. See Section G for ledge and material requirements. This distributor rests on an annular ring.

Standard design for a Model 1017 redistributor includes a wall wiper welded to the tower wall and gas riser covers to collect and redistribute liquid raining down from above.

**DESIGN OPTIONS**

- Corrosion allowance
- Cross-mixing (Model 1017 only)
- Orifice strainers
- Leveling screws

---

Standard design of the Model 1016/1017 distributor passes through 18 in. [450 mm] nominal manway.

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
MODEL 844 PIPE-ARM DISTRIBUTOR

- Diameters larger than 17 in. [430 mm]
- Liquid rates between 1.5 and 10 gpm/ft² [4 – 25 m³/h•m²]

The Model 844 liquid distributor requires little column elevation to accomplish its distribution task, and it provides high open area for high vapor flow. The Model 844 should be used only with clean liquids or with a filter designed to remove any particles that could block the orifices.

The standard design of the Model 844 handles liquid rates up to 10 gpm/ft² [25 m³/h•m²], but special designs can handle higher rates. The normal turndown ratio for the Model 844 is 2.5:1.

CONSTRUCTION DETAILS

The Model 844 is available in any weldable metal pipe or thermoplastic material. The laterals are removable to permit passage through vessel manways. The header section is flanged for standard horizontal feed from the side of the tower. Inlet flange mates to a 150 pound flange. See Section G for material requirements.

This distributor can be used to redistribute liquid from a liquid collector plate above it. See “Liquid Collectors,” Section E, for more information.

DESIGN OPTIONS

- Flanged laterals
- Corrosion allowance (metal only)
- Vertical-feed header, on tower centerline
- Bayonet-style construction for small towers (type I or II metal, type II plastic – see Section G)
- Threaded header

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.

The Model 844 passes through 18 in. [450 mm] nominal manway.

Lateral may require support by customer.
Liquid rates between 0.2 and 50 gpm/ft² [0.5 – 120 m³/h•m²]

The Model 1044 spray-type distributor is an inexpensive distributor used over shallow beds of packing in heat transfer service. It can be designed for very low liquid rates because each spray nozzle covers a large area of the tower, so each nozzle passes a reasonable flow, even at low irrigation rate. The normal turndown ratio is 2:1.

CONSTRUCTION DETAILS

The Model 1044 is available in any weldable metal for which pipe and flanges are readily available. The laterals are removable for manway passage. The header section is flanged for the feed nozzle connection; a 150 pound internal feed flange is expected.

DESIGN OPTIONS

- Corrosion allowance
- 300 pound flanges
- Double or triple coverage patterns

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
Obtaining desirable tower performance requires the proper handling of liquid and vapor entering the column. The types of feeds, or inlets, into a column can generally be classified into four major categories:

- Liquid only (contains less than 1% volume vapor)
- Liquid and vapor above a packed bed (flashing or suppressed flash)
- Vapor only below a packed bed
- Reboiler returns

Selection criteria for each category of feed device is unique. The following tables assist in selecting the proper equipment.

The selection of liquid-only feed devices, which are required as pre-distributors, depends on the type of distributor and on turndown needs. Among the factors Saint-Gobain NorPro considers in designing a feed device are flow rate, operating range, degree of sub-cooled liquid versus column size and temperature, and whether mixing with overhead liquid is required.

For liquid and vapor feed devices above a distributor (Table II), the selection depends on the type of distributor, flow rates, type of flow at feed (flashing or suppressed), turndown necessary, column height needed for flashing vapor distribution and mixing of the inlet liquid with the overhead liquid. In all cases, separating the two phases is a primary concern. Additional pre-distribution (via parting boxes) may be required.

**Table I**

<table>
<thead>
<tr>
<th>Model</th>
<th>Used With</th>
<th>Turndown Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>119</td>
<td>Intalox</td>
<td>≤ 2:1</td>
</tr>
<tr>
<td>129</td>
<td>Intalox</td>
<td>≤ 10:1</td>
</tr>
<tr>
<td>719</td>
<td>Traditional</td>
<td>≤ 2.5:1</td>
</tr>
<tr>
<td>729</td>
<td>Traditional</td>
<td>≤ 10:1</td>
</tr>
</tbody>
</table>

**Table II**

<table>
<thead>
<tr>
<th>Model</th>
<th>Flow Region</th>
<th>Tower Size in. [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>192*</td>
<td>Spray or Separated</td>
<td>&gt; 96 [2400]</td>
</tr>
<tr>
<td>655*</td>
<td>Any</td>
<td>&gt; 60 [1500]</td>
</tr>
<tr>
<td>755</td>
<td>Any</td>
<td>&gt; 36 [900]</td>
</tr>
<tr>
<td>855</td>
<td>Any</td>
<td>&lt; 48 [1200]</td>
</tr>
<tr>
<td>955</td>
<td>Separated</td>
<td>&gt; 48 [1200]</td>
</tr>
</tbody>
</table>

*See page G-4 for general description*
Two factors must be considered in choosing the proper device for a vapor only feed below a packed bed (Table III).

1. Kinetic energy of inlet vapor
The kinetic energy of the inlet vapor must be considered in relation to the pressure drop in the packed bed, the feed nozzle arrangement and tower separation requirements.

2. Vapor composition
When the vapor is introduced between packed beds, consider the degree of mixing of the inlet vapor with the rising vapor. If a gross mismatch of composition and/or temperature exists, mixing of the two vapors optimizes packing performance above.

Specific equipment for vapor distribution may not be required if the pressure drop in the packed bed is sufficient for proper vapor distribution.

To determine the type of feed device required for a reboiler return, the first step is to consider the kinetic energy as described above. After it is determined that vapor distribution is required, factors to consider include feed nozzle size and arrangement, pressure drop in the packed bed, flow rates, tower size and type of reboiler.

If vapor distribution equipment is needed above reboiler return inlets, the Model 896 is an effective distributor. Occasional exceptions are listed in Table IV.

For those towers employing suppressed vaporization reboilers, the pressure release and flash should not occur at the tower nozzle. The Model 144 suppressed flash distributor is effective for these towers.

### Table III

<table>
<thead>
<tr>
<th>Model</th>
<th>Typical Use</th>
<th>Tower Size [in. [mm]]</th>
</tr>
</thead>
<tbody>
<tr>
<td>194*</td>
<td>Vapor Diffuser</td>
<td>&gt; 48 [1200]</td>
</tr>
<tr>
<td>196</td>
<td>Vapor Diffuser  (Reduces Flow Inertia)</td>
<td>&gt; 48 [1200]</td>
</tr>
<tr>
<td>198</td>
<td>Vapor Distributor  (For Uniform Flow/Mixing)</td>
<td>&gt; 17 [430]</td>
</tr>
<tr>
<td>796*</td>
<td>Vapor Distributor  (for Uniform flow)</td>
<td>&gt; 48 [1200]</td>
</tr>
<tr>
<td>896</td>
<td>Vapor Distributor  (for Uniform flow)</td>
<td>All</td>
</tr>
</tbody>
</table>

### Table IV

<table>
<thead>
<tr>
<th>Type Reboiler</th>
<th>Usual Model</th>
<th>Alternate Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forced Circulation</td>
<td>896</td>
<td>796*</td>
</tr>
<tr>
<td>Thermosiphon</td>
<td>896</td>
<td>796*</td>
</tr>
<tr>
<td>Kettle-type</td>
<td>896</td>
<td>196, 796*</td>
</tr>
<tr>
<td>Suppressed Flash</td>
<td>144*</td>
<td>896, 796*</td>
</tr>
</tbody>
</table>

*See page G-4 for general description
The Models 119 and 129 liquid only feed pipes are used when liquid is fed from outside the column onto a NorPro Intalox distributor or redistributor. Each feed pipe meters flow to one or more appropriate feed areas, matching the hydraulic requirements of the distributor. Excessive turbulence and horizontal flow velocity in the distributor are eliminated in a compact design.

The Model 119 feed pipe is a piping system of headers, lateral branches, and downpipes. It is limited in turndown to a 2:1 ratio or perhaps slightly more. The Model 129 feed system employs a parting box or calming boxes below simpler piping. It can handle much higher turndown ratios than the Model 119, but it may require slightly more tower height.

A submerged feed is recommended when the liquid is sub-cooled more than 30° F [17° C] in large towers with low flow rates. Submerging the feed maintains uniform liquid temperature from the distributor and may also be used in cases where a more compact design is required.

**Construction Details**

The Model 119/129 is available in any weldable metal, FRP or thermoplastic material.

With the standard vertical system design, the Model 119/129 attaches to an internal column flange and is further supported by tower wall clips. The submerged style does not require tower wall clips and is supported by the distributor.

**Design Options**

- Corrosion allowance (metal only)
- Bayonet-style construction – see Section G
- All-flanged construction, (eliminates internal threaded connections except with some bayonets)
- Submerged feed
- Support from liquid distributor

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Models 719 and 729 liquid only feed pipes are used when liquid is fed from outside the column onto a traditional distributor or redistributor. The incoming flow must contain less than 1% by volume vapor.

The Model 719 feed pipe is a piping system of headers and downpipes. It can provide a turndown ratio up to 2.5:1. The Model 729 feed system employs a parting box below simpler piping. It can handle much higher turndown ratios than the Model 719, but it usually requires slightly more tower height.

**CONSTRUCTION DETAILS**

The Models 719/729 are available in any weldable metal, FRP or thermoplastic material in pipe or tubular form. With the standard design, feed pipes attach to the internal column flange and are supported by tower wall clips. As an option, the feed pipe can be supported from the distributor.

**DESIGN OPTIONS**

- Corrosion allowance (metal only)
- Bayonet-style construction – see Section G
- All-flanged construction, (eliminates internal threaded connections except with some bayonets)
- Support from liquid distributor

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 755 flashing feed gallery is a two-phase feed device fed by a tangential inlet tower nozzle or a radial nozzle with a flow deflector (shown below). Incoming flow is directed tangentially onto the tower wall. A gallery below the inlet collects liquid into a pool, allowing the vapor or gas to disengage. The liquid then falls directly to a distributor or into a pre-distributor (parting box). The Model 755 is recommended in towers 36 in. [900 mm] ID and larger and handles any liquid to vapor feed ratio.

**Construction Details**

The Model 755 is available in any weldable metal. The inside of the gallery may be round or polygonal. The gallery is clamped to a ledge as standard attachment.

**Design Options**

- Inlet deflector attached to inlet nozzle internal flange
- Joint gasketing
- Corrosion allowance

Flow deflectors are supplied by others. They can be uni- or bi-directional.

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 855 flashing feed chamber is a two-phase feed device which is attached to a radial inlet. The feed is centrifuged in the chamber, separating the phases — vapor out the top and liquid out the bottom to a distributor below. This model is used with either a NorPro Intalox or traditional distributor or redistributor. The liquid falls either directly to a distributor or into a pre-distributor.

The Model 855 is recommended for towers up to 48 in. [1200 mm] ID on most two-phase feeds. This device handles all liquid to vapor ratios. Larger towers may benefit from use of this device if flow rates are suitable.

**Construction Details**

The Model 855 is available in any weldable metal. For towers between 10.12 and 21.14 in. [250 - 530 mm] ID, the Model 855 is constructed in one piece; multi-piece construction is used for larger towers.

With inlet pipe sizes less than 4 in. [10 mm], the Model 855 has a threaded connection to a bayoneted inlet pipe supplied by others as standard. Larger inlet pipe sizes are flanged as standard.

**Design Options**

- Corrosion allowance
- Bayonet construction — see Section G

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 955 flashing feed pipe is used to separate a two-phase feed when the inlet flow is in a separated flow region. With the Model 955, the two-phase flow enters the center pipe. The vapor is released from the upper area of the pipe and the liquid flows to the outer chamber where it is metered to desired points on the distributor below. This model is most often used for vacuum services in towers larger than 48 in. [1200 mm] ID. The compact design of this model makes good use of tower height.

**Construction Details**

The Model 955 is available in any weldable metal. The Model 955 is connected to an internal tower flange and is further supported by a tower wall clip as standard. The device is constructed in one piece, provided access diameter is sufficient. Otherwise, multi-piece construction with gasketing is supplied.

**Design Options**

- Corrosion allowance

---

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 196 vapor diffuser is used where the incoming flow is vapor only and the flow energy is excessive, causing vapor maldistribution to the bed above. This device reduces the flow inertia, which allows proper distribution. The Model 196 is not a vapor distributor; see Model 198. The Model 196 meters the vapor uniformly out the upper area of the tube and the shroud, then directs it down each side of the tube. Pressure drop across this device is relatively low compared to the Model 198. The vapor flow turndown ratio is generally 4:1; however, higher ratios are possible. The Model 196 is used in towers larger than 48 in. [1200 mm] ID.

**CONSTRUCTION DETAILS**

The Model 196 is available in any weldable metal. This model is attached to an internal tower flange and is further supported by a tower wall clip as standard construction. Optionally, the inlet end can be made to sleeve into the vapor inlet nozzle in lieu of an internal tower flange. One-piece construction is standard provided access diameter is sufficient. Otherwise, multi-piece construction is supplied.

**DESIGN OPTIONS**

- Sleeve inlet (eliminates internal flange, but may require extra weld-on wall clips)
- Corrosion allowance

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 198 pipe arm vapor distributor is used when the feed requires uniform distribution over the tower area. Typical applications include introduction of a vapor feed at the bottom of the tower into a very tight space or introduction of a vapor which differs in composition or temperature and needs mixing with the column vapor.

The maximum vapor rate may be limited due to the amount of tower area occupied by the device. Required pressure drop across the distributor to achieve proper distribution is determined by size of the inlet and flow rate. Turndown ratio is generally 4:1; however, higher ratios are possible provided the pressure drop is not excessive for the process. This device can be used in towers larger than 17 in. [430 mm] ID.

**CONSTRUCTION DETAILS**

The Model 198 is available in any weldable metal or thermoplastic pipe material. The laterals are threaded in pipes 3 in. [75 mm] or less and flanged in larger sizes. The access diameter must be sufficient to accommodate the header. The header section is flanged at the inlet end and is further supported by wall clips. Lateral pipes are also supported by wall clips on towers larger than 96 in. [2400 mm] ID. Plastic construction may require added support in smaller towers.

**DESIGN OPTIONS**

- Flanged laterals
- Corrosion allowance (metal only)
- Bayonet-style construction for small towers (Type I or II metal, or Type II plastics — see Section G)

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 896 vapor distributor plate is used above vapor-containing tower feeds to assure good vapor distribution to the packed bed above.

Most packed beds do not need vapor distributors. These beds include beds receiving vapor from other packing, liquid distributors, or liquid collectors below. Beds receiving vapor from low-velocity-head feeds also do not need vapor distributors. The vapor distributors are necessary below beds receiving a large fraction of their vapor from high-velocity-head external feeds.

In performing its vapor distribution task, the Model 896 will consume some pressure drop in the vapor. The design pressure drop will be between 0.5 and 4 in. water (125 - 1000 Pa).

The turndown ratio of the Model 896 is at least 4:1.

**Construction Details**

The Model 896 is available in any weldable sheet metal. It is supported by an annular ring and perhaps by midspan beams in large towers. The Model 896 is gasketed; see Section G for ledge and material requirements.

**Design Options**

- Corrosion allowance
- Liquid downpipes or sumps

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
When are bed limiters required?

**Random Packing**

For metal and plastic random packings, bed limiters are recommended when there is the potential for sufficient vapor load to fluidize the top of the bed. Generally, this occurs during upset conditions, which are difficult to predict.

Use the table below for guidelines.

<table>
<thead>
<tr>
<th>Approximate Point of Fluidization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing Wt. (lbs/ft³)</td>
</tr>
<tr>
<td>∆P (in. WC/ft)</td>
</tr>
</tbody>
</table>

*Pressure drop is difficult to predict in flood.

There are three basic ways to prevent upward movement of random packing: bed limiters, anti-migration bars and weighted plates.

The bed limiter is the most common type. A bed limiter either sits directly on the packing or is attached to the vessel wall. Attachment to the vessel wall increases interference with the distribution pattern. The bed limiter acts as a screen to confine the packing to the defined bed.

Another method of retaining a bed of random packing is through the use of anti-migration bars at the bottom of the distributor's gas risers. Anti-migration bars do not prevent the packed bed from becoming fluidized and unleveled, but they do prevent packing from being blown up through the gas risers. The concern in the use of anti-migration bars is the possibility of restricting vapor passage through the gas risers. This could lead to liquid back-cycling due to high vapor velocity, which may flood the distributor. Hence, close attention to process and internal design parameters is recommended before using anti-migration bars.

The Model 905 is a weighted plate used with ceramic or carbon tower packing to prevent breakage. It is important to level the bed to assure packing contact with the hold-down plate over all areas. In addition to handling vapor surges, weighted plates are recommended when liquid rates are greater than 15 gpm/ft² [35 m³/h•m²].

**Structured Packing**

Bed limiters are recommended for use with structured packing when there is the potential for packing displacement during upset conditions. Retention of the top layer is accomplished with the Model 133, which may be attached to the distributor. For towers with one-piece layers of packing, the Model 133 is typically integral with the distributor to provide a means of support for and attachment to the distributor.

Many columns with structured packing do not need bed limiters.

**Bed Limiter Selection**

Bed limiters must maintain a high free area for vapor/liquid passage and minimize interference with liquid distribution. With Intalox distributors, non-interfering bed limiters such as the Models 103 and 133 are recommended. The Model 822 is specially designed for use on top of random packing with a spray distributor (Model 1044) above.

When laying out tower elevations, the bed limiter is not considered part of the packed bed. The top of the packed bed is normally six to eight in. [150 - 200 mm] from the distributor to allow for gas disengagement from the packed bed. The bed limiter occupies this disengagement area.

The table below summarizes the selection criteria for any size tower. The support method is given in reference to vessel wall attachments. See the appropriate model description for further details.

<table>
<thead>
<tr>
<th>Selecting a Bed Limiter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Number</td>
</tr>
<tr>
<td>103</td>
</tr>
<tr>
<td>823</td>
</tr>
<tr>
<td>133</td>
</tr>
<tr>
<td>822*</td>
</tr>
<tr>
<td>905*</td>
</tr>
</tbody>
</table>

*Contact Saint-Gobain NorPro for plate details.
When traditional metal or plastic random packings are used, the Model 823 is fixed to the tower wall. The standard method of fastening the bed limiter to the vessel wall is by clamps to a ledge welded in the column.

**Construction Details**

The Model 823 is available in any weldable metal or thermoplastic material in sheet form. For metal construction, the plate can withstand 50 lbs/ft\(^2\) [250 kg/m\(^2\)] uniform upward force. Towers up to 36.22 in. [900 mm] ID are furnished with either ledge clamping or jack screws. The plate screen on the opening may vary depending on packing size.

For thermoplastic construction, the plate can withstand 5 lbs/ft\(^2\) [25 kg/m\(^2\)] uniform upward force. All plates are clamped to the support ledge as standard.

**Design Options**

- Greater upward force
- Corrosion allowance (metal only)
- Jack screws on plates smaller than 36.22 in. [920 mm]

### Approximate Weight

<table>
<thead>
<tr>
<th>Material</th>
<th>lbs./ft(^2)</th>
<th>kg/m(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>3.3</td>
<td>16.2</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>1.2</td>
<td>5.9</td>
</tr>
<tr>
<td>CPVC</td>
<td>1.8</td>
<td>8.8</td>
</tr>
</tbody>
</table>

Note: Other materials are available.

---

Model 823
The Model 103 bed limiter is designed to minimize interference with liquid distribution below an Intalox liquid distributor. The bed limiter diameter is expandable to permit contact with the vessel wall, which eliminates the need for wall attachments and prevents random packing from escaping.

The Model 103 is available in any weldable metal or thermoplastic material. The standard minimum access diameter required for the Model 103 is 17 in. (430 mm). With metal construction, standard design can withstand 50 lbs/ft² [250 kg/m²] uniform upward force. The thermoplastic Model 103 can withstand 10 lbs/ft² [50 kg/m²] upward force.

<table>
<thead>
<tr>
<th>Material</th>
<th>lbs./ft²</th>
<th>kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>3.0</td>
<td>14.7</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>1.1</td>
<td>5.4</td>
</tr>
<tr>
<td>CPVC</td>
<td>1.6</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Note: Other materials are available.

The Model 133 metal bed limiter is designed for use with Intalox structured packing or Intalox wire gauze packing. Its design minimizes interference with liquid distribution. This bed limiter is bolted to the vessel wall by means of vertical clips in larger towers. The Model 133 is integral with the distributor when restricting one-piece packing layers.

The Model 133 is available in any weldable sheet metal. This plate will pass through any standard manway. The standard design can withstand 50 lbs/ft² [250 kg/m²] uniform upward force.

<table>
<thead>
<tr>
<th>Material</th>
<th>lbs./ft²</th>
<th>kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>3.0</td>
<td>14.7</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>1.1</td>
<td>5.4</td>
</tr>
<tr>
<td>CPVC</td>
<td>1.6</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Note: Other materials are available.
Saint-Gobain NorPro manufactures support plates for random and structured tower packings. Regardless of the packing, each plate incorporates several critical design factors. First, the plate must physically support the packing under operating conditions. Second, it must have a high percentage of free area to allow unrestricted flow of downcoming liquid and upward flow of gas. Third, it must be easy to install.

There are several criteria for selecting a support plate:

- Type of packing supported (random or structured)
- Process characteristics (corrosion, packing material, temperature)
- Maximum design load supported (bed depth, packing type and material, liquid hold-up, material build up in the bed and surge conditions)

Note: In cases where the column liquid level rises above the vapor entry, the support plates can be subjected to exceptional forces.

Pressure drop calculations for our tower packings include the pressure drop through support plates of our design. No extra pressure drop need be added for the support plate. Support plates can be designed to handle any liquid flow rate. In both cases (pressure drop and liquid rates), the packing is the limiting factor in tower design.

A random-packed bed depth includes the height of the support plate. A structured-packed bed depth does not include the height of the support.

Where tower height is a premium, special designs for support plates are available to permit integral packing support and either vapor distribution or partial liquid collection.

Gas injection support plates are designed to provide separate passageways for gas and liquid so both phases do not compete for the same opening. Unrestricted flow of both phases minimizes pressure drop across the plate. This is done by providing gas inlets above the liquid head, preventing excess liquid build-up. The support plates are designed to retain the various packing sizes while not restricting the capacity of the packing.

Support plates for random packings include the Models 809 light-duty support, 818 support, and 804 multi-beam support. All are made of metals; the Models 818 and 804 are also available in thermoplastic. The Models 819 and 1019 are both available in FRP only.

Selecting a Support Plate

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Tower ID in. [mm]</th>
<th>Type Packing Supported</th>
<th>Construction Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>818</td>
<td>&lt; 48 [1200]</td>
<td>Any Random</td>
<td>Metals and Thermoplastics</td>
</tr>
<tr>
<td>809</td>
<td>&lt; 35.25 [890]</td>
<td>Random (light)</td>
<td>Metals</td>
</tr>
<tr>
<td>804</td>
<td>&gt; 36 [900]</td>
<td>Any Random</td>
<td>Metals and Thermoplastics</td>
</tr>
<tr>
<td>819</td>
<td>&lt; 48 [1200]</td>
<td>Random (except ceramic)</td>
<td>FRP</td>
</tr>
<tr>
<td>1019</td>
<td>&gt; 48 [1200]</td>
<td>Random (except ceramic)</td>
<td>FRP</td>
</tr>
<tr>
<td>134</td>
<td>Any</td>
<td>Structured</td>
<td>Metal</td>
</tr>
</tbody>
</table>

Contact your local Saint-Gobain NorPro representative for applications outside the "standards" shown in this brochure.
Because the Model 818 support plate combines high free area with excellent mechanical strength, it is generally recommended for all towers less than 36 in. [900 mm] ID. This support incorporates the multi-beam design principle into two- or three-pieced units for towers ranging from 12 to 48.62 in. [305 - 1235 mm] ID.

Metal plates can support loads up to 1000 lbs/ft² [4800 kg/m²] or more. The table below provides allowable load values for different thermoplastic materials at various temperatures.

**CONSTRUCTION DETAILS**

The Model 818 is available in any weldable sheet metal or thermoplastic material. These plates are supported by a full ledge. See Section G for ledge and attachment requirements.

Two-piece construction is provided for towers between 12 in. and 34 in. [305 - 865 mm] ID. Three or four-piece construction is provided for towers between 34.1 and 48.62 in. [866 - 1235 mm] ID.

State the size of packing at the time of inquiry.

**MAXIMUM ALLOWABLE LOAD - PLASTICS**

Note: Standard heavy-duty construction increases load capacity 1.25 times. Higher temperatures and/or loads are possible.

<table>
<thead>
<tr>
<th>Curve</th>
<th>Plastic</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Polypropylene</td>
<td>@ 75°F [24°C] through 125°F [52°C]</td>
</tr>
<tr>
<td>2</td>
<td>Polypropylene</td>
<td>@ 75°F [24°C]</td>
</tr>
<tr>
<td>3</td>
<td>Polypropylene</td>
<td>@ 100°F [38°C]</td>
</tr>
<tr>
<td>4</td>
<td>Polypropylene</td>
<td>@ 125°F [52°C] or PVC/CPVC @ 150°F [66°C]</td>
</tr>
<tr>
<td>5</td>
<td>Polypropylene</td>
<td>@ 150°F [66°C]</td>
</tr>
</tbody>
</table>

**APPROXIMATE WEIGHT**

<table>
<thead>
<tr>
<th>Material</th>
<th>lb/ft²</th>
<th>kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>5.5</td>
<td>26.9</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>2.4</td>
<td>11.7</td>
</tr>
<tr>
<td>CPVC</td>
<td>4.1</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Note: Other materials are available.

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 804 support plate is recommended to support random packing in towers greater than 36 in. [900 mm] ID. The Model 804 is recognized as the typical style due to its high open area and mechanical strength. The table below provides the maximum allowable load values for different thermoplastic materials at various temperatures. Contact Saint-Gobain NorPro for maximum spans when using metal.

CONSTRUCTION DETAILS

The Model 804 is available in any weldable sheet metal or thermoplastic material. See Section G for ledge and material requirements.

Thermoplastic supports retain #40 IMTP packing, 2 in. [50 mm] saddles or \( \frac{3}{4} \) in. [19 mm] and larger rings. Contact your Saint-Gobain NorPro representative if smaller packing must be supported.

All beams can be installed through manways 16 in. [406 mm] ID and larger. The plate is supported by a full ledge on which it typically rests freely.

<table>
<thead>
<tr>
<th>Tower ID or Span (millimeters)</th>
<th>Allowable Load (lb/ft²)</th>
<th>kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>300</td>
<td>1250</td>
</tr>
<tr>
<td>48</td>
<td>250</td>
<td>1000</td>
</tr>
<tr>
<td>60</td>
<td>200</td>
<td>750</td>
</tr>
<tr>
<td>72</td>
<td>150</td>
<td>500</td>
</tr>
<tr>
<td>84</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>96</td>
<td>50</td>
<td>0</td>
</tr>
</tbody>
</table>

APPROXIMATE WEIGHT

<table>
<thead>
<tr>
<th>Material</th>
<th>lb/ft²</th>
<th>kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>6.0</td>
<td>29.3</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>2.4</td>
<td>11.7</td>
</tr>
<tr>
<td>CPVC</td>
<td>4.1</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Note: Other materials are available.

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 809 support plate is available for towers between 4 and 35.25 in. [100 - 895 mm] ID supporting metal, ceramic or plastic random packings. This corrugated support plate should be used only when:
- Bed height is limited
- Hydraulic loading is not severe
- Small packings (½ in. or 13 mm) are used in towers greater than 11.7 in. [300 mm] ID

In other cases, consider use of the Model 818 as an alternative.

### Construction Details

The Model 809 is available in any weldable sheet metal. Two piece construction is standard. The Model 809 retains #15 IMTP packing or ¼ in. [6 mm] and larger saddles and rings.

### Design Options

- Ledge clamps for towers greater than 12 in. [300 mm] ID
- Corrosion allowance
- One-piece construction

### Allowable Load Correction Multiplier

<table>
<thead>
<tr>
<th>Temperature °F [°C]</th>
<th>Carbon Steel</th>
<th>Stainless</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 [149]</td>
<td>0.983</td>
<td>0.917</td>
</tr>
<tr>
<td>400 [204]</td>
<td>0.957</td>
<td>0.835</td>
</tr>
<tr>
<td>500 [260]</td>
<td>0.856</td>
<td>0.777</td>
</tr>
<tr>
<td>600 [316]</td>
<td>0.729</td>
<td>0.732</td>
</tr>
<tr>
<td>700 [371]</td>
<td>0.627</td>
<td>0.719</td>
</tr>
<tr>
<td>800 [427]</td>
<td>NR</td>
<td>0.686</td>
</tr>
</tbody>
</table>

Note: Corrosion allowance is not factored into either curve. Materials are carbon steel, 304L and 316L stainless steel. Contact your Saint-Gobain NorPro representative for allowable loads for other materials.

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
Both Models 819/1019 use beam-type construction similar to that of the Model 804. The Model 819 is designed for towers between 18 and 48 in. [450 - 1200 mm] ID while the Model 1019 support plate is designed for towers greater than 48 in. [1200 mm] ID.

Use the allowable load graph below to calculate the maximum length of the beam to support the packed bed plus liquid hold-up. If your actual loads are higher than those included in the graph, contact your Saint-Gobain NorPro representative about a special design.

The Models 819/1019 are available in FRP only. See Section G for material and ledge requirements.

Each model retains 2 in. [50 mm] saddles or 1 in. [25 mm] and larger rings. Contact your Saint-Gobain NorPro representative if smaller packing must be supported. FRP construction is not recommended for use with ceramic packings.

The approximate weight for the Model 819 is 4.75 lbs/ft² [23 kg/m²]; for the Model 1019, 6 lbs/ft² [29 kg/m²]. Beams can be installed through a 7.5 in. [190 mm] ID handhole for the Model 819, and through a 17 in. [430 mm] ID manway for the Model 1019.

This plate is supported on a full ledge. Large plates may require midspans.

This table provides correction factors on maximum operating temperatures. Multiply the allowable load from the curves by the correction factor to obtain the maximum allowable load during operation.

---

### ALLOWABLE LOAD CORRECTION MULTIPLIER

<table>
<thead>
<tr>
<th>Temperature °F ℃</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 [38]</td>
<td>0.948</td>
</tr>
<tr>
<td>125 [52]</td>
<td>0.908</td>
</tr>
<tr>
<td>150 [66]</td>
<td>0.867</td>
</tr>
<tr>
<td>175 [80]</td>
<td>0.827</td>
</tr>
<tr>
<td>200 [93]</td>
<td>0.787</td>
</tr>
<tr>
<td>225 [107]</td>
<td>0.746</td>
</tr>
<tr>
<td>250 [121]</td>
<td>0.706</td>
</tr>
</tbody>
</table>

---

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 134 is used to support either Intalox structured packing or Intalox wire gauze packing. Design of the support grid allows free and uniform passage of gas and liquid so that capacity of the packing is not limited.

**Construction Details**

The Model 134 is available in any weldable sheet metal. The approximate weight of the grid is 14 lbs/ft² [68 kg/m²]. Grids can be installed through a 17 in. [430 mm] ID manway.

This plate is supported on a full ledge. Larger plates may require midspan beams. Lightly loaded plates can span up to 14 ft [4270 mm] without beams, but heavily loaded plates at high temperature may need beams at 10 ft [3050 mm] diameter.

**Design Options**

- Ledge clamps
- Corrosion allowance
- Lower height requirement $H_d$

---

<table>
<thead>
<tr>
<th>Tower Diameter in. [mm]</th>
<th>Maximum Height $H_d$, in. [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 39.37 [1000]</td>
<td>3 [75]</td>
</tr>
<tr>
<td>39.37 to 72.25 [1835]</td>
<td>4 [100]</td>
</tr>
<tr>
<td>72.26 to 96.45 [2450]</td>
<td>5 [125]</td>
</tr>
<tr>
<td>&gt; 96.46 [2450]</td>
<td>6 [150]</td>
</tr>
</tbody>
</table>

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
Liquid collection from between packed beds is frequently required. Liquid collectors are used in three main circumstances:

- Total draw-off of liquid to product or reboiler or pump-around/pump-down
- Partial draw-off of liquid with overflow continuing down the tower
- Collection of liquid for mixing

Collector plates come in different design styles which meet the needs of specific applications. For example, chevron- and trough-style collector plates require less tower height than deck-style collectors and thus are better suited for applications where packed height is limited.

The chevron style of the Model 633 makes this design suitable for high vapor rates, as are typical of vacuum applications. Applying chevrons in towers less than 31.5 in. [800 mm] ID is impractical. The deck-type Model 833 can be used in smaller diameter towers where the Models 633 and 733 cannot. Deck-style construction is versatile at handling high liquid rates. However, thermoexpansion can present leakage problems for a large deck-type collector. In these cases, the trough-type Model 733 is recommended. The troughs eliminate the need to seal the collectors to a ledge. The collector plate’s liquid capacity can be varied by sump and riser design.

The table below is helpful in selecting the appropriate model for various applications.

<table>
<thead>
<tr>
<th>Model</th>
<th>Style</th>
<th>Typical Open Area</th>
<th>Typical Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>633</td>
<td>Chevron</td>
<td>50 - 80%</td>
<td>High Vapor Rates &amp; Low Liquid Rates</td>
</tr>
<tr>
<td>733</td>
<td>Trough</td>
<td>25 - 40%</td>
<td>Thermoexpansion with Low to High Liquid Rates</td>
</tr>
<tr>
<td>833</td>
<td>Deck</td>
<td>25 - 40%</td>
<td>All Liquid Rates</td>
</tr>
</tbody>
</table>
The Model 633 is used in towers that are greater than 31.5 in. [800 mm] ID and that process high vapor loads and low liquid loads (vacuum service). The plate collects overhead liquid which is drawn from the tower or fed to a distributor below. The plate consumes minimal pressure drop and it avoids entrainment even at vapor rates high enough to cause entrainment from conventional gas risers.

The size of the sump varies, depending on the hydraulic needs of each application. The collector has approximately 50% open area in small towers and up to 80% in larger towers. In applications where liquid is directly fed to a distributor below, a feed pipe is required to properly feed the distributor below.

**Construction Details**

The Model 633 is available in any weldable sheet metal. Standard construction has the chevrons resting on an annular sump welded to the tower wall. The annular sump in new towers is generally part of the vessel and only the chevrons are supplied by Saint-Gobain NorPro. For larger towers and high liquid rates, collection trough(s) are added, spanning across the annular sump. These troughs shorten the flow path length of the liquid collected in the chevrons.

**Design Options**

- Corrosion allowance
- Supply of annular sump

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 733 is used for a wide variety of applications in towers greater than 55 in. [1400 mm] ID. The Model 733 is generally the best choice in larger towers where thermoexpansion is a concern. The trough arrangement minimizes welding to the vessel wall. The troughs are free to expand because they rest on the ledge. A wall wiper directs liquid to the troughs. The center sump is usually sealed to a seat at only one end, where the liquid is drawn from the tower, which frees the opposite end to expand and contract. The sump sizes and trough are designed to suit the application needs. This model is used for either total or partial liquid draw-off. Applications where liquid is fed to a distributor below require a feed pipe. The collector has 25 to 40% open area depending on the tower sump size.

**Construction Details**

The Model 733 is available in any weldable sheet metal, thermoplastic or FRP material. See Section G for material requirements. For metal construction, the wall wiper is welded to the column wall. The sump must also be field welded into its seat. For some space-saving designs, field seal welding is required at the trough and sump joint. When the sump size exceeds access diameter, the sump will be segmented with field-weld construction. Standard thermoplastic construction is bolted and gasketed. For FRP construction, a seal-weld kit is supplied to seal the joints. Optionally, sloped construction for improved drainage and/or liquid movement is available.

**Design Options**

- Corrosion allowance
- Sloped construction
- Gasketed and clamped wall wiper
- Bolt and gasketed construction (when not standard)
- Gas riser cover as manway (removable from above or below)

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The versatile Model 833 is used in towers of all sizes. Tall risers can be provided to allow a large volume of liquid on the deck. Sumps can be added on one side, both sides or across the center. This collector has 25 to 40% open area depending on the needs of the application.

**CONSTRUCTION DETAILS**

This collector is available in any weldable sheet metal, thermoplastic or FRP material. For metal construction, the deck and optional sump(s) rest on tower ledgework; the plate is seal-welded. When gas riser height exceeds access size, the gas risers are separate pieces which are seal-welded to the decks.

Standard thermoplastic construction is gasketed and bolted.

**DESIGN OPTIONS**

- Corrosion allowance
- Side sump (one or two)
- Center sump
- Tower body flange mounted
- Bolt and gasket joint construction (specify bolting material)
- Thermoplastic gas risers with FRP construction

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
Packing is used in counter-current liquid/liquid contactors with special internals to disperse one of the phases. Selection and arrangement of the internals depends on which phase (light or heavy) is continuous and which is dispersed. In all cases, feed pipes directing the feed, light and heavy, are recommended to control velocity. It is extremely important to properly feed the dispersed phase to the disperser plate.

In contactors where the light phase (feed which enters the bottom of the tower) is dispersed, packed beds are supported by the Model 834 disperser support plate. In addition to supporting the packing, the plates allow proper dispersion or formation of small droplets which rise through the continuous phase. In breaking the dispersed liquid into small droplets, the Model 834 provides maximum initial contact area between the two phases. Because the droplets tend to coalesce in the packing, beds are typically limited to a depth of 6 to 8 ft [1.5 to 2.5 m]. Multiple beds, each supported by a Model 834, are recommended where a total of more than 8 ft [2.5 m] of packing is required.

When the heavy phase (feed which enters the top of the tower) is dispersed, the Model 835 disperser plate is used above the top bed. When multiple beds are required, the Model 835 is also used to support the upper beds and collect and redisperse the heavy phase to the beds below. The bottom bed is supported by a conventional support plate (see Models 804 or 818). The Model 835, although structurally different, is hydraulically upside-down compared to the Model 834. In heavy phase dispersed contactors, the same bed depth recommendations apply as with light-phase dispersion.

It is generally recommended to disperse the phase with the higher flow rate to generate maximum interfacial contact. The exception to this rule is when the higher volumetric flow rate phase has higher viscosity or preferentially wets the packing surface.

Surfactants may alter surface properties to the extent that the performance of a liquid/liquid contactor cannot be predicted.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
<th>Construction Material</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>834</td>
<td>Disperser/support</td>
<td>Metal</td>
<td>Light dispersed</td>
</tr>
<tr>
<td>835</td>
<td>Disperser/support</td>
<td>Metal</td>
<td>Heavy dispersed</td>
</tr>
<tr>
<td>644</td>
<td>Feed pipe</td>
<td>Metal</td>
<td>Dispersed (heavy or light)</td>
</tr>
<tr>
<td>744</td>
<td>Distributor</td>
<td>Metal</td>
<td>Continuous (light or heavy)</td>
</tr>
</tbody>
</table>
The Model 834 disperser/support plate serves two purposes: to support the packed bed and to disperse the light phase into the continuous heavy phase. Dump tubes allow the heavy phase to travel downward through the plate. The light phase forms a pool under the plate and the orifices generate droplets. The plate design depends on interfacial surface tension, viscosity and differential densities. This plate also acts as a re-disperser in multi-bed towers.

The Model 644 feed pipe is recommended to feed the dispersed phase to the Model 834. Flow rates and turndown may be severely limited if the Model 644 is not used.

**Construction Details**

The Model 834 is available in any weldable sheet metal. This plate is supported by a full ledge. All plates up to 32.87 in. (835 mm) ID are clamped to a ledge. Clamps are recommended on larger towers if the load on the plate is less than 100 lbs/ft² [500 kg/m²]. Maximum allowable loads are 400 lbs/ft² [2000 kg/m²]. The minimum packing sizes retained by this plate include #25 IMTP packing, 1 in. [25 mm] Intalox saddles and ¾ in. [19 mm] rings. Tube restrictor size may vary depending on packing size specified.

**Design Options**

- Corrosion allowance

### Model 834 Flow Rate Boundaries with Model 644*

<table>
<thead>
<tr>
<th>Continuous Phase Flow gpm/ft² [m³/m²•h]</th>
<th>Dispersed Phase Flow gpm/ft² [m³/m²•h]</th>
<th>Maximum Dispersed Turndown Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max.*</td>
<td>Min.</td>
<td></td>
</tr>
<tr>
<td>7.5 [18]</td>
<td>2.1 [5]</td>
<td>72.3 [175]</td>
</tr>
</tbody>
</table>

* These limits apply to the disperser plate capacity; packing capacity may limit operating capacity.
** Turndown of the continuous phase is unlimited.

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
The Model 835 disperses a heavy phase into the continuous light phase. Riser tubes allow the light phase to pass up through the plate. The heavy phase forms a head on the top of the plate and orifices generate droplets. The plate design depends on interfacial surface tension, viscosity and differential densities.

Feed to the Model 835 of the dispersed phase is recommended with the Model 644 feed pipe. Flow rates and turndown may be severely limited if the Model 644 is not used.

**Construction Details**

The Model 835 is available in any weldable sheet metal. The plate is supported by a full ledge.

All plates up to 32.87 in. [835 mm] ID are clamped to the ledge. Clamps are recommended on larger towers if the operating load on the plate is less than 100 lbs/ft² [500 kg/m²]. Most plates support 400 lbs/ft² [2000 kg/m²].

The minimum packing sizes retained by this plate include #25 IMTP packing, 1 in. [25 mm] Intalox saddles and ¾ in. [19 mm]-rings. Tube restrictor size may vary depending on packing size specified.

**Model 835 Flow Rate Boundaries With Model 644**

<table>
<thead>
<tr>
<th>Continuous Phase Flow gpm/ft² [m³/m²•h] Max.</th>
<th>Dispersed Phase Flow gpm/ft² [m³/m²•h] Min. Max.</th>
<th>Maximum Dispersed Turndown Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5 [18]</td>
<td>2.1 [5]</td>
<td>72.3 [175] 5.5:1</td>
</tr>
</tbody>
</table>

* These limits apply to the disperser plate capacity; packing capacity may limit operating capacity.

**Design Options**

- Corrosion allowance

Ask your Saint-Gobain NorPro representative about other options at the time of inquiry.
**Model 644 Dispersed-Phase Feed Pipe**

The Model 644 feed pipe controls velocity of the dispersed phase flow onto the disperser plate. It is important to prevent excessive turbulence at the phase boundary at the plate. The Model 644 controls feed velocity and correctly positions the discharge points to minimize disturbance. If this requirement is not met, this could lead to maldistribution, loss of dispersion, and premature flooding. For additional information on flow rates, see Models 834 or 835.

**Construction Details**

The Model 644 is available in any weldable metal in pipe form and in which flanges are available.

**Design Options**

- Bayonet connection
- Corrosion allowance
- All flanged construction

---

**Model 744 Continuous-Phase Distributor**

The Model 744 distributor controls velocity of the continuous phase flow into the tower. Proper control of velocity is important to prevent excessive disturbance of the heavy/light interface, which could lead to carry-over of the dispersed phase. The maximum continuous phase flow should be less than 7.5 gpm/ft² [18.3 m³•m²]. For additional information on flow rates, see Models 834 or 835.

**Construction Details**

The Model 744 is available in any weldable metal in pipe form and in which flanges are available.

**Design Options**

- Bayonet connection
- Corrosion allowance
- All flanged construction
**Typical Tower Layout**

**Smaller Diameters**  
(Flanged towers)

**Larger Diameters**  
(Internals and packing pass through manways for installation)

**Rough Dimensions**

- Flash feed arrangement not pictured.
- Manways at each distributor should not be $180^\circ \pm 10^\circ$ from the inlet pipe.
- Allow 36 in. ($H_n$) for chimney/collectors.

Typical dimensions are offered for rough estimating purposes.  
Contact Saint-Gobain NorPro to determine more accurate dimensions.
GENERAL DETAILS

SCOPE OF SUPPLY

For the internals described in this brochure, Saint-Gobain NorPro provides all removable parts. The internals do not include shell attachments for connection or support, although these may be quoted/supplied by Saint-Gobain NorPro separately. Examples of attachments required are:

- Support rings, sump frames
- Internal flanges at feed nozzles, including gasket
- Wall clips for internals support
- Deflector for Model 755

Exceptions wherein Saint-Gobain NorPro supplies attachments include:

- Wall wipers for Models 107, 127, 137, 1017 and 733

MINIMUM LEDGE WIDTHS

<table>
<thead>
<tr>
<th>Tower ID [mm]</th>
<th>Plates Resting or Clamped to Ledge [mm]</th>
<th>Plates Bolted or With Leveling Screws [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 18 [up to 457]</td>
<td>0.75 [20]</td>
<td>1.5 [40]</td>
</tr>
<tr>
<td>18.1 – 24.24 [458 – 615]</td>
<td>1.0 [25]</td>
<td>1.5 [40]</td>
</tr>
<tr>
<td>24.25 – 48.24 [616 – 1225]</td>
<td>1.5 [40]</td>
<td>2.0 [50]</td>
</tr>
<tr>
<td>48.25 – 72.24 [1226 – 1835]</td>
<td>2.0 [50]</td>
<td>2.0 [50]</td>
</tr>
<tr>
<td>72.25 – 96.5 [1836 – 2450]</td>
<td>2.5 [65]</td>
<td>2.5 [65]</td>
</tr>
<tr>
<td>96.6 – 144.5 [2451 – 3670]</td>
<td>3.0 [75]</td>
<td>3.0 [75]</td>
</tr>
<tr>
<td>144.6 – 168.7 [3671 – 4285]</td>
<td>3.5 [90]</td>
<td>3.5 [90]</td>
</tr>
<tr>
<td>168.8 – 216.3 [4286 – 5495]</td>
<td>4.0 [100]</td>
<td>4.0 [100]</td>
</tr>
<tr>
<td>216.4 – 240.5 [5496 – 6110]</td>
<td>4.5 [115]</td>
<td>4.5 [115]</td>
</tr>
</tbody>
</table>

If your ledge size is other than listed above, special consideration must be given to the plate diameter and vessel tolerances.

BAYONET TYPE INLET NOZZLES

Type I

Type II

Non-lethal service

Type III

Meets ASME code for lethal service
The following metals are most frequently used for tower internals:

- Carbon Steel
- Stainless Steel (low carbon content is preferred) - Ferritic, Austenitic, Duplex, Martensitic
- Nickel Alloys
- Copper Alloys
- Titanium, zirconium

Internals are not stress-relieved or annealed. Internals do not typically classify to pressure vessel standards.

All fasteners will be \(\frac{3}{8}\) in. [10 mm] unless otherwise specified.

All weights shown in this brochure for metal internals are for standard thickness stainless steel, unless otherwise specified.

Some multiple-piece-construction tower internals (primarily liquid distributors and liquid collectors) require gasketing for linear joints on the devices. Many choices of gasketing material are available; braided fiberglass tape and expanded PTFE strip are common. Other tower internals (primarily feed devices and some liquid distributors) require pipe-flange gaskets. Non-asbestos SBR and PTFE sheet are common.

The table below shows rough temperature limits for tower internal made of various thermoplastics. Designs for temperatures approaching these limits may need special heavy construction, especially if the design loads are high or if the tower diameter is large.

The maximum operating temperature of thermoplastic internals varies from the maximum temperature of the packing of the same material because of the creep tendency of thermoplastics.

Thermoplastic fasteners are generally \(\frac{1}{2}\) in. [13 mm].

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**Fiber Reinforced Plastic (FRP)**

Fiber Reinforced Plastics are available in the following materials:

- Polyester (such as Atlac 382-05A, Hetron 700, Dion 6694)
- Vinyl ester (such as Derakane 411-45, Atlac 580-05A, Hetron 922, Dion 9100, Corezyn 8300)
- High temperature vinyl ester (such as Derakane 470-300, Hetron 980)

Reinforcing mat for all resins is corrosion resistant glass. A curing system must be specified when using polyester, vinyl ester or high temperature vinyl ester resins. Our standard curing method is MEKP/Cobalt. Optional methods include BPO/DMA or CHP/Cobalt. The standard surface veiling for these resins is one-ply nexus; two-ply nexus is optional. The veiling is on the inside and outside surfaces of the internal. Cut edges and weld joints are not veiled; they are sealed with a gel coat as standard.

Several types of tower internals require ledge clamps, which cannot be provided in FRP. Specify thermoplastic or metal clamps for these internals.

Atlac, Dion-Cipp are registered trademarks of Reichhold, Inc.
Hetron resin is a registered trademark of Ashland Chemical, Inc.
Derakane is a registered trademark of Dow Plastics.
Corezyn is a registered trademark of Commercial Resins Div., Interplastic Corp.
When your specifications for internals fall outside the standards shown in this brochure, Saint-Gobain NorPro can modify the design in accordance with your equipment needs. Saint-Gobain NorPro designs and fabricates tower internals and packings in metals, ceramic, graphite or plastics to meet your mass transfer requirements.

The following is a partial listing of models which are supplied by Saint-Gobain NorPro, but not specifically covered in this brochure. For more information on these or other models contact your Saint-Gobain NorPro representative.

<table>
<thead>
<tr>
<th>Device</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributors</td>
<td>120</td>
<td>Metal internal strainer baskets used to strain internal liquid flow to prevent low flow liquid distributors and Intalox wire gauze packing from fouling.</td>
</tr>
<tr>
<td></td>
<td>146</td>
<td>Metal enclosed Intalox distributor used in clean systems with limited height.</td>
</tr>
<tr>
<td></td>
<td>176</td>
<td>Metal Intalox trough distributor with parting box and bottom orifices.</td>
</tr>
<tr>
<td></td>
<td>854</td>
<td>Metal in-bed distributor to distribute small quantities of liquid feed into a bed without separating the random packed section.</td>
</tr>
<tr>
<td>Feed Devices</td>
<td>144</td>
<td>Metal suppressed flash vapor distributor which achieves vapor distribution and vapor mixing in a flashing feed or reboiler return.</td>
</tr>
<tr>
<td></td>
<td>192</td>
<td>Metal vapor horn for atmospheric and vacuum crude towers.</td>
</tr>
<tr>
<td></td>
<td>194</td>
<td>Metal vane-style vapor inlet diffuser.</td>
</tr>
<tr>
<td></td>
<td>655</td>
<td>Metal two-phase feed pipe with shelter plates. Used in feeding collector plates or distributors with parting box(es).</td>
</tr>
<tr>
<td></td>
<td>796</td>
<td>Metal gas distributing support plate used in low pressure (low liquid flow) service where vapor distribution in a compact space is required.</td>
</tr>
<tr>
<td>Bed Limiters</td>
<td>822</td>
<td>Metal bed-limiter used with Model 1044 spray distributors to reduce spray pattern interference at the top of the bed.</td>
</tr>
<tr>
<td>Support Plates</td>
<td>104</td>
<td>Metal non-interfering support plate that allows liquid to pass without diversion, eliminating need for redistribution. Limited to short beds of packing.</td>
</tr>
<tr>
<td></td>
<td>1004</td>
<td>Metal gas injection type support plate for catalyst beds.</td>
</tr>
<tr>
<td></td>
<td>840</td>
<td>Metal gas injection type support plate used to divert liquid to feed a tray or other device or to provide partial liquid draw-off.</td>
</tr>
<tr>
<td>Collector Plates</td>
<td>841</td>
<td>Metal in-bed collector/draw off of up to 3 to 5% of column liquid for flows up to 26 gpm [6.0 m³/hr].</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>100</td>
<td>Metal support ledge for field attachment.</td>
</tr>
<tr>
<td></td>
<td>101</td>
<td>Metal support beam.</td>
</tr>
<tr>
<td></td>
<td>102</td>
<td>Metal support truss.</td>
</tr>
<tr>
<td></td>
<td>858</td>
<td>Metal in-bed wall wiper (Rosette type).</td>
</tr>
<tr>
<td></td>
<td>111</td>
<td>Metal anti-migration screen to separate different size packing in a single bed.</td>
</tr>
</tbody>
</table>

Also ask your Saint-Gobain NorPro representative about their line of ceramic tower internals. Saint-Gobain NorPro provides a complete line of distributors and support plates in a high-strength Aludur® ceramic body.
FAST SERVICE

Saint-Gobain NorPro offers a FAST hotline (Fast Action Support Team). No amount of planning can prepare you for an emergency shutdown. However, when the unexpected happens, the NorPro™ FAST team stands ready to help you get your mass transfer tower back in service without delay. FAST is available 24-hours a day, seven days a week, to expedite your order for replacement tower internals, packings, trays and related parts for plant emergencies or capacity-expanding revamps.

For FAST service, call your account manager or in the U.S. call (330) 813-1000. In the U.K. call 0044 78 74456.

SOFTWARE AVAILABLE

Our Packed Tower Design program helps you size your tower and select the proper packing for optimal tower performance. The program calculates pressure drop, efficiency and capacity of NorPro packings and estimates liquid hold-up.

Saint-Gobain NorPro offers a tray design manual and PC software program to assist engineers in designing and evaluating NorPro™ trays. The program automates all calculations necessary for process design. The software is simple to use, and it offers easy data file storage and retrieval.

Software is available as a download feature from our web site, www.intalox.com.

ONE CALL FOR A TRUE EDGE IN PROBLEM SOLVING

From finding out what's wrong with your tower to providing the necessary equipment and installing it, a single phone call covers it all. Saint-Gobain NorPro has forged a cooperative alliance with three leading independent service companies, forming a network of specialists dedicated to meeting all your mass transfer needs seamlessly.

EXPERT INSTALLATION AND INSPECTION SERVICES BY CANA-TEX FIELD SERVICES

The experts at Cana-Tex Field Services work to put your tower back in service without delay. Installation technicians and engineers coordinate schedules for maximum efficiency and minimal down-time. The firms’ critical path focus assures you that your installation activities will be completed safely and on time. With locations positioned throughout the world, we can guarantee a team of experienced technicians on site when you need them.

INSTALLATION, MODIFICATION AND REPAIR SERVICES

- Inspection services
- ASME “U” and NBIC “R” code stamps
- CWI and API 510 qualified personnel
- Site supervision and project management services

STATE-OF-THE-ART TROUBLESHOOTING BY SYNETIX SERVICES

Identifying problem areas quickly and accurately is the key to getting your tower running at peak performance without costly delays. Whether you are troubleshooting a problem tower, establishing a baseline for future reference or simply looking for ways to improve production, Synetix leads the industry in tower diagnostics with proven technology and the knowledge to apply it. Synetix has established itself over their 30 year history as a world leader with its Tracerco brand of gamma scanning and tower diagnostic services.

- Tracerco™ Gamma Ray Scanning
- Tracerco™ Radiotracer Diagnostics
- Tracerco™ Neutron Backscatter

EXTENSIVE MODULAR PROCESS PLANT CAPABILITIES WORLDWIDE

The acquisition of Eta Process Plant Ltd expanded Saint-Gobain NorPro’s capability to provide completely integrated modular process plants. Our continuum of specialized services begins with conceptual design and continues through site installation, commissioning and training.

Our multi-disciplined engineering team offers expertise in the areas of process design, mechanical engineering, project management, electrical engineering, instrumentation and information technology.

We now specialize in distillation, scrubbing and stripping processes for our European customers. Known globally for its excellence, Eta’s water deaeration technology is available to NorPro customers throughout the world.

Customers now can receive the best mass transfer products available along with innovative design services, reliable delivery, strict quality control and efficient process performance.

In the U.S., Saint-Gobain NorPro offers pre-assembled distillation plants through an agreement with APV Americas Separation Technologies division. APV uses the latest process simulation software as well as their in-house pilot facilities to provide reliable designs for their modular process plants. APV constructs each plant in easy-to-assemble modules, which contain Saint-Gobain NorPro’s industry-leading trays and packings. Their extensive list of successful distillation systems in operation includes pharmaceutical, specialty chemicals, beverage, flavorings, fragrances and fuel ethanol processes.

Whatever your process or wherever you are located, Saint-Gobain NorPro has the resources to meet all your process plant needs.
Locations

Worldwide Headquarters
Saint-Gobain NorPro Corporation
P.O. Box 350
Akron, OH 44309-0350
Telephone: (330) 673-5860
U.S. Toll Free: 1-866-NORPRO-1
Fax: (330) 677-7245

Main Office Europe
Saint-Gobain NorPro
European Operations
King Street
Fenton, Stoke-on-Trent
ST4 2LT England
Telephone: (44) 1782 744561
Fax: (44) 1782 744330

Main Office Japan
Saint-Gobain Norton KK
Saint-Gobain NorPro
Saint-Gobain Building 6F
3 Chome 7, Kojimachi
Chiyoda-ku
Tokyo 102-0083, Japan
Telephone: (81) 3 3263 0096
Fax: (81) 3 3263 0097

The information herein does not constitute a
guarantee or warranty. The Saint-Gobain NorPro
Corporation warranty is set forth in its standard terms
and conditions, which govern sales of Saint-Gobain
NorPro products. The standard terms are set forth
on Saint-Gobain NorPro quotations and acknowl-
edgements and are also available on request.

Saint-Gobain NorPro Corporation, worldwide
headquarters, sales offices and manufacturing
facilities are certified for ISO 9001:1994.

Saint-Gobain NorPro’s European operation
is approved and certified through BSI to