Liquid Distribution

Liquid distributors are used in packed columns above each bed of packing. The distributor, depending upon its design features, is elevated between 0 to 8 in. [0-200mm] above the packing. The space is determined by the distributor type and the vertical height required to disengage the vapor phase from the packing before it flows through the distributor gas passage area.

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

- Uniform liquid distribution
- Proper operation through its turn-down range
- Low vapor phase pressure drop
- Resistance to plugging or fouling
- Optimal use of vessel height for proper performance
- Minimal liquid residence time
- Mixing capability for redistribution to the next bed

The introduction of high performance tower packings in the 1970's and 1980's accentuated the design deficiencies of distributors available at the time. In response, Koch-Glitsch introduced distributors with features to correct these deficiencies. These important features are well understood by Koch-Glitsch and have been incorporated in the family of INTALOX high performance distributors.

Koch-Glitsch offers two categories of liquid distributors to meet the requirements of specific applications. In determining which category to choose, it is necessary to know the sensitivity of the process and whether the liquid distribution will significantly affect the overall tower performance.

As a general rule:

- Koch-Glitsch INTALOX high performance distributors are used typically with FLEXIPAC, FLEXIPAC HC, INTALOX and wire gauze structured packings or IMTP, SNOWFLAKE, CMR and β-ETA RING high performance random packings in the following services: distillation, processes approaching equilibrium or heat-transfer applications with close approach temperature.

- Koch-Glitsch “traditional” distributors are generally used with traditional packings (FLEXIRING® and HY-PAK® Random Packings, plastic Super INTALOX® Saddles, FLEXIGRID® and GLITSCH GRID® Structured Packings) in general absorption, stripping and heat transfer applications. Traditional distributors take advantage of standardized, pre-engineered design and the optimal use of raw materials. These distributors do not generally provide liquid flow uniformity comparable to INTALOX high performance distributors.

Redistribution

The decision of when to install more than one packed bed and redistribute the liquid is somewhat more involved. There are six major reasons to split a packed bed and redistribute the liquid:

- Feed introduction
- Product side draw
- High theoretical stage count
- Desire to cross-mix the liquid
- Liquid maldistribution
- Physical weight of the packed bed

Introduction of a liquid or vapor feed to a column requires a space in the packing and redistribution of the liquid phase. Important factors to keep in mind with the introduction of a liquid feed are the temperature and composition of the feed stream compared to the internal column liquid. Normally, unless the feed rate is small compared to the flow rate of the internal column liquid, it is desirable to mix the feed with the internal liquid to provide compositional uniformity before distributing it to the packed bed below. It is also advisable to mix the feed stream and internal liquid when their temperatures are significantly different. The degree of the thoroughness of the mixing depends upon the magnitude of the differences and to what extent the gradients are expected to affect the overall performance.

Liquid cross-mixing and maldistribution correction often go hand-in-hand. When a packed column is designed with a large number of theoretical stages or transfer units, a constant liquid to vapor ratio (L/V) is needed to achieve the best overall column performance. Redistribution of the liquid ensures that the L/V ratio is maintained, while cross-mixing between beds ensures uniform composition.

Based on Koch-Glitsch's operating experience, a rule-of-thumb is to limit a single packed bed to no more than 20 theoretical stages or transfer units. Consult a Koch-Glitsch technical representative for further details. Note that in some special circumstances, Koch-Glitsch applies more restrictive rules than those discussed above.
Perfect liquid distribution is defined as providing equal liquid per unit area of the packed bed surface. Theoretically, this would require an infinite number of liquid streams, all at identical flow. This is clearly impossible. A number of factors such as orifice size, fouling potential, and mechanical construction limit the ability to make the “perfect” distributor. INTALOX high performance distributors approach perfection by applying the following criteria:

- Drip points located in a uniform pattern
- Drip point positions uninterrupted by vapor chimneys or mechanical supports
- Drip points properly spaced with respect to the vessel wall
- Minimal variation in flow between drip points

Koch-Glitsch “traditional” distributors have less uniform distribution patterns and liquid flow than the INTALOX high performance distributors. This is due to significant standardization and pre-engineering of the traditional internals to optimize their construction and to fit them for a wide range of conditions. This optimized, standardized design makes traditional distributors an economical alternative. Traditional distributors have been used successfully for many years in a wide range of applications.

Koch-Glitsch developed a distributor rating system to quantify distributor performance or “distribution quality”. The rating uses a percentage scale with theoretical perfection set at 100%. Low percentage ratings reflect areas of the column that are receiving liquid flow significantly different from other areas.

INTALOX high performance distributors are always recommended for:

- Distillation services with high stage count per bed
- Distillation systems with a low relative volatility
- High purity product distillation services
- Distillation services operating near the minimum reflux ratio or close to a pinch point
- Absorption or stripping applications with close approach to equilibrium
- Heat transfer applications with close approach temperatures

The chart below demonstrates the overall effect that can be expected with various levels of distribution quality. The maximum maldistribution that can be tolerated in a packed bed is strongly dependent on the product composition, the relative volatility, the liquid to vapor ratio, etc. Koch-Glitsch considers all these aspects as well as others while designing packed columns.

Liquid Rate and Cross Flow Capability

As the liquid rate on a distributor is increased, the cross flow capability of the distributor and its pre-distribution system become more critical. Since gravity fed distributors are dependent on liquid level to determine flow, the liquid must be carefully balanced in order to provide point-to-point flow uniformity. It is important that the pre-distribution system properly meters liquid flow to the distributor without inducing excessive horizontal velocities, gradients in liquid head or turbulence. Pre-distribution is achieved by the use of feed pipes, pre-distribution channels and/or parting boxes. The design of the pre-distribution system becomes increasingly complex as the specific liquid rate and/or the column diameter increases.
The drip point density has an influence on the efficiency of the uppermost part of a packed bed. With the most commonly used sizes of random and structured packings, the effect of the drip point density is relatively minor. In actual laboratory testing, three packings tested under identical conditions, with the exception of drip point density, indicated the effect shown on the right.

The change from 5.5 to 14.5 points/ft\(^2\) [60 to 155 pts/m\(^2\)] has a relatively minor effect on the Height Equivalent to a Theoretical Plate (HETP). High drip point densities can greatly affect the cost of a high performance distributor and can also limit the vapor capacity for some distributor types. In addition, distributors with high drip point densities can be prone to fouling due to small orifice diameters (See page 6).

However, drip point density does have a considerable affect on the performance of high surface area, very high efficiency packings. The table below details the guidelines for drip point count based on the high performance packing to be used.
**Fouling**

For a distributor to perform correctly, it is important that the metering devices do not become fouled. There are several mechanisms and sources of fouling materials: polymerization, coking, scale, construction debris, sediment, rust flakes, etc. All precautions should be taken to eliminate fouling materials outside of the column since external strainers and filters are far easier to clean than distributors. In some cases it is not possible to eliminate all external fouling sources. In other cases the source of the fouling material can be within the column itself. Therefore, the choice of the distributor should be dependent on the nature of any fouling.

The list below ranks the fouling resistance of various metering devices and arrangements for liquid distributors, starting at the top with the most resistant:

- V-notch weir
- Spray distributor
- Slotted weir
- Sidewall orifice
- Bottom orifice

Optional strainers and filter boxes can be provided to protect orifices from small quantities of particulate matter such as vessel wall or pipe scale. These devices are not effective if the fouling material coats, pastes or sticks to metal surfaces. Distributors with weirs for liquid metering will not meet the criteria for flow variation for an INTALOX high performance distributor.

**Operating Range**

A distributor will give its best performance at and around 100% of the design liquid flow rate. As the rate decreases and the liquid head drops, levelness of the distributor as well as gradients in liquid level become a larger percentage of the operating liquid head. At some turndown rate, the flow variation from point-to-point will fall outside of acceptable limits. INTALOX distributors are designed to have a maximum flow variation, defined as the coefficient of variation (Cv), equal to no more than 3% at design rates and no more than 5% at turndown rates. Special designs are available for many INTALOX high performance distributors that will result in even lower flow variation. Typical turndown ranges are given in the description for the various distributor models.

Koch-Glitsch "traditional" distributors allow greater flow variations than INTALOX high performance distributors and typically have a broader range of operation. For high turndown requirements, multi-level orifices or slotted weirs may be used with some INTALOX distributor designs as well as traditional distributor styles. It should be noted, however, that when using these metering devices, the flow variation will be higher throughout all or part of the operating range than with a single orifice. While the liquid level is in the area of transition between multi-level orifices, there will be a zone of high flow variation that will significantly exceed the limits allowable for an INTALOX high performance distributor.

**Orifice Size**

In gravity-fed distributors, the orifice size is dependent upon the drip point density, the specific liquid rate and the height of the liquid. For a single level orifice, with an operating range of 60 to 120% of the design flow, the approximate orifice size is indicated in the graph below.

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**Approximate Orifice Size for Gravity Flow Distributors**

![Graph showing approximate orifice size for gravity flow distributors.](image-url)
Depending on the flow rates, column configuration and general mechanical preferences, there are several ways to achieve good liquid distribution.

Deck Type Distributors
Deck style distributors are clamped on an annular ring that is seal welded to the tower wall. For revamp applications of trayed columns, most often an existing tray ring is utilized and seal welded segments are added as needed. In the case where welding is not permitted, bolt-in segments are available by special request but provide a less reliable liquid seal. Leakage from and around bolt-in support ring segments can be a significant portion of the total liquid flow, resulting in poor distribution quality. In this case, a trough or channel type distributor should be considered.

Channel Type Distributors
The center channel is designed as a structural member allowing the distributors to rest on a support ring and span columns up to 20 ft [6 m] without the need for additional beams.

Locating the distributor on existing support ring in revamp work often makes it easy to determine the tower layout. Supporting a channel type distributor on an annular ring generally requires a more complex design and construction in order to provide drip points at the proper proximity to the tower wall. This increased complexity can be avoided by supporting channel type distributor with the center channel resting on a seat and the channel troughs hung from beams or a ring above. Both beam and ring supported channel distributors can be designed to accommodate uplift conditions. The center channel of a channel type distributor provides cross flow capacity between troughs, to enable liquid head equalization.

The addition of covers or hats over the gas riser area provides the ability to turn the device into a redistributor for use between packed beds. This design is especially useful when tower elevation is tight and minimal height for redistribution is required.

Trough Type Distributors
Trough type distributors are usually hung from beams. When used in conjunction with structured packings, in special circumstances, the trough distributor may be supported from an integral support system resting directly on the packing. Trough type distributors are easily installed and leveled, do not require gaskets and have no annular ring below to interfere with the distribution pattern.

Each trough is fed a metered amount of liquid from one or more parting boxes. Because there is no flow communication between troughs, the performance of the parting box is critical. Koch-Glitsch’s years of experience ensure parting box designs for proper flow metering.

When used between packed beds for redistribution, a trough type distributor requires the use of a collector to catch the liquid from the bed above. The use of a separate collector provides complete cross mixing of the liquid before redistribution and also allows mixing of feed streams with the internal column liquid. A separate collector requires more column height than a channel type redistributor.

Model 106 INTALOX® Pan Distributor (Model 107 Redistributor)

- Diameters 6 - 36 in. [150 - 900 mm]
- Orifices in pan floor
- Liquid rates above 2 gpm/ft² [5 m³/m² h]
- Limited fouling resistance

Orifices in the pan bottom are arranged to provide optimum distribution quality, with gas risers positioned between the drip points. Small diameter pans may not require 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 tend not to foul. Orifice strainer caps, raised orifices or a Model 136/137 should be considered for low flow rates in combination with fouling concerns. For rates lower than 2 gpm/ft² [5 m³/m² h] a Model 136/137 should be considered first. This distributor has a standard turn-down range of 2:1 and can be leveled during installation.

In towers less than 24 in. [600 mm] diameter, one-piece construction, for installation through a body flange, is standard. A special multi-piece construction is available upon request.

Construction Details
Standard connection to the tower wall is by bolting to clips. As an option, the distributor can be suspended from clips or a ring trapped between body flanges. Setting the distributor on an annular ring is not recommended.

All joints in multi-piece pans are gasketed.

The standard design for a Model 107 redistributor includes gas riser covers and a weld-on wall wiper.

Design Options
- Orifice strainers
- Expandable and gasketed wall wiper (Model 107)
- Suspended mounting
- Raised tube metering for high turndown or fouling concern
- Anti-migration bars
The Model 116/117 distributor is 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. Design of the Model 116/117 distributor takes into account support ring levelness tolerances within ASME code or as otherwise specified. All joints are gasketed.

For redistribution between beds, a separate liquid collector is not required. The standard design for a Model 117 redistributor includes gas riser covers to collect liquid.

- Orifice strainers
- Anti-migration bars in gas risers
- Raised tube metering for high turndown or fouling concern
- Construction for mounting between flanges

The standard turndown range is 2 : 1.

Model 126 INTALOX® Channel Distributor with Bottom Orifices (Model 127 Redistributor)

- Diameters greater than 36 in. [900 mm]
- Liquid rates between 2 - 16 gpm/ft² [5 - 40 m³/m² h]
- Orifices in channel base
- Limited fouling resistance
- Structural center channel provides flow equalization

Orifices in the base of the channels are positioned to optimize distribution quality. Vapor passage is provided by the space between the channels. Rates lower than 2 gpm/ft² [5 m³/m² h] can be accommodated but a Model 136 sidewall orifice distributor should be considered first. For systems with liquid rates in excess of 12 gpm/ft² [30 m³/m² h] a Model 116 deck style distributor should be considered.

The channel-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 low to moderate fouling resistance.

The standard turndown range is 2 : 1.
The Model 136/137 distributor are usually constructed as pans for diameters below 30 in. [750 mm] and as channels for diameters above 30 in. [750 mm].

The Model 136/137 distributor rests on an annular ring or is suspended from beams or clips. All joints are gasketed.

The standard design for the Model 137 redistributor includes a weld-on wall wiper and bolted gas riser covers to collect and redistribute liquid. The redistributor design uses less column height than a separate collector/distributor layout and is valuable where space is limited and total cross mixing of liquid between beds is not critical.

- Cross-mixing capability (extent is dependent on diameter and rate)
- Orifice strainers
- Leveling screws
- Multi-level orifices
- Expandable and gasketed wall wiper (small diameter Model 137)
- Removable drip tubes

Orifices in the sidewalls of the channels are positioned to optimize distribution quality. Vapor passage is provided by the space between the troughs.

The fouling resistance of this distributor is higher than that of deck-type distributors because it features a debris collection zone below the sidewall orifices. The center channel of the distributor provides structural support as well as equalization of liquid between troughs.

The liquid from each drip point is conducted into the lower vapor velocity region below the distributor troughs. This results in low entrainment levels. In addition, overflow holes are provided at each conductor tube to ensure that if the maximum flow range of the distributor is exceeded, the liquid will be conducted to the packing in a controlled manner rather than to randomly spill over the troughs.

The standard turndown for a single sidewall orifice is 2 : 1. Using multiple orifices at two or more levels of the same discharge conductor can extend the turndown range. Turndown ratios up to 10 : 1 are achievable. The flow variation will be higher throughout all or part of the operating range with multi-level orifices.

Diameters greater than 10 in. [250 mm]
Liquid rates between 0.3 - 12 gpm/ft² [0.75 - 30 m³/m² h]
Structural center channel provides flow equalization
Liquid overflow protection
Side-wall orifices
Fouling resistant

Construction Details

The Model 136/137 distributor are usually constructed as pans for diameters below 30 in. [750 mm] and as channels for diameters above 30 in. [750 mm].

The Model 136/137 distributor rests on an annular ring or is suspended from beams or clips. All joints are gasketed.

The standard design for the Model 137 redistributor includes a weld-on wall wiper and bolted gas riser covers to collect and redistribute liquid. The redistributor design uses less column height than a separate collector/distributor layout and is valuable where space is limited and total cross mixing of liquid between beds is not critical.

Design Options
Model 141 INTALOX® Tubular Distributor

- Diameters 6 - 120 in. [150 - 3000 mm]
- Liquid rates between 0.3 - 8 gpm/ft² [0.75 - 20 m³/m² h]
- Enclosed tubular laterals
- High distribution point density
- Clean service only

The Model 141 distributor is most often used in conjunction with wire gauze packings. Orifices in the bottom of the tubular laterals are positioned to optimize distribution quality with a high drip point density. Vapor passage is provided by the space between the laterals. The Model 141 INTALOX distributor is suggested only for towers in extremely clean service free of fouling materials and debris.

The standard turndown is 2 : 1. However, the turndown range can be extended to approximately 5 : 1 if sufficient column height is available.

Model 156 INTALOX® Trough Distributor with Enhanced Baffle Plates

- Diameters greater than 30 in. [760 mm]
- Liquid rates between 0.3 - 8 gpm/ft² [0.75 - 20 m³/m² h]
- Sidewall orifice with enhanced baffle
- Fouling resistant
- For use with structured packing
- High vapor capacity
- Low entrainment

The Model 156 INTALOX distributor is designed for use only above structured packing. Orifices in the sidewalls of the troughs are positioned to issue liquid against an enhanced baffle that spreads the liquid in a direction perpendicular to the orientation of the top layer of the structured packing. The enhanced baffle increases the effective drip point density by uniformly wetting each and every sheet of structured packing. This increase in effective drip point density provides the ability to use a larger orifice diameter, contributing to increased fouling resistance.

The baffle plate distributor has excellent distribution performance characteristics particularly at low liquid rates. Total wetting of the packing surface is completed in only one layer of packing. Vapor passage is provided by the space between the troughs. The baffle also acts to shield the liquid from the vapor stream to avoid entrainment, thereby making this an excellent distributor choice when operating at high vapor rates.

Construction Details
- As the standard, the Model 141 distributor is supported and leveled from an integral distributor support grid (Model 883).

For redistribution between packed beds, a separate liquid collector is required. The use of a separate liquid collector provides total cross mixing of the liquid between beds.

Design Options
- Turndown ratio greater than 2 : 1
- Non-standard mounting arrangements
- Diameters exceeding standard range

Construction Details
- The Model 156 is suspended from beams. The troughs are continuous across the column diameter and are fed with one or more parting boxes. Details of baffle arrangement are variable depending upon specific liquid rates and are determined at the time of design. There are no joints to seal, therefore, no gaskets are required for this distributor.

For redistribution between packed beds, a separate liquid collector is required. The use of a separate liquid collector provides total cross mixing of the liquid between beds.

Design Options
- Mount on packing with the
- Model 883 bed limiter/support
- Metering boxes
Model 186 INTALOX® Trough Distributor with Drip Tubes

- Diameters greater than 30 in. [760 mm]
- Liquid rates between 0.3 - 10 gpm/ft²
  [0.75 - 25 m³/m² h]
- Sidewall orifice
- Liquid overflow protection
- Fouling resistant
- Low entrainment

Orifices in the sidewalls of the troughs are positioned to optimize distribution quality. Vapor passage is provided by the space between the troughs. Special designs can handle liquid rates above or below the above stated range.

The liquid from each drip point is conducted into the lower vapor velocity region below the distributor troughs. This results in low entrainment levels. In addition, overflow holes are provided at each conductor tube to ensure that if the maximum flow range of the distributor is exceeded, the liquid will be conducted to the packing in a controlled manner rather than to randomly spill over the troughs.

The standard turndown for a single sidewall orifice is 2 : 1. Using multi-level orifices at each discharge conductor can extend the turndown range up to 10 : 1. The flow variation will be higher throughout all or part of the operating range with multi-level orifices.

Construction Details

- Orifice strainers
- Multi-level orifices
- Metering Boxes
- Mounted on support ring or supported by Model 883 bed limiter/support

As the standard, the Model 186 distributor is suspended from beams. By special request, and within a limited range of diameters, provisions can be made for the distributor to rest on an existing support ring.

Model 186 troughs are continuous across the column diameter and are fed with one or more parting boxes. There are no joints to seal, therefore, no gaskets are required.

For redistribution between packed beds, a separate liquid collector is required. The use of a separate liquid collector provides total cross mixing of the liquid between beds.
Model 905 Pan Distributor with V-Notch Risers

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

The Model 905 pan distributor is used for highly fouling services in towers with a diameter of less than 48 in. [1200 mm]. Cylindrical risers with “V” shaped weirs act as liquid downcomers as well as vapor risers. A high liquid turndown ratio is possible due to the weirs. However, the vapor velocity in the riser limits both liquid and vapor flow rates since both phases are flowing counter-currently in the same passages.

Model 906 Pan Distributor with Bottom Orifices

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

The pan-type construction provides liquid level balance. Vapor passage is provided by circular gas risers as well as around the periphery of the pan. For small diameters, all vapor passage may be provided by the gap between the pan and the vessel wall, rather than gas risers.

For towers with diameters up to 20 in. [500 mm], the standard is to construct the pan in one piece for installation through a body flange. The standard turndown range is 2.5 : 1.
The distributor rests on an annular ring and is secured with tray clamps. For redistribution between beds, a separate liquid collector is not needed. The standard design for a Model 917 redistributor includes gas riser covers to collect liquid.

Distributors in services with liquid rates below 4 gpm/ft² [10 m³/m² h] are gasketed as standard.

### Model 926 Channel Distributor with Bottom Orifices (Model 927 Redistributor)

- **Diameters greater than 36 in. [900 mm]**
- **Liquid rates between 1 - 20 gpm/ft² [2.5 - 50 m³/m² h]**
- **Orifices in base**
- **Limited fouling resistance**
- **Structural center channel provides flow equalization**

The Model 926 distributor is a channel type distributor providing good cross flow and liquid handling capacity with low leakage compared to a deck style (Model 916) distributor. The structural center sump allows this distributor to be used in large diameter columns, up to 26 ft [8 m], without the need for additional support beams. The standard turndown range is 1.8 : 1.

### Construction Details

The Model 926/927 distributor rests on an annular ring. Gasketed joints are standard for liquid rates below 4 gpm/ft² [10 m³/m² h].

The Model 927 redistributor includes gas riser area covers to collect liquid as well as a wall wiper to be welded to the column wall.

### Design Options

- **Cross mixing (Model 927)**
- **Clamped to support ring for uplift resistances**
- **Leveling screws**
Model 976 Trough Distributor with Bottom Orifices

- Diameters greater than 36 in. [900 mm]
- Liquid rates between 1 - 20 gpm/ft²
  \([2.5 - 50 \text{ m}^3/\text{m}^2 \cdot \text{h}]\)
- Orifices in troughs

Orifices are located in the base of the troughs. Vapor passage is provided by the space between the troughs.

The trough-type construction allows easy liquid sealing and distributor leveling. Troughs are fed with a parting box.

The standard turndown range is 2 : 1.

Model 985 Trough Distributor with Weirs

- Diameters greater than 36 in. [900 mm]
- Liquid rates between 2 - 40 gpm/ft²
  \([5 - 100 \text{ m}^3/\text{m}^2 \cdot \text{h}]\)
- Weirs in troughs

The Model 985 is a weir-trough distributor for versatile liquid flow handling capability in towers with diameters larger than 36 in. [900 mm]. This distributor is particularly effective in handling high liquid flow rates in moderate and severely fouling services.

Model 985 distributors designed for the highest flow rates employ triangular weirs, also called “V” notches. If fouling is not severe, distributors designed for lower flow rates employ vertical rectangular notches, also called slotted weirs, for better flow control. Vapor passage is provided by the space between troughs.

Liquid is proportionately metered to the closed-end troughs by one or more parting boxes. The normal turndown ratio is 2.5 : 1. Higher turndown ratios can be achieved with special parting box design.

Construction Details

As the standard, the Model 976 distributor is suspended from beams. Within a limited range of diameters, provisions can be made for the distributor to rest on an existing support ring.

For redistribution between packed beds, a separate liquid collector is required. The use of a separate liquid collector provides cross mixing of liquid between beds.

There are no joints to seal for this distributor, therefore, no gaskets are required.

Construction Details

The Model 985 distributor rests on a full annular ring.

For redistribution between packed beds, a separate liquid collector is required.

Design Options

- Orifice strainers
- Mount on support ring

Design Options

- Clamped to support ring
- Uplift resistant
- Distribution notch shape
- Guide channels
Model 986 Trough Distributor with Drip Tubes

- Diameters greater than 30 in. [760 mm]
- Liquid rates between 0.3 - 20 gpm/ft² [0.75 - 50 m³/m² h]
- Sidewall orifice
- Liquid overflow protection
- Fouling resistant
- Low entrainment

The construction and many features of this distributor are similar to the high performance Model 186 liquid distributor, except that many aspects of the construction are standardized, resulting in a distribution pattern and/or point-to-point flow variation that falls outside the INTALOX high performance criteria.

Orifices are located in the sidewalls of the troughs. Vapor passage is provided by the space between the troughs. The Model 986 distributor is a versatile distributor with a wide range of applicability. It is particularly desirable for use where liquid rates are low or in towers where fouling resistance and/or high turndown is required.

The liquid from each drip point is conducted into the lower vapor velocity region below the distributor troughs. This results in low entrainment levels. In addition, overflow holes are provided at each conductor tube to ensure that if the maximum flow range of the distributor is exceeded, the liquid will be conducted to the packing in a controlled manner rather than to randomly spill over the troughs.

The standard turndown for a single sidewall orifice is 2 : 1. Using multi-level orifices at each discharge conductor can extend the turndown range up to 10 : 1. The flow variation will be higher throughout all or part of the operating range with multi-level orifices.

Construction Details

As the standard, the Model 986 distributor is suspended from beams. Upon special request, and within a limited range of diameters, provisions can be made for the distributor to rest on an existing support ring.

For redistribution between packed beds, a separate liquid collector is required. The use of a separate liquid collector provides total cross mixing of the liquid between beds.

Design Options

- Orifice strainers
- High turndown ratio
- Metering boxes
- Mount on support ring or supported by Model 883 bed limiter/support
Model 941 Pipe-Arm Distributor with Orifices

- **Diameters greater than 18 in. [430 mm]**
- **Liquid rates between 1.5 - 10 gpm/ft² [4 - 25 m³/m² h]**

The header section is flanged for standard horizontal feed from the side of the tower. Inlet flange mates to a 150 psi [PN 10] flange. The end of the header opposite the flange connection as well as the lateral ends are supported by clips as required. Laterals attach to the main header with flanged connections as standard.

When an external column feed is not present and for using this device as a redistributor, a total draw-off liquid collector with an external pump loop is required.

Model 943 Spray Nozzle Distributor

- **Liquid rates between 0.2 - 50 gpm/ft² [0.5 - 120 m³/m² h]**

Spray nozzle distributors are primarily used where good liquid coverage and complete wetting of the bed is necessary. They are commonly used in scrubbers and in the wash, pumparound and heat transfer sections of refining columns. For further detail regarding refining applications, please ask for Brochure KGSS-1.

The Model 943 spray nozzle distributor can be designed for very low liquid rates because each spray nozzle covers a large area of the tower. It can utilize relatively large nozzle opening sizes, so each nozzle provides a reasonable flow, even at low irrigation rates.

Full cone spray nozzles with an angle of 90° or 120° are the standard design for most applications. Spray nozzles providing maximum free passage and special distributor configurations to prevent liquid stagnation are typically recommended for refining column wash beds or other applications where complete wetting is critical to avoid fouling.

Turndown ratio is limited to 2 : 1 by the range of effective operation of the spray nozzles.

**Construction Details**
- The header section is flanged for standard horizontal feed from the side of the tower.
- The flange mates to a 150 psi [PN 10] flange. Laterals attached to the main header with flanged connections are standard.

**Design Options**
- Threaded header and laterals (4" [100 mm] and under)
- Vertical-feed header, on tower centerline
- Bayonet-style construction for small towers

**Construction Details**
- The header section is flanged for standard horizontal feed from the side of the tower.
- The ends of the header are supported by clips as required. Laterals are attached to the main header with flanged connections as standard.

**Design Options**
- Maximum free passage nozzles for fouling services
- Special piping design for fouling service
Model 961 Enclosed Channel Distributor for Offshore Applications

- Diameters greater than 30 in. [760 mm]
- Liquid rates between 1 - 30 gpm/ft² [2.5 - 75 m³/m² h]
- For off-shore columns subject to motion

The Model 961 is a distributor designed specifically for off-shore column applications subjected to tilt and motion. Orifices are located in the base of the enclosed channels. Liquid is fed to each channel using a pre-distribution header. Vapor passage is provided by the space between the channels.

The enclosed channel construction allows the use of high liquid heads to minimize the flow variation due to the tilt and the effects of motion and acceleration of swaying columns.

Because of the unique nature and design of the Model 961 distributor, a Koch-Glitsch representative should be contacted for these applications.

### Construction Details

This distributor is hung from beams and is securely attached to withstand the rigors of column motion.

When located at the top of the column with a reflux stream, the reflux pump pressure is used to provide liquid head.

For use as a redistributor, a separate Model 613 liquid collector, (specifically designed for motion column service), is used in conjunction with the Model 961 distributor to provide the necessary liquid head.

The column height requirement is dependent upon turndown range and motion dynamics.

### Design Options

- Dependent on column configuration and requirement.

*Testing of Model 961 enclosed channel distributor in the Koch-Glitsch test facility simulating wave motion.*