Basis: Air-water system

Note: These are general purpose curves. Do not use above 85% of flood.

\[
\frac{\text{CFM (air)}}{\text{Valve}} = 60 \left( \frac{\text{Actual CFS}}{\text{Valve}} \right) \sqrt{\frac{d_v}{0.0735}}
\]
EFFECTIVE DEPTH OF LIQUID
1½" WEIR HEIGHT

Chart I

NOTE: THESE ARE GENERAL PURPOSE CURVES. DO NOT USE ABOVE 86% OF FLOOD.

LIQUID DEPTH, INCHES CLEAR LIQUID

CFM (air) = 60 (Actual CFS) / \sqrt{d_v}

BASIS: AIR-WATER SYSTEM

d_v = \sqrt{0.0735}

100 GPMFT
20 GPMFT
5 GPMFT
10 GPMFT
25 GPMFT
50 GPMFT
75 GPMFT
125 GPMFT WEIR
EFFECTIVE DEPTH OF LIQUID
2" WEIR HEIGHT

CFM (air) = 80 \left( \frac{d}{\text{Valve}} \right) \frac{\text{d}}{0.0735}

BASIS: AIR-WATER SYSTEM

NOTE: THESE ARE GENERAL PURPOSE CURVES.
DO NOT USE ABOVE 82% OF FLOOD.

LIQUID DEPTH, INCHES CLEAR LIQUID
Basis: Air-water system

Note: These are general purpose curves. Do not use above 85% of flood.

\[
\text{CFM (air)} = 60 \left( \frac{\text{Actual CFS}}{\text{Valve}} \right) \sqrt{\frac{d_v}{0.0735}}
\]
Basis: Air-water system
Note: These are general purpose curves. Do not use above 85% of flood.

CFM (air) = \( 60 \left( \frac{\text{Actual CFS}}{\text{Valve}} \right) \sqrt{\frac{d_v}{0.0735}} \)
ARRANGEMENT OF TRAYS AND NOZZLES

The maximum capacity of a trayed column can only be obtained with the proper arrangement of the nozzles with respect to the trays.

SEAL PANS: Figure 1 shows recommended seal pan dimensions. Seal pans are required to seal the bottom tray and are also used when a transition is required between two sections with a different number of passes.

REBOILER NOZZLES: Thermosyphon reboiler return nozzles should be arranged as shown in Figure 2 so that the mixed phase from the reboiler enters parallel to the seal pan. The recommended spacing below the tray is a minimum distance to allow disengagement space.

FEED NOZZLES: The recommended procedure for feeding between two trays is shown in Figure 3. Note that the nozzle is located outside the downcomer. Internal piping is not necessary. A similar procedure should be followed for two, three and four pass trays.

SEGMENTAL DRAWOFFS: Recommended sump dimensions are shown in Figure 4. When large diameter drawoff nozzles are required, the tray space between the drawoff tray and the tray below may need to be increased so that the distance between the bottom of the sump and the tray below is at least 80 percent of the normal tray spacing.

CENTER DRAWOFFS: Recommended sump dimensions are shown in Figure 5. The minimum width at the bottom of the center downcomer and the width of the sump is usually made equal to the nozzle diameter plus 2 inches.

NON-OVERFLOWING TRAPS: Recommended dimensions are shown in Figure 6. This procedure is recommended, for example, for a total drawoff to the reboiler. The drawoff should never be attempted from the downcomer by raising the seal pan weir.

OVERFLOWING TRAPS: A partial liquid drawoff can be made below a seal pan as shown in Figure 7. This procedure is also useful in making a transition to the tray below having a different number of passes. The drawoff should never be attempted from the seal pan alone.
SEAL PANS

"A" = ( NORMALLY ) TRAY SPACE + 6'.
For steam strippers nominal tray space is satisfactory.

FIG. 1

FEED NOZZLES

8 = 6' above tray for liquid feed to 1/2 tray space for mixed feed.

FIG. 3

THERMOSYPHON REBOILER VAPOR RETURN

TRAY SP. + 12' MIN

FIG. 2

DRAWOFFS-SEGMENTAL

DOWNSCOMER FROM TRAY ABOVE

TRAY FLOOR

1-1/2D MIN.

FIG. 4
NON-OVERFLOWING TRAPS

DRAWOFFS-CENTER

OVERFLOWING TRAPS

FIG. 5

FIG. 6

FIG. 7
MECHANICAL SPECIFICATIONS FOR VALVE TYPE TRAYS

Deflection at Operating Conditions

\[ \frac{1}{8} \text{ inch for } 10'0" \text{ (diameter) and smaller.} \]
\[ 0.001 \text{ (dia) for greater than } 10'0" \text{ diameter.} \]
Basis: 12 lbs./sq. ft. live load & 64 lbs./sq. ft. on seal pot area.
Comments: Valve type trays, with their greater minimum submergences, are less sensitive to deflection and out-of-level installation.

Tolerance — Out-of-Level, Downcomer Clearance and Weir Heights — \( \frac{1}{8} \) inch

Comments: The above tolerances should be minimized on long weirs and particularly those with low liquid traffic. There is good evidence that a series of multipass trays out of level in the same direction will suffer serious efficiency losses.

Structural Design for Erection and Maintenance

250 lbs. concentrated load on any member.
Basis: Allowable stress at atmospheric temperature.
Comments: Such loading specifications vary from 200 to 300 pounds.

Min. Thickness of Tray Parts

(Trays, Downcomers & General Const.)
Non Ferrous and Alloy ................................................. 14 ga.
Carbon Steel ............................................................ 10 ga.

Support Ring Dimensions

<table>
<thead>
<tr>
<th>Tower Diameter</th>
<th>Carbon Steel</th>
<th>Alloy</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'0&quot; and Smaller</td>
<td>1(\frac{1}{8})&quot; x (\frac{1}{4})&quot;</td>
<td>1(\frac{1}{8})&quot; x (\frac{1}{4})&quot;</td>
</tr>
<tr>
<td>5'6&quot; thru 7'6&quot;</td>
<td>2&quot; x (\frac{1}{4})&quot;</td>
<td>2&quot; x (\frac{1}{4})&quot;</td>
</tr>
<tr>
<td>8'0&quot; thru 10'0&quot;</td>
<td>2(\frac{1}{4})&quot; x (\frac{3}{4})&quot;</td>
<td>2(\frac{1}{4})&quot; x (\frac{3}{4})&quot;</td>
</tr>
<tr>
<td>10'6&quot; thru 11'6&quot;</td>
<td>3&quot; x (\frac{3}{8})&quot;</td>
<td>3&quot; x (\frac{3}{4})&quot;</td>
</tr>
<tr>
<td>12'0&quot; thru 15'0&quot;</td>
<td>3(\frac{1}{8})&quot; x (\frac{3}{8})&quot;</td>
<td>3(\frac{1}{8})&quot; x (\frac{3}{4})&quot;</td>
</tr>
<tr>
<td>15'6&quot; thru 20'0&quot;</td>
<td>3(\frac{1}{8})&quot; x (\frac{3}{8})&quot;</td>
<td>3(\frac{1}{8})&quot; x (\frac{3}{4})&quot;</td>
</tr>
</tbody>
</table>

*Notes. Use gussets under concentrated load points.
Tower diameters larger than 20'0" to have special consideration.

Downcomer Bar Thickness

\( \frac{1}{4} \) inch minimum for alloy.
\( \frac{1}{4} \) C.S. plus corrosion allowance.

Bolting

\( \frac{3}{8} \) dia. C.S. or alloy. (Larger if necessary for long major beams.)
Comments: Some users specify alloy bolting at tray manways on carbon steel trays. A few specify alloy bolting for all bolting on carbon steel trays.

Adjustable Weirs

Not required.
Comments: Adjustability should not be specified for valve type trays on any but long weirs with low liquid loads. The hazards of maladjustment overcome their potential benefits.

Tray Manways

Top and bottom removable.
Maximum weight 65 lbs.
Minimum clearance 12" x 16".
Vertically aligned where possible.

Leakage Tests

Not required for valve type tray deck areas.

Comments: The valve type tray, unlike the bubble cap tray, has no net positive head of liquid on the tray and, therefore, during operation, cannot leak to the tray below. For this reason, no gaskets are required and tray leakage tests are meaningless and unnecessary. Gasket elimination has contributed greatly toward reducing installation and maintenance costs.
### FLEXITRAY RATING SHEET

The Koch Engineering Co., Inc.
Wichita, Kansas

<table>
<thead>
<tr>
<th>Tower Section</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CFS = ( \frac{\text{lbs./hr. Vapor}}{3600 \times d_v, \text{lbs./ft.}^3} )</td>
<td>3600x</td>
<td>3600x</td>
<td>3600x</td>
</tr>
<tr>
<td>( \sqrt{ } = \sqrt{\frac{d_v}{d_l - d_v}} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vapor Load = CFS( \sqrt{ } )</td>
<td>CFS( \sqrt{ } ) =</td>
<td>CFS( \sqrt{ } ) =</td>
<td>CFS( \sqrt{ } ) =</td>
</tr>
<tr>
<td>GPM = ( \frac{\text{lbs./hr. Liq. x 7.48}}{d_l, \text{lbs./ft.}^3 x 60} \times 8.021 )</td>
<td>( \times 8.021 = )</td>
<td>( \times 8.021 = )</td>
<td>( \times 8.021 = )</td>
</tr>
<tr>
<td>CFM(_{\text{air}}) = ( 60 \times \text{(ACFS)} \times \sqrt{\frac{d_v}{0.0735}} )</td>
<td>x =</td>
<td>x =</td>
<td>x =</td>
</tr>
</tbody>
</table>

### CAPACITY CALCULATIONS
(As % Calculated Flood)

<table>
<thead>
<tr>
<th>( \triangle P ) Calculations</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CFM(_{\text{air}})/Valve</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPM/ft. Weir</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weir Height</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type Valve</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry( \triangle P = \text{in. water} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liq.( \triangle P = \text{in. liq. x} ) ( \frac{d_l}{62.4} \times \frac{62.4}{62.4} = )</td>
<td>( \times \frac{62.4}{62.4} = )</td>
<td>( \times \frac{62.4}{62.4} = )</td>
<td></td>
</tr>
<tr>
<td>Total/tray, inches water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total/tray, mmHg.</td>
<td>31</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## INDEX

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blowing</td>
<td>5</td>
</tr>
<tr>
<td>Bubbling Area</td>
<td>8</td>
</tr>
<tr>
<td>Downcomer</td>
<td></td>
</tr>
<tr>
<td>- Capacity</td>
<td>9</td>
</tr>
<tr>
<td>- Clearance</td>
<td>10</td>
</tr>
<tr>
<td>- Seal Pan</td>
<td>27</td>
</tr>
<tr>
<td>- Sizing</td>
<td>8</td>
</tr>
<tr>
<td>Draw Off Sumps</td>
<td>27</td>
</tr>
<tr>
<td>FLEXITRAY Advantages</td>
<td>3</td>
</tr>
<tr>
<td>Flooding</td>
<td>5</td>
</tr>
<tr>
<td>Preliminary Sizing</td>
<td>7</td>
</tr>
<tr>
<td>Pressure Drop</td>
<td>10</td>
</tr>
<tr>
<td>System Factors</td>
<td>6</td>
</tr>
<tr>
<td>Tray Capacity</td>
<td>5,9</td>
</tr>
<tr>
<td>Tray Space Factor</td>
<td>6</td>
</tr>
<tr>
<td>Valve Assemblies</td>
<td>1</td>
</tr>
<tr>
<td>Weir Height</td>
<td>5</td>
</tr>
</tbody>
</table>

We have made every effort to assure accuracy for the data published in this manual. However, it would be necessary to review your specific requirements before a guarantee can be made.