PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

This Practice is subject to revision at any time.

© Process Industry Practices (PIP), Construction Industry Institute, The University of Texas at Austin, 3925 West Braker Lane (R4500), Austin, Texas 78759. PIP Member Companies and Subscribers may copy this Practice for their internal use. Changes or modifications of any kind are not permitted within any PIP Practice without the express written authorization of PIP. Authorized Users may attach addenda or overlays to clearly indicate modifications or exceptions to specific sections of PIP Practices. Authorized Users may provide their clients, suppliers and contractors with copies of the Practice solely for Authorized Users’ purposes. These purposes include but are not limited to the procurement process (e.g., as attachments to requests for quotation/ purchase orders or requests for proposals/contracts) and preparation and issue of design engineering deliverables for use on a specific project by Authorized User’s client. PIP’s copyright notices must be clearly indicated and unequivocally incorporated in documents where an Authorized User desires to provide any third party with copies of the Practice.

PUBLISHING HISTORY

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 1997</td>
<td>Issued</td>
</tr>
<tr>
<td>June 1999</td>
<td>Complete Revision</td>
</tr>
<tr>
<td>February 2007</td>
<td>Technical Revision</td>
</tr>
<tr>
<td>January 2014</td>
<td>Editorial Revision</td>
</tr>
<tr>
<td>February 2014</td>
<td>Technical Correction</td>
</tr>
<tr>
<td>September 2014</td>
<td>Technical Revision</td>
</tr>
<tr>
<td>October 2017</td>
<td>Technical Revision</td>
</tr>
</tbody>
</table>

Not printed with State funds
PIP VEFV1100
Vessel/S&T Heat Exchanger Standard Details
(U.S. Customary Units)

Table of Contents

1. Scope ........................................... 3

2. References .................................. 3
   2.1 Industry Codes and Standards ...... 3
   2.2 Government Regulations .............. 3

Drawings
VEFV1101 – Vessel Nameplate Bracket
VEFV1102 – Vessel Tolerances (2 Pages)
VEFV1103 – Vessel Grounding Lug
VEFV1104 – Small Horizontal Vessel Saddle Supports
VEFV1105 – Horizontal Vessel Saddles Supported on Concrete
VEFV1106 – Horizontal Vessel Saddles Supported on Structural Steel
VEFV1107 – Vertical Vessel Type A Skirt Base Plate with Gussets
VEFV1108 – Vertical Vessel Type B Skirt Base Plate with Cap Plate and Gussets
VEFV1109 – Vertical Vessel Type C Skirt Base Plate with Cap Plate and Offset Gussets
VEFV1110 – Vertical Vessel Type D Skirt Base Plate with Top Ring and Gussets
VEFV1111 – Vertical Vessel Beam Type Leg Supports
VEFV1112 – Vertical Vessel Angle Type Leg Supports without Pad
VEFV1113 – Vertical Vessel Angle Type Leg Supports with Reinforcement Pad
VEFV1114 – Vessel Vertical Type A Support Lug with Cap Plate
VEFV1115 – Vessel Vertical Type B Support Lug with Cap Plate and/or Rings
VEFV1116 – Vessel Manway Hinges
VEFV1117 – Vessel Vertical Manway Davits
VEFV1118 – Vessel Horizontal Manway Davits
VEFV1119 – Vessel Column Davits (2 Pages)
VEFV1120 – Pipe Supports Attached to Vessels (3 Pages)
VEFV1121 – Pipe Guides Attached to Vessels (2 Pages)
VEFV1122 – Horizontal Vessel Insulation Supports
VEFV1123 – Vertical Vessel Insulation and Fireproofing Supports (5 Pages)
VEFV1124 – Vessel Vortex Breaker
VEFV1125 – Vessel Internal Rungs
VEFV1126 – Locking Studs for Heat Exchanger Removable Tubesheets
VEFV1127 – Heat Exchanger Fixed Tubesheet Vent and Drain
VEFV1128 – Skirt Attachments (5 Pages)
VEFV1129 – Vessel Studded Joints
VEFV1130 – Solids Product Container Blend Tube and Shell Interface
VEFV1131 – Solids Product Container Flush-Mounted Side-Entry Manway Detail
VEFV1132 – Minimum Clearance for Nozzle Adjacent to Integral Tubesheet
VEFV1133 – Internal Head Attachment **NEW**
VEFV1134 – Skirt Openings Vertical Vessels (2 Pages) **NEW**
VEFV1135 – Flared Skirt Attachment to Shell Detail **NEW**
1. **Scope**

This Practice provides fabrication and installation details and dimensional tolerances for the design of supports and other attachments for vessels, heat exchangers and solids products containers.

This Practice describes typical fabrication and installation requirements for the following:

a. Nameplate  
b. Vessel fabrication tolerances and connection orientation tolerances  
c. Grounding lugs  
d. Horizontal vessel saddle supports  
e. Vertical vessel skirts  
f. Vertical vessel leg type supports  
g. Vertical vessel support lugs  
h. Manway and column davits  
i. Pipe supports and guides from vessels  
j. Insulation and fireproofing supports  
k. Vessel internals  
l. Heat exchanger tube sheet locking studs and vents/drains  
m. Studded joints  
n. Solids product container internals and manways

2. **References**

Applicable parts of the following industry codes and standards and references shall be considered an integral part of this Practice. The edition in effect at the date of contract award shall be used, except as otherwise noted. Short titles are used herein where appropriate.

### 2.1 Industry Codes and Standards

- American Society of Mechanical Engineers (ASME)  
  - *Boiler and Pressure Vessel Code, Section VIII, Division 1*
- American Society for Testing and Materials (ASTM)  
  - A123 - *Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products*
  - A143 - *Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement*

### 2.2 Government Regulations

- U. S. Occupational Safety and Health Administration (OSHA)  
<table>
<thead>
<tr>
<th>NUMBER</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VEFV1101</td>
<td>VESSEL NAMEPLATE BRACKET</td>
</tr>
<tr>
<td>VEFV1102</td>
<td>VESSEL TOLERANCES (2 PAGES)</td>
</tr>
<tr>
<td>VEFV1103</td>
<td>VESSEL GROUNDING LUG</td>
</tr>
<tr>
<td>VEFV1104</td>
<td>SMALL HORIZONTAL VESSEL SADDLE SUPPORTS</td>
</tr>
<tr>
<td>VEFV1105</td>
<td>HORIZONTAL VESSEL SADDLES SUPPORTED ON CONCRETE</td>
</tr>
<tr>
<td>VEFV1106</td>
<td>HORIZONTAL VESSEL SADDLES SUPPORTED ON STRUCTURAL STEEL</td>
</tr>
<tr>
<td>VEFV1107</td>
<td>VERTICAL VESSEL TYPE A SKIRT BASE PLATE W/ GUSSETS</td>
</tr>
<tr>
<td>VEFV1108</td>
<td>VERTICAL VESSEL TYPE B SKIRT BASE PLATE W/ CAP PLATE AND GUSSETS</td>
</tr>
<tr>
<td>VEFV1109</td>
<td>VERTICAL VESSEL TYPE C SKIRT BASE PLATE W/ CAP PLATE AND OFFSET GUSSETS</td>
</tr>
<tr>
<td>VEFV1110</td>
<td>VERTICAL VESSEL TYPE D SKIRT BASE PLATE W/ TOP RING AND GUSSETS</td>
</tr>
<tr>
<td>VEFV1111</td>
<td>VERTICAL VESSEL BEAM TYPE LEG SUPPORTS</td>
</tr>
<tr>
<td>VEFV1112</td>
<td>VERTICAL VESSEL ANGLE TYPE LEG SUPPORTS W/O PAD</td>
</tr>
<tr>
<td>VEFV1113</td>
<td>VERTICAL VESSEL ANGLE TYPE LEG SUPPORTS W/ REINFORCEMENT PAD</td>
</tr>
<tr>
<td>VEFV1114</td>
<td>VESSEL VERTICAL TYPE A SUPPORT LUG W/ CAP PLATE</td>
</tr>
<tr>
<td>VEFV1115</td>
<td>VESSEL VERTICAL TYPE B SUPPORT LUG W/ CAP PLATE AND/OR RINGS</td>
</tr>
<tr>
<td>VEFV1116</td>
<td>VESSEL MANWAY HINGES</td>
</tr>
<tr>
<td>VEFV1117</td>
<td>VESSEL VERTICAL MANWAY DAVITS</td>
</tr>
<tr>
<td>VEFV1118</td>
<td>VESSEL HORIZONTAL MANWAY DAVITS</td>
</tr>
<tr>
<td>VEFV1119</td>
<td>VESSEL COLUMN DAVITS (2 PAGES)</td>
</tr>
<tr>
<td>VEFV1120</td>
<td>PIPE SUPPORTS ATTACHED TO VESSELS (3 PAGES)</td>
</tr>
<tr>
<td>VEFV1121</td>
<td>PIPE GUIDES ATTACHED TO VESSELS (2 PAGES)</td>
</tr>
<tr>
<td>VEFV1122</td>
<td>HORIZONTAL VESSEL INSULATION SUPPORTS</td>
</tr>
<tr>
<td>VEFV1123</td>
<td>VERTICAL VESSEL INSULATION AND FIREPROOFING SUPPORTS (5 PAGES)</td>
</tr>
<tr>
<td>VEFV1124</td>
<td>VESSEL VORTEX BREAKERS</td>
</tr>
<tr>
<td>VEFV1125</td>
<td>VESSEL INTERNAL LADDERS</td>
</tr>
<tr>
<td>VEFV1126</td>
<td>VESSEL LOCKING STUDS FOR REMOVABLE TUBESHEETS</td>
</tr>
<tr>
<td>VEFV1127</td>
<td>VESSEL TYPICAL FIXED TUBESHEET VENT AND DRAIN</td>
</tr>
<tr>
<td>VEFV1128</td>
<td>SKIRT ATTACHMENTS (5 PAGES)</td>
</tr>
<tr>
<td>VEFV1129</td>
<td>VESSEL STUDED JOINTS</td>
</tr>
<tr>
<td>VEFV1130</td>
<td>SOLIDS PRODUCT CONTAINER BLEND TUBE AND SHELL INTERFACE</td>
</tr>
<tr>
<td>VEFV1131</td>
<td>SOLIDS PRODUCT CONTAINER FLUSH-MOUNTED SIDE-ENTRY MANWAY DETAIL</td>
</tr>
<tr>
<td>VEFV1132</td>
<td>SHELL AND TUBE EXCHANGER; MINIMUM CLEARANCE FOR NOZZLE ADJACENT TO INTEGRAL TUBESHEET</td>
</tr>
<tr>
<td>VEFV1133</td>
<td>INTERNAL HEAD ATTACHMENT</td>
</tr>
<tr>
<td>VEFV1134</td>
<td>SKIRT OPENINGS VERTICAL VESSELS (2 PAGES)</td>
</tr>
<tr>
<td>VEFV1135</td>
<td>FLARED SKIRT ATTACHMENT TO SHELL DETAIL</td>
</tr>
</tbody>
</table>
MINIMUM PROJECTION SHALL BE THE MAXIMUM OF
1) INSULATION THICKNESS +1"
2) 3"
3) L/2

1. "L" & "W" MAY BE ADJUSTED TO ACCOMMODATE MANUFACTURER’S AND/OR USER’S NAMEPLATE.
2. THE BRACKET MATERIAL SHALL BE THE SAME NOMINAL COMPOSITION AS THE VESSEL.
3. THE MANUFACTURER NAMEPLATE SHALL BE ATTACHED PERMANENTLY TO THE BRACKET, SEAL WELD IS PREFERRED; HOWEVER, STAINLESS STEEL OR ALLOY 400 RIVETS MAY BE USED. THE BRACKET SHALL BE WELDED TO THE VESSEL.
4. LOCATION OF NAMEPLATE SHALL BE AS SPECIFIED ON VESSEL DRAWING/DATA SHEET.
5. ALL THICKNESSES ARE MINIMUMS.
6. UNDERCUTTING OF SHELL SHALL BE AVOIDED WHEN WELDING BRACKET TO VESSEL.
VESSSEL TOLERANCES

NOTES:

1. HEIGHT FROM BASE LINE TO FACE OF TOP NOZZLE
   \( \pm 1/4" \) OR \( 1/64" \) PER FOOT OF HEIGHT \( 5/4" \) MAX.

2. NOZZLES FOR AGITATOR MOUNTING SHALL HAVE
   FLANGE FACE ALIGNED WITHIN \( 1/4 \) DEG. OF SPECIFIED PL.
   ALSO SEE NOTE 27.

3. DISTANCE FROM BOTTOM TO TOP OF TRAY SUPPORTS \( \pm 1/8" \).

4. WEIR HEIGHT \( \pm 1/8" \) MEASURED AT HIGH POINT OF WEIR.

5. VERTICAL CLEARANCE UNDER DOWFLOW PLATE FOR
   INSTALLED TRAYS \( \pm 1/16" \).

6. FACE OF NOZZLE TO CENTERLINE OF VESSEL \( \pm 1/2" \).

7. ALIGNMENT OF FLANGE FACE OF NOZZLE SHALL BE
   WITHIN \( 1/2 \) DEG. OF SPECIFIED PL.

8. LOCATION OF SHELL NOZZLES FROM BASE LINE SHALL
   \( \pm 3/32" \) FOR SHOP FABRICATED VESSELS OR SUB-
   ASSEMBLIES AND \( 1/2" \) FOR FIELD ASSEMBLED
   VESSELS IF LOCATION SPECIFIED OTHERWISE.
   REFERENCE POINTS, TOLERANCE SHALL BE \( \pm 1/8" \).

9. ALIGNMENT OF FLANGE FACE OF MANWAY SHALL BE
   WITHIN \( 1/2 \) DEG. OF SPECIFIED PL.

10. FACE OF MANWAY TO CENTERLINE OF VESSEL \( \pm 1/2" \).

11. LOCATION OF MANWAY FROM BASE LINE SHALL BE
    \( \pm 1/8" \) FOR SHOP FABRICATED VESSELS AND SUB-
    ASSEMBLIES AND \( 1/2" \) FOR FIELD ASSEMBLED VESSELS.

12. BOTTOM OF VESSEL SUPPORT TO BASE LINE \( \pm 0" \)
    FOR FOOT OF VESSEL DIAMETER \( 1/2" \) MAX.

13. SUPPORTS LOCATED FROM BASE LINE SHALL HAVE
    TOLERANCES \( \pm 1/2" \) PER FOOT OF VESSEL DIAM \( 1/2" \) MAX.

14. ALIGNMENT OF CYLINDRICAL SHELL SECTIONS SHALL BE
    TRUE AND STRAIGHT WITHIN \( 0.010" \) PER FOOT OF HEIGHT
    FROM BASE LINE BUT SHALL NOT EXCEED \( 3/4" \).

15. HIGH POINT TO LOW POINT OF INSTALLED TRAYS SHALL
    BE LEVEL AND PLANE WITHIN THE FOLLOWING:

    | VESSEL ID | TOLERANCE |
    |-----------|-----------|
    | <60" | 1/16" |
    | 60" <120" | 1/4" |
    | >120" | 1/4" |

16. FAR SIDE OF TOWER TO WEIR PLATE \( \pm 1/8" \).

17. WEIR SHALL BE \( \pm \) \( 1/4" \) WITHIN \( 1/2" \) FROM A LEVEL
    PLANE AT THE MIDPOINT OF THE TOWER AT THE MIDPOINT OF THE
    TOWER OR \( \pm \) \( 1/4" \) FROM A LEVEL
    PLAN.

18. "LOCATION OF TRAY PLATES FROM BASE LINE \( \pm 1/8" \).

19. DEVIATION OF AVERAGE I.D. (AS DETERMINED BY
    STRAPPING) FROM NOMINAL I.D. \( \pm 1/16" \), ASME CODE
    SECTION VIII SHALL APPLY TO OUT-OF-ROUNDNESS UNLESS
    OTHERWISE SPECIFIED.

20. PIPE OR WALKWAY SUPPORTS AND STRUCTURAL
    ATTACHMENTS TO VESSEL CENTERLINE \( \pm 1/8" ;
    BASE LINE \( \pm 1/8" ;

21. LOCATION OF HORIZONTAL VESSEL SUPPORT FROM
    VESSEL CENTERLINES \( \pm 1/8" \).

22. LOCATION OF HORIZONTAL VESSEL SUPPORTS FROM
    BASE LINE \( \pm 1/4" \) SUPPORTS LOCATED FROM
    OTHER REFERENCE POINT \( \pm 1/8" \).

23. LOCATION OF BOTTOM NOZZLE FLANGE FACE FROM
    BASE LINE SHALL BE \( \pm 1/16" \).

24. LASH CENTER PUNCH MARK (WITH A ROUND NOSE
    STAMP) THE PRINCIPAL CENTER LINES SHOWN ON
    ORIENTATION PLAN. PUNCH MARKS SHALL BE CIRCLED WITH
    PAINT TO DESIGNATE LOCATION.

25. PUNCH MARKS OUT OF LINE \( \pm 1/32" \) OR \( \pm 0.012" \) FROM ANY DIAMETER THE
    GREATER OF \( \pm 1/32" \) OR \( \pm 0.012" \) FOR FOOT OF
    VESSEL DIAM \( 1/2" \) MAX.

26. BOLT HOLES WITHIN 1/8" OF SPECIFIED LOCATION

27. IF BOTTOM FLANGE IS USED AS FOOT BEARING
    MOUNT AND WITH AGITATOR MOUNTING FLANGE
    HORIZONTAL CENTERLINE OF BOTTOM FLANGE SHALL
    \( \pm 3/16" \) WITHIN \( 0.012" \) PER FOOT (IF DISTANCE BETWEEN
    FLANGE CENTERS) OF BOTTOM FLANGE AND
    BOTTOM FLANGE SHALL NOT BE MORE THAN \( 1/4 \) DEG.
    OFF HORIZONTAL.

28. HORIZONTAL CLEARANCE BETWEEN DOWFLOW PLATE
    AND TOP OF INLET WEIR \( \pm 1/16" \).

29. FOR FOOT SUPPORTED RAYS, CLEARANCE BETWEEN
    TRAY COLLAR AND SHELL 0.015" MAX. OVER 90% OF
    CIRCUMFERENCE \( \pm 1/16" \) MAX. OVER REMAINING \( 0.015" \) MAX.

30. TOLERANCES APPLY TO VERTICAL AND HORIZONTAL
    VESSELS, UNLESS OTHERWISE SPECIFIED ON VESSEL
    DRAWING/DATA SHEET.
NOTES:
1. LOCATION OF SADDLE FROM ORIENTATION LINE SHALL BE ± 3/16".
2. LOCATION OF CLIPS FROM ORIENTATION LINE SHALL BE ± 1/4".
3. LOCATION OF NOZZLES FROM ORIENTATION LINE SHALL BE ± 3/16".
4. LOCATION OF MANWAYS FROM ORIENTATION LINE SHALL BE ± 1".
5. TOLERANCE ON NOZZLE BOLT HOLE ORIENTATION ± 1/16"
6. ORIENTATION LINE FOR VERTICAL VESSELS IS BASED ON A DIRECTIONAL CENTERLINE (E.G. NORTH, SOUTH, ETC.). ORIENTATION LINE FOR HORIZONTAL VESSELS IS BASED ON THE VERTICAL CENTERLINE.
7. TOLERANCES APPLY TO VERTICAL AND HORIZONTAL VESSELS UNLESS OTHERWISE SPECIFIED ON VESSEL DRAWINGS/DATA SHEETS.
NOTES:

1. LUG MATERIAL SHALL BE AUSTENITIC STAINLESS STEEL IF ATTACHED TO CARBON OR LOW ALLOY STEEL PARTS. IF ATTACHED TO OTHER MATERIALS, LUG MATERIAL SHALL BE SIMILAR TO THE MATERIAL TO WHICH ATTACHED.

2. SEE VESSEL DRAWING/DATA SHEET FOR ELEVATION AND ORIENTATION.

3. GROUNDING LUG SHALL NOT BE PAINTED.
NOTES:

1. THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE.
   REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND
   ALLOWABLE STRESSES AT DESIGN TEMPERATURE. SEE ASME CODE SECTION VIII, DIV. 1 APPENDIX G FOR GUIDANCE
   ON DESIGN CONSIDERATIONS.

2. SEE VESSEL DESIGN DRAWING/DATA SHEET FOR LOCATION, SPACING OF SADDLES, AND TYPE OF MATERIAL.

3. ANCHOR BOLT HOLES:
   A. HOLES IN FIXED END SHALL BE PROVIDED AS FOLLOWS:
      1" FOR 3/4" Ø BOLTS
   B. SLOTTED HOLES IN SLIDING END SHALL BE PROVIDED AS FOLLOWS:
      SL = SLOT LENGTH, INCHES
      D = MEAN COEFFICIENT OF THERMAL EXPANSION FOR SHELL MATERIAL AT MAX. NAMEPLATE TEMP (INCH/INCH °F)
      ΔT = DIFFERENCE BETWEEN MAX. NAMEPLATE TEMPERATURE AND 70°F

4. SADDLE MAY BE MADE WITH TWO PIECE CONSTRUCTION OR FROM BENT PLATE.

5. DIMENSION "B" SHOULD BE DETERMINED BASED ON INSULATION THICKNESS (HOT OR COLD) AND NOZZLE
   PROJECTION. SADDLES SHALL EXTEND A MINIMUM OF 1" BEYOND THE NOZZLE FACE.

6. 1/4" VENT HOLE SHALL BE PROVIDED IN LOW SPOT OF EACH SADDLE WEAR PLATE.

<table>
<thead>
<tr>
<th>VESSEL DIAM.</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>1-2</td>
<td>NOTE 5</td>
<td>2</td>
<td>3/8&quot;</td>
<td>3/8&quot;</td>
<td>4-1/2&quot;</td>
<td>3/4&quot;</td>
<td>3-3/8&quot;</td>
</tr>
<tr>
<td>18</td>
<td>1-3</td>
<td>NOTE 5</td>
<td>2</td>
<td>3/8&quot;</td>
<td>3/8&quot;</td>
<td>3-1/2&quot;</td>
<td>3/4&quot;</td>
<td>3-3/8&quot;</td>
</tr>
<tr>
<td>20</td>
<td>1-3</td>
<td>NOTE 5</td>
<td>2</td>
<td>3/8&quot;</td>
<td>3/8&quot;</td>
<td>5-1/2&quot;</td>
<td>3/4&quot;</td>
<td>3-3/8&quot;</td>
</tr>
<tr>
<td>24</td>
<td>1-3</td>
<td>NOTE 5</td>
<td>2</td>
<td>3/8&quot;</td>
<td>3/8&quot;</td>
<td>6-1/2&quot;</td>
<td>3/4&quot;</td>
<td>3-3/8&quot;</td>
</tr>
<tr>
<td>30</td>
<td>2-2</td>
<td>NOTE 5</td>
<td>2-3/8&quot;</td>
<td>7/8&quot;</td>
<td>7/8&quot;</td>
<td>8&quot;</td>
<td>3/4&quot;</td>
<td>3-3/8&quot;</td>
</tr>
<tr>
<td>36</td>
<td>2-2</td>
<td>NOTE 5</td>
<td>2-3/8&quot;</td>
<td>7/8&quot;</td>
<td>7/8&quot;</td>
<td>10&quot;</td>
<td>3/4&quot;</td>
<td>3-3/8&quot;</td>
</tr>
<tr>
<td>42</td>
<td>3-1</td>
<td>NOTE 5</td>
<td>2-3/8&quot;</td>
<td>7/8&quot;</td>
<td>7/8&quot;</td>
<td>12&quot;</td>
<td>3/4&quot;</td>
<td>3-3/8&quot;</td>
</tr>
</tbody>
</table>
NOTES:

1. THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE.
2. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADING AND ALLOWABLE STRESSES AT DESIGN TEMP. SEE ASME CODE SECTION VIII, DIV 1 APPENDIX B FOR GUIDANCE IN DESIGN CONSIDERATIONS.
3. 1/4" VENT HOLE SHALL BE PROVIDED IN LOW SPOT OF EACH SADDLE WEAR PLATE.
4. BOLTED HOLES IN SUIDING END SHALL BE PROVIDED AS FOLLOWS: 1-1/4" FOR 1" BOLTS & 1-1/2" FOR 1-1/4" BOLTS.
5. SADDLES SHALL EXTEND A MIN. OF 1" BEYOND FACE OF NOZZLE.

COMMENT: THE FIRE RESISTANCE OF STEEL SADDLES IN FLAMMABLE AND COMBUSTIBLE LIQUID SERVICE IS AFFECTION BY THE HEIGHT OF THE SADDLE AT THE LOWEST POINT. FOR EXAMPLE: SEE 29 CFR SECTION 1910.106(10)(A), WHICH ALLOWS NO FIREPROOFING FOR SADDLES IF LESS THAN 12" HIGH.

END PLATES AND WEAR PLATES ARE OPTIONAL FOR SIZE 16", 18" AND 20".
SKIRT BASE PLATE TYPE A

<table>
<thead>
<tr>
<th>BOLT SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>H</th>
<th>T</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>1-1/2&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>3/8&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>1/4&quot;</td>
</tr>
<tr>
<td>7/8&quot;</td>
<td>1-5/8&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>3/8&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>1/4&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1-3/4&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>3/8&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>1/4&quot;</td>
</tr>
</tbody>
</table>

NOTES:
1. THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRESSES AT DESIGN TEMPERATURE.
2. SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.
### TABLE 1: BOLT SIZES AND DIMENSIONS

<table>
<thead>
<tr>
<th>BOLT SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>H</th>
<th>T1</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>1-1/2&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>5&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>7/8&quot;</td>
<td>1-5/8&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>5&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1-3/4&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>5&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>2&quot;</td>
<td>6&quot;</td>
<td>2-1/4&quot;</td>
<td>2&quot;</td>
<td>3/8&quot;</td>
<td>6&quot;</td>
<td>9&quot;</td>
<td>1/2&quot;</td>
<td>1-1/8&quot;</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>2-1/4&quot;</td>
<td>8&quot;</td>
<td>2-1/2&quot;</td>
<td>2&quot;</td>
<td>1/2&quot;</td>
<td>7&quot;</td>
<td>10&quot;</td>
<td>3/4&quot;</td>
<td>1-3/8&quot;</td>
</tr>
<tr>
<td>1-3/4&quot;</td>
<td>2-1/2&quot;</td>
<td>8&quot;</td>
<td>2-3/4&quot;</td>
<td>2&quot;</td>
<td>1/2&quot;</td>
<td>7&quot;</td>
<td>11&quot;</td>
<td>3/4&quot;</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>2-3/4&quot;</td>
<td>8&quot;</td>
<td>3&quot;</td>
<td>2-1/2&quot;</td>
<td>5/8&quot;</td>
<td>8&quot;</td>
<td>12&quot;</td>
<td>3/4&quot;</td>
<td>1-5/8&quot;</td>
</tr>
<tr>
<td>2-1/4&quot;</td>
<td>3&quot;</td>
<td>8&quot;</td>
<td>3-1/4&quot;</td>
<td>2-1/2&quot;</td>
<td>5/8&quot;</td>
<td>8&quot;</td>
<td>14&quot;</td>
<td>3/4&quot;</td>
<td>1-3/4&quot;</td>
</tr>
<tr>
<td>2-1/2&quot;</td>
<td>3-1/4&quot;</td>
<td>10&quot;</td>
<td>3-1/2&quot;</td>
<td>2-1/2&quot;</td>
<td>3/4&quot;</td>
<td>9&quot;</td>
<td>15&quot;</td>
<td>3/4&quot;</td>
<td>1-7/8&quot;</td>
</tr>
<tr>
<td>2-3/4&quot;</td>
<td>3-1/2&quot;</td>
<td>10&quot;</td>
<td>3-3/4&quot;</td>
<td>2-1/2&quot;</td>
<td>3/4&quot;</td>
<td>9&quot;</td>
<td>15&quot;</td>
<td>3/4&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>3-3/4&quot;</td>
<td>10&quot;</td>
<td>4&quot;</td>
<td>2-1/2&quot;</td>
<td>1&quot;</td>
<td>10&quot;</td>
<td>16&quot;</td>
<td>1&quot;</td>
<td>2-1/4&quot;</td>
</tr>
</tbody>
</table>

### NOTES:

1. **THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRESSES AT DESIGN TEMPERATURE.**

2. **SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.**

3. **WELD SIZE "W" SHALL BE AS A MINIMUM, THE GREATER OF 1/4" OR 0.75 TIMES THE THICKNESS OF THE THINNER OF THE TWO COMPONENTS JOINED.**
### SKIRT BASE PLATE TYPE C

<table>
<thead>
<tr>
<th>BOLT SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>H</th>
<th>T MIN</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>1-1/2&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>5&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>7/8&quot;</td>
<td>1-5/8&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>5&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1-3/4&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>5&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>7/8&quot;</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>2&quot;</td>
<td>6&quot;</td>
<td>2-1/4&quot;</td>
<td>2&quot;</td>
<td>3/8&quot;</td>
<td>6&quot;</td>
<td>9&quot;</td>
<td>1/2&quot;</td>
<td>1-1/8&quot;</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>2-1/4&quot;</td>
<td>8&quot;</td>
<td>2-3/4&quot;</td>
<td>2&quot;</td>
<td>1/2&quot;</td>
<td>7&quot;</td>
<td>10&quot;</td>
<td>3/4&quot;</td>
<td>1-3/8&quot;</td>
</tr>
<tr>
<td>1 3/4&quot;</td>
<td>2-1/2&quot;</td>
<td>8&quot;</td>
<td>2-3/4&quot;</td>
<td>2&quot;</td>
<td>1/2&quot;</td>
<td>7&quot;</td>
<td>11&quot;</td>
<td>3/4&quot;</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>2-3/4&quot;</td>
<td>8&quot;</td>
<td>3&quot;</td>
<td>2-1/2&quot;</td>
<td>5/8&quot;</td>
<td>8&quot;</td>
<td>12&quot;</td>
<td>3/4&quot;</td>
<td>1-5/8&quot;</td>
</tr>
<tr>
<td>2 1/4&quot;</td>
<td>3&quot;</td>
<td>8&quot;</td>
<td>3-1/4&quot;</td>
<td>2-1/2&quot;</td>
<td>5/8&quot;</td>
<td>8&quot;</td>
<td>14&quot;</td>
<td>3/4&quot;</td>
<td>1-3/4&quot;</td>
</tr>
<tr>
<td>2 1/2&quot;</td>
<td>3-1/4&quot;</td>
<td>10&quot;</td>
<td>3-1/2&quot;</td>
<td>2-1/2&quot;</td>
<td>3/4&quot;</td>
<td>9&quot;</td>
<td>15&quot;</td>
<td>3/4&quot;</td>
<td>1-7/8&quot;</td>
</tr>
<tr>
<td>2 3/4&quot;</td>
<td>3-1/2&quot;</td>
<td>10&quot;</td>
<td>3-3/4&quot;</td>
<td>2-1/2&quot;</td>
<td>3/4&quot;</td>
<td>9&quot;</td>
<td>15&quot;</td>
<td>3/4&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>3-3/4&quot;</td>
<td>10&quot;</td>
<td>4&quot;</td>
<td>2-1/2&quot;</td>
<td>1&quot;</td>
<td>10&quot;</td>
<td>16&quot;</td>
<td>1&quot;</td>
<td>2-1/4&quot;</td>
</tr>
</tbody>
</table>

**NOTES:**

1. THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRESSES AT DESIGN TEMPERATURE.

2. SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.

3. WELD SIZE "W" SHALL BE AS A MINIMUM, THE GREATER OF 1/4" OR 0.75 TIMES THE THICKNESS OF THE THINNER OF THE TWO COMPONENTS JOINED.
**SKIRT BASE PLATE TYPE D**

<table>
<thead>
<tr>
<th>BOLT SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>H</th>
<th>T1 (MIN.)</th>
<th>T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>1-1/2&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>7/8&quot;</td>
<td>1-5/8&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1-3/4&quot;</td>
<td>6&quot;</td>
<td>2&quot;</td>
<td>1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>6&quot;</td>
<td>1/2&quot;</td>
<td>7/8&quot;</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>2&quot;</td>
<td>6&quot;</td>
<td>2-1/4&quot;</td>
<td>2&quot;</td>
<td>3/8&quot;</td>
<td>9&quot;</td>
<td>1/2&quot;</td>
<td>1-1/8&quot;</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>2-1/4&quot;</td>
<td>8&quot;</td>
<td>2-1/2&quot;</td>
<td>2&quot;</td>
<td>1/2&quot;</td>
<td>10&quot;</td>
<td>3/4&quot;</td>
<td>1-3/8&quot;</td>
</tr>
<tr>
<td>1-3/4&quot;</td>
<td>2-1/2&quot;</td>
<td>8&quot;</td>
<td>2-3/4&quot;</td>
<td>2&quot;</td>
<td>1/2&quot;</td>
<td>11&quot;</td>
<td>3/4&quot;</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>2-3/4&quot;</td>
<td>8&quot;</td>
<td>3&quot;</td>
<td>2-1/2&quot;</td>
<td>5/8&quot;</td>
<td>12&quot;</td>
<td>3/4&quot;</td>
<td>1-5/8&quot;</td>
</tr>
<tr>
<td>2-1/4&quot;</td>
<td>3&quot;</td>
<td>8&quot;</td>
<td>3-1/4&quot;</td>
<td>2-1/2&quot;</td>
<td>5/8&quot;</td>
<td>14&quot;</td>
<td>3/4&quot;</td>
<td>1-3-4&quot;</td>
</tr>
<tr>
<td>2-1/2&quot;</td>
<td>3-1/4&quot;</td>
<td>10&quot;</td>
<td>3-1/2&quot;</td>
<td>2-1/2&quot;</td>
<td>3/4&quot;</td>
<td>15&quot;</td>
<td>3/4&quot;</td>
<td>1-7/8&quot;</td>
</tr>
<tr>
<td>2-3/4&quot;</td>
<td>3-1/2&quot;</td>
<td>10&quot;</td>
<td>3-3/4&quot;</td>
<td>2-1/2&quot;</td>
<td>3/4&quot;</td>
<td>15&quot;</td>
<td>3/4&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>3-3/4&quot;</td>
<td>10&quot;</td>
<td>4&quot;</td>
<td>2-1/2&quot;</td>
<td>1&quot;</td>
<td>16&quot;</td>
<td>1&quot;</td>
<td>2-1/4&quot;</td>
</tr>
</tbody>
</table>

**NOTES:**

1. The thicknesses and dimensions shown are suggested starting values for the configuration above. Required thicknesses and dimensions shall be determined by calculations using the design loads and allowable stresses at design temperature.
2. See vessel drawing/data sheet for material.
3. Weld size "W" shall be as a minimum, the greater of 1/4" or 0.75 times the thickness of the thinner of the two components joined.
NOTCH BEAM TO TYP. WELD SEAM (1/2" EA. SIDE OF SEAM)

VESEL DIAMETER

<table>
<thead>
<tr>
<th>VESSEL DIAMETER</th>
<th>SIZE &amp; TYPE OF SUPPORT LEG</th>
<th>NO. OF LEGS</th>
<th>BASE PLATE SIZE</th>
<th>BOLT SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>90&quot; TO 108&quot;</td>
<td>W6 X 20</td>
<td>4</td>
<td>SEE VIEW BB*</td>
<td>1&quot;</td>
</tr>
<tr>
<td>114&quot; TO 120&quot;</td>
<td>W8 X 35</td>
<td>4 (MIN.)</td>
<td>SEE VIEW BB*</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

NOTES:
1. THE THICKNESSES, DIMENSIONS AND NUMBER OF LEGS SHOWN ARE STARTING VALUES FOR THE CONFIGURATION ABOVE. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRESSES AT DESIGN TEMPERATURE.
2. SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.
3. STRUCTURAL SHAPES LISTED CONFORM TO AISC AND ASTM A6.
NOTES
1. THE THICKNESSES, DIMENSIONS AND NUMBER OF LEGS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE. ACTUAL DIMENSIONS AND THICKNESSES SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRENGTHS AT DESIGN TEMPERATURE.
2. SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.
3. STRUCTURAL SHAPES LISTED CONFORM TO AISC AND ASTM A6.

<table>
<thead>
<tr>
<th>VESSEL DIAMETER</th>
<th>SIZE &amp; TYPE OF SUPPORT LEG</th>
<th>NO. OF LEGS</th>
<th>BASE PLATE SIZE</th>
<th>BOLT SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>12” TO 24”</td>
<td>3” x 3” x 1/4” ANGLE</td>
<td>3</td>
<td>6” x 6” x 3/8”</td>
<td>1-1/2</td>
</tr>
<tr>
<td>30” TO 36”</td>
<td>3” x 3” x 3/8” ANGLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42” TO 48”</td>
<td>4” x 4” x 3/8” ANGLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54” TO 66”</td>
<td>4” x 4” x 1/2” ANGLE</td>
<td>4</td>
<td>8” x 8” x 3/8”</td>
<td>1”</td>
</tr>
<tr>
<td>72”</td>
<td>6” x 6” x 3/8” ANGLE</td>
<td></td>
<td></td>
<td>2”</td>
</tr>
<tr>
<td>78”</td>
<td>6” x 6” x 5/8” ANGLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>84”</td>
<td>6” x 6” x 5/8” ANGLE</td>
<td></td>
<td></td>
<td>1-3/4</td>
</tr>
</tbody>
</table>
NOTES:
1. THE THICKNESSES, DIMENSIONS AND NUMBER OF LEGS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRESSES AT DESIGN TEMPERATURE.
2. SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.
3. REINFORCING PLATES SHALL BE PROVIDED IN ACCORDANCE WITH DETAIL SHOWN FOR:
   a) CARBON STEEL VESSELS WITH WALL THICKNESS LESS THAN 1/4".
   b) STAINLESS STEEL VESSELS WITH WALL THICKNESS LESS THAN 3/8". REINFORCING PAD SHALL BE SAME MATERIAL AS SHELL.
4. STRUCTURAL SHAPES LISTED CONFORM TO AISC AND ASTM A572.

<table>
<thead>
<tr>
<th>VESSEL DIAMETER</th>
<th>SIZE &amp; TYPE OF SUPPORT LEG</th>
<th>NO. OF LEGS</th>
<th>BASE PLATE SIZE</th>
<th>BOLT SIZE X</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot; TO 24&quot;</td>
<td>3&quot; x 3&quot; x 1/4&quot; ANGLE</td>
<td>3</td>
<td>6&quot; x 6&quot; x 3/8&quot;</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td>30&quot; TO 36&quot;</td>
<td>3&quot; x 3&quot; x 3/8&quot; ANGLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42&quot; TO 48&quot;</td>
<td>4&quot; x 4&quot; x 3/8&quot; ANGLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54&quot; TO 66&quot;</td>
<td>4&quot; x 4&quot; x 1/2&quot; ANGLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72&quot;</td>
<td>6&quot; x 6&quot; x 3/8&quot; ANGLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>78&quot;</td>
<td>6&quot; x 6&quot; x 5/8&quot; ANGLE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>84&quot;</td>
<td>6&quot; x 6&quot; x 5/8&quot; ANGLE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SUPPORT LUG BASE PLATE TYPE A

NOTES:

1. THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRESSES AT DESIGN TEMPERATURE.

2. ALL LUGS REQUIRE REINFORCING PADS IF CORRODED SHELL THICKNESS IS LESS THAN THE FOLLOWING:
   A. CARBON STEEL: 1/4" MIN.
   B. STAINLESS STEEL: 3/8" MIN.

3. REINFORCING PADS SHALL BE SAME MATERIAL AS SHELL UNLESS OTHERWISE SPECIFIED.

4. SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.
NOTES:

1. THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRESSES AT DESIGN TEMPERATURE.

2. ALL LUGS REQUIRE REINFORCING PADS IF CORRODED SHELL THICKNESS IS LESS THAN THE FOLLOWING:
   A. CARBON STEEL: 1/4" THK.
   B. STAINLESS STEEL: 3/8" THK.

3. REINFORCING PADS SHALL BE SAME MATERIAL AS SHELL UNLESS OTHERWISE SPECIFIED ON VESSEL DRAWING/DATA SHEET. REINFORCING PADS SHALL BE CHECKED PER NOTE 1.

4. SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.
### VESSEL MANWAY HINGES

**WELD WASHER TO HINGE PIN AS A STOP, TOP END ONLY.**

**3/16" DIA. SPLIT PIN @ WASHER @ BOTTOM END ONLY.**

---

#### ASSEMBLY OF HINGE TABS
**VIEW A-A**

---

**NOTES:**

1. HINGES SHALL PERMIT COVER FLANGE TO OPEN AND CLOSE FREELY.
2. ALL THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRESSES AT DESIGN TEMPERATURES.
3. WELDS MARKED MT OR PT SHALL BE EXAMINED IN ACCORDANCE WITH ASME CODE SECTION VIII, DIV. 1 APPENDIX 6 OR B, RESPECTIVELY.
4. IF AXIS OF MANWAY IS NOT HORIZONTAL, FORCES REQUIRED TO OPEN AND CLOSE MANWAY SHALL BE CONSIDERED.

---

**MANWAY CLASS 150 CLASS 300 CLASS 600**

<table>
<thead>
<tr>
<th>SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>20&quot;</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-3/4</td>
<td>1-3/4</td>
<td>1-13/16</td>
<td>3-1/2</td>
</tr>
<tr>
<td>24&quot;</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-3/4</td>
<td>1-3/4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1-1/16</td>
</tr>
</tbody>
</table>

---

**FLANGE TAB (2)**

**C DIAMETER**

**D RADIUS**

**SLOT**

**COVER TAB (1)**

**5/8" DIA. BAR HANDLE**

**1/16"**

**TO SUIT FLANGE EDGE THICKNESS**

**MT OR PT**

**3/8"**

**A**

**D RADIUS**

**C + 3/16"**

**3/16"**

**BAR LENGTH = COVER DIA. MINUS 9"**

**ASSEMBLY OF HINGE TABS**
**VIEW A-A**

---

**COVERAGE TAB (1)**

**3/8"**

**A**

**A**

---

**5/8" DIA. BAR HANDLE**

**1/4"**

**1-1/2"**

**TO SUIT FLANGE EDGE THICKNESS**

---

**MANWAY CLASS 150 CLASS 300 CLASS 600**

<table>
<thead>
<tr>
<th>SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>20&quot;</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-3/4</td>
<td>1-3/4</td>
<td>1-13/16</td>
<td>3-1/2</td>
</tr>
<tr>
<td>24&quot;</td>
<td>1-1/4</td>
<td>1-1/4</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-1/2</td>
<td>1-3/4</td>
<td>1-3/4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1-1/16</td>
</tr>
</tbody>
</table>
1. See plan of vessel for true location of davit.
2. The thicknesses and dimensions shown are suggested starting values for the configuration above. Required thicknesses and dimensions shall be determined using the design loads and allowable stresses at design temperature.
3. Welds marked MT or PT shall be examined in accordance with ASME Code Section VIII, Div. 1 Appendix B or B, respectively.
4. Davit arms and sleeves are designed using pipe sections. Sizes shown are nominal pipe sizes.
5. Unless otherwise required because of manway material, davit material shall be ASME code approved mild carbon steel.
6. The bearing surfaces of the davit arm shall be galvanized after attaching the bearing ring. Galvanizing shall be in accordance with applicable parts of ASTM A123 and A143.
### Notes:
1. See plan of vessel for true location of davit.
2. The thicknesses and dimensions shown are suggested starting values for the configuration above. Required thicknesses and dimensions shall be determined using the design loads and allowable stresses at design temperature.
3. Welds marked MT or PT shall be examined in accordance with ASME Code Section VIII, Div. 1 Appendix B or O, respectively.
4. Davit arms and sleeves are designed using pipe sections. Sizes shown are nominal pipe sizes.
5. Unless otherwise required because of manway material, davit material shall be ASME Code approved mild carbon steel.
6. The bearing surfaces of the davit arm shall be galvanized after attaching the bearing ring. Galvanizing shall be in accordance with applicable parts of ASTM A123 and A143.
1. See plan of vessel for true location of davit.
2. The thicknesses and dimensions shown are suggested starting values for the configuration above. Required thicknesses and dimensions shall be determined using the design loads and allowable stresses at design temperature.
3. 1/4" thk. pad shall be provided for high alloy vessels less than 3/8" thk. and for carbon steel vessels less than 1/4" thk. (including corrosion allowance). Material shall be same as shell.
4. Surface preparation and painting shall be per purchaser's paint specification.
5. Davit arm shall be shipped loose for field assembly by others.
6. Davit shall rotate freely.
7. Loads are for davit and cups only. Shell stresses shall be considered on an individual basis.
8. Welds marked M1 or PT shall be examined in accordance with ASME Code Section VIII, Div. 1 Appendix 6 or 8, respectively.
1. SEE PLAN OF VESSEL FOR TRUE LOCATION OF DAVIT.
2. THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE.
   REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED USING THE DESIGN LOADS AND ALLOWABLE STRESSES
   AT DESIGN TEMPERATURE.
3. 1/4" THK. PAD SHALL BE PROVIDED FOR HIGH ALLOY VESSELS LESS THAN 3/8" THK. AND FOR CARBON STEEL
    VESSELS LESS THAN 1/4" THK. (EXCLUDING CORROSION ALLOWANCE). MATERIAL SHALL BE SAME AS SHELL.
4. SURFACE PREPARATION AND PAINTING SHALL BE PER PURCHASER'S PAINT SPECIFICATION.
5. DAVIT ARM SHALL BE SHIPPED LOOSE FOR FIELD ASSEMBLY BY OTHERS.
6. DAVIT SHALL ROTATE FREELY.
7. LOADS ARE FOR DAVIT AND CLIPS ONLY. SHELL STRESSES SHALL BE CONSIDERED ON AN INDEPENDENT BASIS.
8. WELDS MARKED MT OR PT SHALL BE EXAMINED IN ACCORDANCE WITH ASME CODE SECTION VIII, DIV. 1 APPENDIX 6 OR
   B, RESPECTIVELY.
### Legend

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14G</td>
<td>Max. Allow. Lineal Ft. of Pipe Filled with Water</td>
</tr>
<tr>
<td>118</td>
<td>Support Weight Including Angle Clips</td>
</tr>
</tbody>
</table>

Weights shown in tables are net fabricated weights for estimating purposes.

### Pipe Supports Dimensions

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>8&quot;</th>
<th>10&quot;</th>
<th>12&quot;</th>
<th>14&quot;</th>
<th>16&quot;</th>
<th>18&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule</td>
<td>40</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

**Type 2**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>12&quot;</th>
<th>14&quot;</th>
<th>16&quot;</th>
<th>18&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>14&quot;</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>16&quot;</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>18&quot;</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
</tr>
</tbody>
</table>

**Plan View Dimensions**

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>2&quot;</th>
<th>3&quot;</th>
<th>4&quot;</th>
<th>6&quot;</th>
<th>8&quot;</th>
<th>10&quot;</th>
<th>12&quot;</th>
<th>14&quot;</th>
<th>16&quot;</th>
<th>18&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLIP ANGLE</td>
<td>3&quot; × 2&quot; × 3/8&quot; (Furnished by Others) - Ship Loose, Field Weld to Pipe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>3-1/4&quot;</th>
<th>3-1/4&quot;</th>
<th>3-1/4&quot;</th>
<th>3-1/4&quot;</th>
<th>3-1/4&quot;</th>
<th>3-1/4&quot;</th>
<th>3-1/4&quot;</th>
<th>3-1/4&quot;</th>
<th>3-1/4&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3&quot;</td>
<td>3&quot;</td>
<td>3&quot;</td>
<td>3&quot;</td>
<td>3&quot;</td>
<td>3&quot;</td>
<td>3&quot;</td>
<td>3&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>B</td>
<td>2-3/4&quot;</td>
<td>3-1/2&quot;</td>
<td>4-1/4&quot;</td>
<td>5-7/8&quot;</td>
<td>7-1/2&quot;</td>
<td>9&quot;</td>
<td>10-3/8&quot;</td>
<td>11-1/4&quot;</td>
<td>12-3/4&quot;</td>
</tr>
<tr>
<td>C (See Note 3)</td>
<td>8-7/8&quot;</td>
<td>10&quot;</td>
<td>11&quot;</td>
<td>13-1/8&quot;</td>
<td>15-3/8&quot;</td>
<td>17-3/4&quot;</td>
<td>19-3/4&quot;</td>
<td>21&quot;</td>
<td>23&quot;</td>
</tr>
</tbody>
</table>
NOTES

1. VESSEL CLIP OR PAD MATERIAL WELDED DIRECTLY TO VESSEL SHALL BE THE SAME AS THE MATERIAL TO WHICH
   IT IS WELDED. REINFORCEMENT PADS SHALL BE PROVIDED FOR LOAD DISTRIBUTION FOR THIN WALL VESSELS.
   PADS, IF USED, SHALL BE THE SAME THICKNESS AS THE SHELL IF POSSIBLE. EACH PAD SHALL HAVE A 1/4"
   NPT HOLE FOR VENTING / TESTING.
2. STRUCTURAL MEMBERS SHALL HAVE A MINIMUM YIELD STRENGTH OF 36 ksi.
3. DIMENSION "C" IS FOR UNINSULATED PIPE. IF REQUIRED, DIMENSION "C" SHALL BE ADJUSTED TO INCLUDE
   INSULATION THICKNESS BY ADJUSTING "C" DIMENSION BY INSULATION X 2.
4. THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR ALL PIPE SUPPORTS.
   REQUIRED THICKNESSES AND DIMENSIONS SHALL BE CALCULATED USING THE APPLICABLE DESIGN LOADS.
   SUPPORT CLIP BOLTING SHALL BE CHECKED TO ASSURE THAT PIPE SUPPORT BRACKET AND BOLTING CLEAR
   OUTSIDE OF INSULATION, BASED ON SUPPORT MEMBER SIZE, BOLT SIZE AND WRENCH DIAMETER CLEARANCE.
6. SEE VESSEL OR LADDER AND PLATFORM DRAWING/DATA SHEET FOR ACTUAL DIMENSIONS.
7. THERMAL EXPANSION TO BE CONSIDERED FOR TYPE 4 SUPPORT.
8. O.D. OF PIPE OR INSULATION.
FOR GENERAL NOTES SEE VEFV1121, PAGE 2

MAXIMUM GUIDE SPACING

<table>
<thead>
<tr>
<th>TYPE</th>
<th>L</th>
<th>1&quot;</th>
<th>1-1/2&quot;</th>
<th>2&quot;</th>
<th>3&quot;</th>
<th>4&quot;</th>
<th>6&quot;</th>
<th>8&quot;</th>
<th>10&quot;</th>
<th>12&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE 1</td>
<td>L=12&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td></td>
<td>L=14&quot;</td>
<td>16&quot;</td>
<td>16&quot;</td>
<td>16&quot;</td>
<td>16&quot;</td>
<td>16&quot;</td>
<td>16&quot;</td>
<td>16&quot;</td>
<td>16&quot;</td>
<td>16&quot;</td>
</tr>
<tr>
<td></td>
<td>L=16&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td></td>
<td>L=18&quot;</td>
<td>25&quot;</td>
<td>25&quot;</td>
<td>25&quot;</td>
<td>25&quot;</td>
<td>25&quot;</td>
<td>25&quot;</td>
<td>25&quot;</td>
<td>25&quot;</td>
<td>25&quot;</td>
</tr>
<tr>
<td></td>
<td>L=20&quot;</td>
<td>30&quot;</td>
<td>30&quot;</td>
<td>30&quot;</td>
<td>30&quot;</td>
<td>30&quot;</td>
<td>30&quot;</td>
<td>30&quot;</td>
<td>30&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td></td>
<td>L=22&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
</tr>
<tr>
<td></td>
<td>L=24&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
</tr>
<tr>
<td></td>
<td>L=26&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
</tr>
<tr>
<td></td>
<td>L=28&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
</tr>
<tr>
<td></td>
<td>L=30&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
<td>40&quot;</td>
</tr>
</tbody>
</table>

NOTE 1: L" DIMENSION - SEE NOTE 1

NOTE 2: SEE ORIENTATION PLAN

NOTE 5: 2-1/2" X 1/2" BARS FOR TYPE 1

NOTE 2: 3-1/2" X 1/2" BARS FOR TYPE 2

TYPE 1 & 2
NOTES:
1. SEE VESSEL OR LADDER AND PLATFORM DRAWING/DATA SHEET FOR ACTUAL "L" DIMENSION, ORIENTATION AND ELEVATION.
2. VESSEL CLIP MATERIAL SHALL BE THE SAME AS THE MATERIAL TO WHICH IT IS WELDED. REINFORCEMENT PADS SHOULD BE PROVIDED FOR LOAD DISTRIBUTION FOR THIN WALL VESSELS. PADS, IF USED, SHALL BE THE SAME ALLOY AS THE VESSEL AND OF THE SAME THICKNESS AS THE SHELL IF POSSIBLE. EACH PAD SHALL HAVE A 1/4" NPT HOLE FOR VENTING/TESTING. PAD SHALL HAVE A 1/4" NPT HOLE FOR VENTING/TESTING.
3. BOLT HOLES SHALL BE 13/16" DIA. FOR 3/4" DIA. ASTM A325 HEAVY HEX HEAD BOLTS WITH HEAVY HEX NUTS.
4. THE THICKNESSES AND DIMENSIONS SHOWN ARE SUGGESTED STARTING VALUES FOR THE CONFIGURATION ABOVE. REQUIRED THICKNESSES AND DIMENSIONS SHALL BE DETERMINED BY CALCULATIONS USING THE DESIGN LOADS AND ALLOWABLE STRESSES AT DESIGN TEMPERATURES.
5. FOR INSULATED VESSELS, THE DIMENSION SHOWN BETWEEN THE OUTSIDE OF THE INSULATION AND PIPE SUPPORT CLIP BOLTING SHALL BE CHECKED TO ASSURE THAT PIPE SUPPORT BRACKET AND BOLTING CLEAR OUTSIDE OF INSULATION, BASED ON SUPPORT MEMBER SIZE, BOLT SIZE, AND WRENCH DIAMETER CLEARANCE.

<table>
<thead>
<tr>
<th>TYPE OF GUIDE</th>
<th>&quot;L&quot; DIMENSION - SEE NOTE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L=12&quot;</td>
</tr>
<tr>
<td>14&quot;</td>
<td></td>
</tr>
<tr>
<td>18&quot;</td>
<td></td>
</tr>
<tr>
<td>16&quot;</td>
<td></td>
</tr>
</tbody>
</table>
NOTES:
1. HORIZONTAL SUPPORT SHALL BE PROVIDED FOR VESSELS 8'-0" DIAMETER AND LARGER.
2. SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.
3. FOR PARTIALLY INSULATED VESSELS, ALTERNATE DETAILS MAY BE REQUIRED.
NOTE:
SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL.
FLANGE BOLT
INSUL. THK. PLUS 1” (MIN.)

1/4” THK. ANGLE OR PLATE W/ 1” VERTICAL LEG
INSUL. THK. PLUS 1/2”

3/8” DIA. C.S. ROD FLOATING RING

DETAILED "A"
FABRICATOR SHALL TIE-OFF
3/8” DIA. ROD FOR SHIPMENT.

O.S. SHELL
INSUL. THK. MINUS 1/2”

1/2” MIN.
1/4” THK. C.S. CONT. RING (DO NOT WELD TO THE LUG)

1/4” THK. PLATE SPACED ON APPROX. 24” CENTERS

DETAILED "B"

O.S. HEAD
HEAD TO SHELL SEAM

1/4” DIA. C.S. ROD TACK WELD

1/4” X 1” SQ. SPACED ON 24” CENTERS (MAX.)

1/4” ANGLE OR PLATE

INSULATION THK. PLUS 1/2” MIN. (TYP. FOR BOTH ANGLE LEGS)

DETAILED "C"

SM

DETAILED "D"
FOR UNINSULATED VESSELS
DETAIL "F"  
VERTICAL VESSEL WITHOUT SKIRTS

DETAIL "E"  
VERTICAL VESSEL WITH SKIRTS

T = GREATER OF INSULATION OR FIREPROOFING THICKNESS

3/8" DIA C.S. FLOATING CONTINUOUS RING

1/4" THK. X 2" LG. X T WIDE FLAT BAR SPACED ON APPROX 12" CENTERS

1 1/2" PLUS T

1/4" THK CONT. RING (SLOPE FOR DRAINAGE)

1/4" THK. C.S. ROD W/ STAND-OFF FLIPS FIXED ON 24" CENTERS (ONE PER LAYER)

1/4" THK X 2" LG. X T WIDE FLAT BAR SPACED ON APPROX 12" CENTERS

1/4" ANGLE X 2" X INSUL. THK.

1/2" GAP

3/8" DIA C.S. FLOATING CONTINUOUS RING

DETAIL "G" - HOT BOX DESIGN  
VERTICAL VESSEL WITH SKIRTS
**PROCESS INDUSTRY PRACTICES**

**FABRICATION/INSTALLATION DETAILS**

**VERTICAL VESSEL INSULATION AND FIREPROOFING SUPPORTS**

---

**T** = GREATER OF INSULATION OR FIREPROOFING THICKNESS

3/8" DIA. FLOATING RING ANCHOR RING (ONE PER LAYER)

CENTER NOZZLE

3/8" ROUND BAR 3/4" STAND-OFF CUPS EACH ON 24" CENTERS (ONE PER LAYER)

1/4" THK. CONTINUOUS RING (SLOPE FOR DRAINAGE)

1 1/2" PLUS T

10 GA. WELD PIN INSULATION ANCHORS, SEALED ON 24" CENTERS

---

DETAIL "H" FOR "COLD" INSULATION
VESSEL VORTEX BREAKER

FLUSH TYPE

D - NOMINAL DIA. OF NOZZ.
H/" = 1/8" PLUS CORR. ALLOW.
H/" = 1/8" PLUS 2(CORR. ALLOW.)

(3) BLADES

(4) BLADES

SECTION "A-A"

INSIDE PROJECTION TYPE

NOTE:
SEE VESSEL DRAWING/DATA SHEET FOR MATERIAL AND BLADE REQUIREMENTS.

NOTE:
COPE TO CLEAR WELD

INSIDE BOTTOM HEAD OR SHELL

1" (MIN.)

1/4" DRAIN HOLE
FLUSH WITH BOTTOM

0.5 (1" MIN.)

D/2 (1" MIN.)
VESEL INTERNAL RUNGS

**NOTES:**

1. **LADDER RUNGS BELOW MANWAY SHALL BE**
   **PRODUCED WHERE SHOWN ON VESSEL**
   **DRAWING/DATA SHEET OR IF THE DISTANCE**
   **FROM THE CENTERLINE OF THE MANWAY**
   **TO LOWER HEAD OR RAY DECK IS**
   **GREATER THAN 6'-0".**

2. **SEE VESSEL DRAWING/DATA SHEET**
   **FOR MATERIAL**

**INTERNAL LADDER RUNG OR GRAB RUNG**

**VESEL INTERNAL RUNGS**

**VERTICAL VESSEL**

**HORIZONTAL VESSEL**

**GRAB RUNG**

REQUIRED UNLESS OTHERWISE SPECIFIED.

**LADDER RUNGS**

6" ABOVE BOTTOM HEAD WELD LINE OR 2'-0" ABOVE DECK CONTINUE RUNGS BELOW BOTTOM HEAD WELD AS REQUIRED FOR EGRESS

**12" SPACING**

2'-0" MAX
NOTES:

1. Locking studs are intended for use with removable tube bundles having stationary tubesheets. With gasket flanged joints both sides and thru-flange bolting, their purpose is to facilitate the removal of the channel for inspection and maintenance without disturbing the tubesheet to shell gasket seating.

2. All flange bolting and locking studs in the joint assembly shall be properly in place before pressure testing the shell side.

3. Locking studs shall be provided for every fourth bolt rule in the tubesheet.

4. Material specifications and stud diameter for the locking stud assembly shall be the same as for the other bolting in the flanged joint and shall be in accordance with the vessel specifications.

5. Joint assembly shown is for illustration only. Actual types of flanges, faces, gaskets, etc., shall be as specified in the vessel specifications.
NOTES:
1. THE MINIMUM TUBESHEET THICKNESS AT THE OUTER EDGE SHALL BE THE GREATER OF THE CALCULATED THICKNESS OR 2".
2. CLASS 6000 FORGED THREADED FITTING SHALL BE USED IF TUBESHEET THICKNESS IS GREATER THAN 2-3/8".
3. WHEN USED AS A DRAIN FOR A HORIZONTAL EXCHANGER, THE DRAIN SHOULD BE AT THE LOWEST POINT OF THE SHELL.
SKIRT ATTACHMENT

TYPE A-1 FILLET WELD ATTACHMENT DETAIL (E=0.45)
SKIRT-SHELL ATTACHMENT FOR
TORISPHERICAL AND TORICONICAL HEADS

TYPE A-2 GROOVE WELD ATTACHMENT DETAIL (E=0.60) SEE NOTE 1
SKIRT-SHELL ATTACHMENT FOR
TORISPHERICAL AND TORICONICAL HEADS

NOTES:
1. THE TYPE A-2 ATTACHMENT SHOULD BE USED FOR HIGH
   TEMPERATURE OR CYCLIC LOADING CONDITIONS.
2. SKIRT WELD SHOULD BE BELOW HEAD/ SHELL WELD SEAM
   AND OUTSIDE OF WELD HEAT AFFECTED ZONE.
TYPE B-1 FILLET WELD ATTACHMENT DETAIL (E=0.60) SEE NOTE 1.
SKIRT-SHELL ATTACHMENT FOR
ELLIPSOIDAL OR HEMISPHERICAL HEADS

TYPE B-2 GROOVE WELD ATTACHMENT DETAIL (E=0.70) SEE NOTES 1 & 2.
SKIRT-SHELL ATTACHMENT FOR
ELLIPSOIDAL OR HEMISPHERICAL HEADS

NOTES:
1. TYPICALLY THE SKIRT O.D. MATCHES THE VESSEL O.D.
   IF THE SKIRT AND VESSEL SHELL THICKNESSES ARE SIMILAR.
2. THE TYPE B-2 ATTACHMENT SHOULD BE USED FOR HIGH TEMPERATURE OR
   CYCLIC LOADING CONDITIONS.
SKIRT ATTACHMENTS

TYPE C
INTEGRAL SKIRT ATTACHMENT DETAIL
(E=1.0 WITH FULL RADIOGRAPHY)

NOTES:
1. THE TYPE C ATTACHMENT SHOULD BE USED FOR HIGH PRESSURE DESIGNS, HIGH TEMPERATURES, AND LARGE VERTICAL LOADINGS IF THICK WALL SHELLS AND HEADS ARE REQUIRED.
2. THE FORGING CONNECTION TO HEAD WELD SHOULD BE ACCESSIBLE FOR NDE FROM INSIDE THE SKIRT.
NOTE:
TOP RING MAY BE USED TO REINFORCE CONE TO SHELL JUNCTION.
TYPE E FILLET WELD ATTACHMENT DETAIL (E=0.60)

SKIRT—SHELL ATTACHMENT FOR
JACKETED VESSELS
**NOTES:**

1. THE TABULATED DIMENSIONS ARE IN ACCORDANCE WITH ASME CODE SECT. VII, DIV 1, PAR UG-43(g) REQUIREMENTS FOR STUD MATERIALS HAVING ALLOWABLE STRESS OF 25,000 PSI AND TAPPED MATERIALS HAVING AN ALLOWABLE STRESS OF 20,000 PSI AT THE DESIGN TEMPERATURE OF THE JOINT. FOR MATERIALS HAVING OTHER ALLOWABLE STRESSES, DIMENSIONS SHALL BE ADJUSTED ACCORDINGLY.

2. STUDS AND NUTS SHALL BE POLYMIDE/AIMIDE COATED (450°F MAX. NAMEPLATE TEMPERATURES) OR GALVANIZED.

3. OVERALL STUD LENGTH MAY BE DETERMINED BY ADDING THE THICKNESS OF THE MATING FLANGE + NUT HEIGHT + GASKET THICKNESS + E + THICKNESS OF SPACER (IF ANY) + 1/4".

4. EFFECTIVE STUD LENGTH MAY BE INCREASED BY INSTALLING A SPLIT RING BACKUP FLANGE BEHIND THE MATING FLANGE. BACKUP FLANGE SHALL HAVE SAME THICKNESS AS MATING FLANGE.
DEFLECTOR DETAILS
Blend Tube/Cone Intersection
**PROCESS INDUSTRY PRACTICES**

**FABRICATION/INSTALLATION DETAILS**

**MINIMUM CLEARANCE FOR NOZZLE ADJACENT TO INTEGRAL TUBESHEET**

---

**Symbols and Calculations:**

- \( d \) = NOZZLE INSIDE DIAMETER
- \( t_n \) = NOZZLE NECK THICKNESS
- \( R \) = MEAN SHELL RADIUS
- \( t \) = SHELL THICKNESS
- \( R_p \) = OUTSIDE RADIUS OF NOZZLE FLANGE (IF PRESENT)
- \( P \) = DISTANCE FROM OUTSIDE OF THE NOZZLE NECK TO THE TOE (OR OUTSIDE EDGE OF THE REINFORCEMENT PAD (OR INSERT PLATE) ATTACHMENT WELD.
- \( W \) = WIDTH OF THE ATTACHMENT WELD CONNECTING THE SHELL TO THE BODY FLANGE OR EXTENDED PORTION OF TUBESHEET.
- \( B \) = LARGER OF 2" OR C
- \( C \) = BOLT DIAMETER + 0.25 INCHES (2 THREADS, 8 UNC) + 0.25 INCH CHAMFER

**Notes:**

1. The above is intended to assist determining the minimum dimensions necessary to provide suitable clearances.
2. Consideration must be given for bolt installation and withdrawal requirements.
3. Dimensions shown are based on hand wrench being used. Other methods may require additional clearance.
INTERNAL HEAD ATTACHMENT

TYPE 1

I.S. SHELL
TANGENT LINE
FORGING
HEAD

TYPE 2

TANGENT LINE

TYPE 3

TANGENT LINE
WELD BUILT UP

RECOMMENDED FOR HEAVY WALL FABRICATION DUE TO POTENTIAL SHELL DISTORTION

PERMISSIBLE INTERNAL HEAD ATTACHMENT DETAILS IN ADDITION TO THAT SHOWN IN ASME SECTION VIII
**STUD BOLT LENGTH**
PLUS 1" MINIMUM

**ACCESS OPENING**
(1) REQUIRED FOR SKIRTS LESS THAN 60" DIA.
(2) REQUIRED FOR GREATER THAN 60" DIA. SKIRT, 180' APART

**VESSSEL DIAMETER**

<table>
<thead>
<tr>
<th>VESSEL DIAMETER</th>
<th>48&quot;</th>
<th>54&quot;</th>
<th>60&quot;</th>
<th>72&quot;</th>
<th>84&quot;</th>
<th>96&quot; AND ABOVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A *</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>18&quot;</td>
<td>24&quot;</td>
<td>24&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>B</td>
<td>2 1/2&quot;</td>
<td>3&quot;</td>
<td>3&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

C = 4 X ANCHOR BOLT DIA (MINIMUM)

**NOTES**
- THICKNESS OF BANDING AT SKIRT OPENINGS
- LENGTH OF BANDING AT SKIRT OPENING
- R = STRAIGHT SIDE OF ACCESS OPENING (MINIMUM MAY BE INCREASED WHEN SKIRT DIMENSION WILL PERMIT)
- T = SKIRT THICKNESS

**SECTION X-X**
BANDING DETAIL
SHOWN IS MINIMUM BANDING FOR FIREPROOFING. ALL OPENINGS 3" AND LARGER MUST BE BANDED FOR 100% REPLACEMENT OF CROSS-SECTIONAL AREA REMOVED. (2" @ 2 RT)

**DETAIL 1** - SKIRT DRAIN
(2) REQUIRED, 180' APART
WHEN DRAIN IS USED, THE FOUNDATION INSIDE THE BASE RING SHALL BE GROUTED FLUSH WITH TOP OF LOWER BASE RING AND THE GROUT MUST BE FINISHED TO SLOPE TOWARDS THE SKIRT DRAINS.

**VENT**

**DETAIL 2** - VENT B
BANDING DETAIL
WHEN BANDING IS REQUIRED FOR FIREPROOFING, IT SHALL BE APPLIED PER THIS DETAIL AND SECTION X-X. A STANDARD WALL THICKNESS PIPE IS SUFFICIENT FOR VENT B FOR FIREPROOF BANDING, OR REINFORCING WITHOUT FIREPROOFING.
VELV1134
PROCESS INDUSTRY PRACTICES
FABRICATION/INSTALLATION DETAILS
SKIRT OPENINGS
VERTICALVESSELS

VENTS ARE EQUALLY SPACED; BANDING IS REQUIRED FOR FIREPROOFING; REINFORCING IS REQUIRED FOR 3" AND LARGER DIAMETER.

VENT SIZE B, SEE DETAIL 2
LOCATE IN SKIRT AS HIGH AS POSSIBLE TAKING INTO CONSIDERATION THE THICKNESS OF INSULATION OR FIREPROOFING ON BOTTOM HEAD OF VESSEL.

2 VENTS REQUIRED FOR SKIRTS 30" AND SMALLER, 4 REQUIRED FOR SKIRTS LARGER THAN 30"

STUD BOLT LENGTH PLUS 1" MINIMUM

ACCESS OPENINGS, (1) REQUIRED FOR SKIRTS LESS THAN 60" DIA., (2) REQUIRED FOR GREATER THAN 60" DIA. SKIRT, 180° APART

INSULATION

A/4

A/2

X

SS WIRE SCREEN

REMOVABLE SS OR COATED CS WIRE MESH SCREEN

DETAIL 1

VESEL DIAMETER 48" 54" 60" 72" 84" >96" AND
A 18" 18" 18" 24" 24" 30"
B 2 1/2" 3" 3" 4" 4" 4"

C = 4 x ANCHOR BOLT DIA (MINIMUM)

T = THICKNESS OF BANDING AT SKIRT OPENING
L = LENGTH OF BANDING AT SKIRT OPENING
R = STRAIGHT SIDE OF ACCESS OPENING (MINIMUM MAY BE INCREASED WHEN SKIRT DIMENSION WILL PERMIT)
T = SKIRT THICKNESS

1/4" MINIMUM
2" MIN

3/16

3/16

BREAK SHARP CORNERS

SECTION X-X
BANDING DETAIL

SHOWN IS MINIMUM BANDING FOR FIREPROOFING. ALL OPENINGS 3" AND LARGER MUST BE BAND FOR 100% REPLACEMENT OF CROSS-SECTIONAL AREA REMOVED. (2)X > RT

WHEN DRAIN IS USED, THE FOUNDATION INSIDE THE BASE RING SHALL BE GROUTED FLUSH WITH TOP OF LOWER BASE RING AND THE GROUT MUST BE FINISHED TO SLOPE TOWARDS THE SKIRT DRAINS.

DETAIl 1 - SKIRT DRAIN
(2) REQUIRED, 180° APART

WHEN BANDING IS REQUIRED FOR FIREPROOFING, IT SHALL BE APPLIED PER THIS DETAIL AND SECTION X-X. A STANDARD WALL THICKNESS PIPE IS SUFFICIENT FOR VENT B FOR FIREPROOF BANDING, OR REINFORCING WITHOUT FIREPROOFING.

DETAIL 2 - VENT B
BANDING DETAIL

1/4" MIN

2" MIN

BREAK SHARP CORNERS
NOTES:

1. The joint between vessel shell and support skirt shall provide for a smooth transition, minimizing peak stress concentration effects. The joint detail may be made by forcing a single butt welding component integral with the vessel shell. Weld metal build up or built up as shown. Backing strips, if used to join the skirt to a forged or weld build up detail shall be removed after welding. Welds shall be ground or machined to a smoother flush contour. 100% magnetic particle or dye penetrant examination of all weld surfaces shall be performed after final post weld heat treatment.

2. All pressure retaining welds shall be located such that they are accessible for field non-destructive examination from the outside.