Process Industry Practices
Process Control

PIPELINE CONTROL

PIP PCFFL000
Orifice Plate Fabrication Details
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.

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PUBLISHING HISTORY
January 2001 Issued
January 2008 Reaffirmation with Editorial Revision
April 2014 Reaffirmation

Not printed with State funds
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Drawings

PCFFL001 – Concentric Square-Edged Orifice Plate
PCFFL002 – Square-Edged Orifice Plate Dimensions for Nominal Flange Sizes and Ratings
PCFFL003 – Eccentric Square-Edged Orifice Plate
PCFFL004 – Orifice Meter Run for “Not Designated” Uncertainty Class (Shop/Field Fab Using Pipe per Pipe Spec)
1. Introduction

1.1 Purpose
This Practice provides fabrication details for orifice plates and meter runs.

1.2 Scope
This Practice describes the minimum requirements for fabricating concentric or eccentric square edge orifice plates and the orifice meter run.

2. References

Applicable parts of the following PIP Practices shall be considered an integral part of this Practice. The edition in effect on the date of contract award shall be used, except as otherwise noted. Short titles are used herein where appropriate.

2.1 Process Industry Practices (PIP)
   - PIP PCCFL001 – Flow Measurement Design Criteria
   - PIP PNF0200 – Vents, Drains, and Instrument Connection Details

2.2 Industry Codes and Standards
   - ANSI B16.36 – Orifice Flanges
Notes:
1. Orifice plate shall be in accordance with API 14.3 (AGA 3),
   (e.g., bore tolerance and smoothness).
3. Weep hole (if specified only) — size as specified.
   Also note on handle to indicate presence of weep hole.
   Mark as vent—v or drain—d.
4. All information shown on handle in figure above are required. The order
   in which the information is stamped may be the vendor's standard.
5. Bevel outlet is not required for restriction orifice.
6. Dimensions "A", "E", "e", and "L" are listed in the table on PIP PCFFL002.

Process Industry Practices
Fabrication Details
Concentric Square Edged
Orifice Plate

Dimension "H" = \( \frac{\text{Pipe I.D.} - \text{Weep Hole I.D.}}{2} - 0.125 \)
<table>
<thead>
<tr>
<th>FLANGE SIZE</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;E&quot; PLATE THICKNESS (NOTE 1)</td>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
<td>1/8</td>
<td>1/4</td>
<td>1/4</td>
<td>1/4</td>
<td>1/4</td>
<td>3/8</td>
<td>3/8</td>
<td>3/8</td>
<td>3/8</td>
</tr>
<tr>
<td>&quot;e&quot; DIMENSION (NOTE 2)</td>
<td>1/32</td>
<td>1/32</td>
<td>1/16</td>
<td>3/32</td>
<td>1/8</td>
<td>3/16</td>
<td>3/16</td>
<td>1/4</td>
<td>1/4</td>
<td>5/16</td>
<td>3/8</td>
<td>3/8</td>
</tr>
<tr>
<td>&quot;L&quot; (MINIMUM) (NOTE 4)</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

ALL DIMENSIONS IN INCHES.

NOTES:
1. "E" DIMENSIONS:
   - MINIMUM STANDARD "E" DIMENSIONS FOR ORIFICE PLATES ARE GIVEN IN THE TABLE.
   - IF DIFFERENT THICKNESS IS REQUIRED, SPECIFY ON DATA SHEET.
   - RESTRICTION ORIFICES WITH HIGH PRESSURE DROPS MAY REQUIRE SIGNIFICANTLY THICKER "E" DIMENSIONS.
   - HIGH PRESSURE DROP RESTRICTION ORIFICES SHOULD HAVE THE PLATE THICKNESS REQUIREMENT CONFIRMED.
   - FOR 8" ORIFICE PLATES, AN "E" DIMENSION OF 1/8" (NO BEVEL) IS ACCEPTABLE IF THE DIFFERENTIAL PRESSURE DOES NOT EXCEED 150 INCHES OF WATER.

2. "e" DIMENSIONS:
   - DIMENSION "e" IN THE TABLE IS A NOMINAL VALUE THAT CAN BE USED IN THE ABSENCE OF AN EXACT VALUE.
     - CALCULATED BY A SIZING PROGRAM. THIS TABLE VALUE CAN BE USED WITH NO FLOW MEASUREMENT ACCURACY OR UNCERTAINTY IMPACT.
   - MAXIMUM "e" DIMENSION = 0.02 X PIPE I.D. OR 0.125 X BORE DIAMETER.
   - DIMENSIONS ARE BASED ON SMALLER VALUES OF API 14.3.

3. "A" DIMENSIONS:
   - DIMENSION "A" IN THE TABLE IS BASED ON ORIFICE PLATE VENDOR STANDARDS.

4. "L" DIMENSIONS:
   - MINIMUM NOMINAL "L" DIMENSION GIVEN IN THE TABLE IS BASED ON ORIFICE FLANGES THAT ARE NOT INSULATED.
   - IF LONGER LENGTH NEEDED, SPECIFY ON DATA SHEET.
NOTES:
1. ORIFICE PLATE SHALL BE IN ACCORDANCE WITH API 14.3 (AGA3) (E.G., BORE TOLERANCE AND SMOOTHNESS)
2. MATERIALS – 316 S.S. UNLESS OTHERWISE SPECIFIED
3. WEEP HOLE (IF SPECIFIED ONLY) – SIZE AS SPECIFIED. ALSO NOTE ON HANDLE TO INDICATE
   PRESENCE OF WEEP HOLE MARK AS VENT-V.
   
   \[ \text{DIMENSION "H" = } \frac{\text{PIPE I.D. - WEEP HOLE I.D.}}{2} - 0.125 \]

4. ALL INFORMATION SHOWN ON THE HANDLE IN FIGURE ABOVE ARE REQUIRED. THE ORDER
   IN WHICH THE INFORMATION IS STAMPED MAY BE THE VENDOR'S STANDARD.
5. DIMENSIONS "A", "E", AND "L" ARE LISTED IN THE TABLE ON PIP PCFFL002.
6. DIMENSION "G" OFFSET IS MEASURED FROM CENTERLINE OF PLATE.
   \[ \text{DIMENSION "G" = } 0.98 \text{ PIPE I.D. - BORE "d"} \]
NOTES:

1. ALL PIPE SPOOL FABRICATED RUNS SHALL BE 2" OR LARGER.
2. ORIFICE FLANGE I.D. SHALL BE SELECTED IN ACCORDANCE WITH PIPE SIZE AND SCHEDULE.
3. EXCESS WELD METAL SHALL BE BORED OR GROUND OUT TO THE SAME I.D. AS THE PIPE.
4. TWO I.D. MEASUREMENTS (90 DEG. APART) SHALL BE TAKEN 1" TO 2" FROM THE FLANGE FACE. TWO I.D. MEASUREMENTS (90 DEG. APART) SHALL BE TAKEN ON THE PIPE SIDE OF THE PIPE-TO-FLANGE WELD. RESOLUTION REQUIREMENT IS +/-0.1" OR BETTER. MEASUREMENTS ARE INTENDED TO VERIFY PIPE SCHEDULE. MEASUREMENTS SHALL BE DOCUMENTED AND PROVIDED TO THE OWNER.
5. FLANGE THICKNESS SHALL BE IN ACCORDANCE WITH ANSI B16.36 300# OR HEAVIER AS REQUIRED WITH RAISED FACE.
6. MINIMUM "A" DIMENSION SHALL BE 10 PIPE DIAMETERS. MINIMUM "B" DIMENSION SHALL BE 5 PIPE DIAMETERS. SEE PIP PCFFL001 FOR UPSTREAM & DOWNSTREAM OVERALL LENGTH. REQUIREMENTS.
7. TAPS (SOCKET WELDED OR THREADED) SHALL BE IN ACCORDANCE WITH DATA SHEET OR PIPING ISOMETRIC. (REF. PIP PNFO20) INSTALL THREADED OR SOCKET WELD PLUGS IN UNUSED TAPS PER PIPING ISOMETRIC.
8. SEE PIPING ISOMETRIC OR INDIVIDUAL PIPING MATERIAL SPECIFICATION FOR TYPE OF GASKET TO BE USED.
9. MATERIAL FOR ORIFICE RUN PIPING AND ORIFICE FLANGES SHALL MATCH PIPING SPECIFICATION.
10. POSITIONS OF JACK SCREWS SHOWN ARE PREFERRED, BUT ARE NOT PER ASME B16.36. JACK SCREWS LOCATED 90 DEG. FROM TAPS, PER ASME B16.36, ARE PERMITTED.