Orifice plates are widely used for measurement as they provide the simplest and the most economical means of flow detection. Orifice plates are available in the concentric type that the round opening (bore) of the orifice plate is positioned concentrically with the center of the pipe and the opening edge (bore edge) is available either in the concentric square edge type (sharp. Square edge type) or in the quadrant edge type (round edgy type). Orifice plates are also available in the eccentric type that the opening of the orifice is shifted from the center of the pipe. They also are available in the segmental type that the opening is a circular segmental segment and the orifice is comparable to a partially opened gate valve.

**ORIFICE BORE TYPE**
- Concentric Square Edged Orifice
- Quadrant Edged Orifice
- Eccentric Orifice
- Segmental Orifice

**FLOW CALCULATION STANDARDS**
- ISO 5167
- AGA report #3
- ASME MFE-3M (R.W Miller)
- L.K.Spink
- JIS Z 8762

**FLANGE RATINGS**
- JIS 10, 20, 30 etc.
- ANSI Class 150, 300, 600, 900 etc.

**PRESSURE TAPS**
- Flange taps
- Corner taps
- Vena contract taps
- 1D and 1/2D (Radius) taps
- Pipe taps

**PLATE THICKNESS**
- 3, 6, 9, 12mm

**TAB HANDLE**
- Welded to orifice plate

**PLATE MATERIAL**
- Standard : 304SS, 316SS
- Non-standard : Monel, Hastelley-B/C, Titanium etc.

**DRAIN AND VENT HOLE**
- Per ASME recommendations
- Not drilled for orifice bores smaller than 25.4mm

**MARKINGS**
- Upstream side of tab handle stamped “UPSTREAM” and with bore type and size, line size, tag number, and flange rating.

**SPECIAL MARKINGS**
- Special marking may be furnished to meet special requirement
Concentric Orifice Plate
Simple-structured with high precision, this orifice plate can be easily mounted and dismounted. In strict conformance with applicable standards, it is precisely finished to have required shape, size, surface roughness and flatness. For differential pressure measurement, it is combined with flange taps, vena contracta taps or corner taps.

Quarter-Circle Orifice Plate
The inlet edge of the bore of this orifice plate is rounded with a radius of a quarter circle. This orifice plate is principally used for measuring flow rates of low Reynolds Numbers. Flange taps or corner taps are used.

Eccentric Orifice Plate
For liquids containing solid particles that are liable to settle, or for vapors liable to deposit water condensate, this orifice plate is installed with its eccentric bore bottom flush with the bore bottom of the piping, so that the sedimentation of such inclusions is avoided. Likewise, for gases or vapors, it may be installed with its eccentric bore top flush with the bore top of the piping to avoid the stay of gas or vapor in its vicinity. Flange taps or vena contracta taps are used with.

Segmental Orifice Plate
The vertical section of the bore of this orifice plate is a semicircle to perform the same function as the eccentric orifice plate. Used for the similar purposes. Flange taps or vena contracta taps are employed to take out fluid pressures.

Summary

<table>
<thead>
<tr>
<th>Orifice Type</th>
<th>Fluid Type</th>
<th>Nominal line Size Normally Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gas(Vapor)</td>
<td>Liquid</td>
</tr>
<tr>
<td>Concentric-Square Edge</td>
<td>E</td>
<td>X</td>
</tr>
<tr>
<td>Concentric-Quadrant Edge</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Eccentric-Square Edge</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Segmental-Square Edge</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
"d,K1,K2,G1,G2 : Refer to Specification Sheet

<table>
<thead>
<tr>
<th>Nominal Dia</th>
<th>150A</th>
<th>300A</th>
<th>600A</th>
<th>900A</th>
<th>1500A</th>
<th>2500A</th>
<th>Plate Thick.</th>
<th>Edge</th>
<th>Tap Handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2B</td>
<td>47.8</td>
<td>53.8</td>
<td>53.8</td>
<td>63.6</td>
<td>63.6</td>
<td>69.9</td>
<td>3.0</td>
<td>-</td>
<td>25/90</td>
</tr>
<tr>
<td>3/4B</td>
<td>57.3</td>
<td>66.7</td>
<td>66.7</td>
<td>69.9</td>
<td>69.9</td>
<td>76.3</td>
<td>3.0</td>
<td>-</td>
<td>25/90</td>
</tr>
<tr>
<td>1</td>
<td>66.8</td>
<td>73.0</td>
<td>73.0</td>
<td>79.4</td>
<td>79.4</td>
<td>85.8</td>
<td>3.0/0.5</td>
<td>25</td>
<td>90</td>
</tr>
<tr>
<td>1 1/2B</td>
<td>85.8</td>
<td>95.3</td>
<td>95.3</td>
<td>98.6</td>
<td>98.6</td>
<td>117.5</td>
<td>3.0</td>
<td>0.5</td>
<td>25/90</td>
</tr>
<tr>
<td>2B</td>
<td>104.6</td>
<td>111.1</td>
<td>111.1</td>
<td>128</td>
<td>142.8</td>
<td>146.1</td>
<td>3.0/0.5</td>
<td>25</td>
<td>90</td>
</tr>
<tr>
<td>2 1/2B</td>
<td>123.6</td>
<td>130.4</td>
<td>130.4</td>
<td>165.1</td>
<td>165.1</td>
<td>168.3</td>
<td>3.0/0.5</td>
<td>25</td>
<td>90</td>
</tr>
<tr>
<td>2B</td>
<td>152.6</td>
<td>149.1</td>
<td>149.1</td>
<td>168.3</td>
<td>174.6</td>
<td>196.9</td>
<td>3.0/1.0</td>
<td>25</td>
<td>90</td>
</tr>
<tr>
<td>4B</td>
<td>174.6</td>
<td>183.2</td>
<td>183.2</td>
<td>206.4</td>
<td>209.6</td>
<td>235.0</td>
<td>3.0/1.0</td>
<td>38</td>
<td>110</td>
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<tr>
<td>8B</td>
<td>217.0</td>
<td>216.0</td>
<td>216.0</td>
<td>247.7</td>
<td>260.4</td>
<td>279.5</td>
<td>3.0/1.5</td>
<td>38</td>
<td>110</td>
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<tr>
<td>16B</td>
<td>222.5</td>
<td>250.7</td>
<td>266.7</td>
<td>288.9</td>
<td>282.6</td>
<td>317.5</td>
<td>3.0/1.5</td>
<td>38</td>
<td>110</td>
</tr>
<tr>
<td>32B</td>
<td>279.5</td>
<td>308.0</td>
<td>320.7</td>
<td>358.8</td>
<td>352.4</td>
<td>387.8</td>
<td>3.0/1.5</td>
<td>38</td>
<td>110</td>
</tr>
<tr>
<td>64B</td>
<td>349.8</td>
<td>361.9</td>
<td>400.1</td>
<td>435.0</td>
<td>435.0</td>
<td>476.5</td>
<td>6.0</td>
<td>-</td>
<td>44</td>
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<tr>
<td>128B</td>
<td>408.8</td>
<td>442.3</td>
<td>457.3</td>
<td>398.5</td>
<td>520.7</td>
<td>549.5</td>
<td>6.0</td>
<td>-</td>
<td>44</td>
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<tr>
<td>256B</td>
<td>450.6</td>
<td>485.8</td>
<td>492.2</td>
<td>520.0</td>
<td>577.9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>44</td>
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<tr>
<td>512B</td>
<td>514.1</td>
<td>539.8</td>
<td>565.2</td>
<td>574.7</td>
<td>641.4</td>
<td>-</td>
<td>-</td>
<td>44</td>
<td>120</td>
</tr>
<tr>
<td>1024B</td>
<td>549.4</td>
<td>597.0</td>
<td>612.8</td>
<td>637.9</td>
<td>704.9</td>
<td>-</td>
<td>9.0</td>
<td>-</td>
<td>50</td>
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<tr>
<td>2048B</td>
<td>666.5</td>
<td>704.9</td>
<td>733.5</td>
<td>-</td>
<td>-</td>
<td>9.0</td>
<td>-</td>
<td>-</td>
<td>50</td>
</tr>
<tr>
<td>4096B</td>
<td>717.8</td>
<td>774.7</td>
<td>790.6</td>
<td>838.2</td>
<td>901.7</td>
<td>-</td>
<td>9.0</td>
<td>-</td>
<td>50</td>
</tr>
</tbody>
</table>
Orifice Ring Assemblies are used for flow measurement of smaller or medium sized pipe at lower pressures. Each assembly consists of one orifice plate and two orifice rings. Differential pressures are taken out in a corner tap system. Orifice Blocks, which are of a unit-construction type and provide higher pressure ratings than the Orifice Ring Assemblies, also are available.

**ORIFICE BORE TYPE**
- Concentric Square Edged Orifice
- Quadrant Edged Orifice
- Minimum quadrant edged orifice diameter 4.5mm
- Minimum quadrant edged radius 0.5mm

**FLOW CALCULATION STANDARDS**
- ISO 5167
- JIS Z8762
- AGA3, 8
- General Application
- L.K Spink

**FLANGE RATINGS**
- JIS 5, 10, 20 etc.
- ANSI (or JPI) 150, 300 etc.
  (Note: ANSI and JPI ring dimensions are identical)

**PRESSURE TAP NIPPLES**
- 15mm (1/2 inch) Sch 40, 80
- Length : 150mm
- Tap Connections : PT 1/2 or NPT male,
  Socket weld, Butt weld or Flange. (Flange rating to be the same as the of the process pipeline)

**DRAIN AND VENT HOLE**
- Per ASME recommendations
- Not drilled for orifice bores smaller than 25.4mm

**MARKINGS**
- Special marking may be furnished to meet special requirements

**SPECIAL MARKINGS**
- Special marking may be furnished to meet special requirements

**MATERIALS**
- Ring and Pressure Tap Nipple : 304SS, 316SS
- Plate : 304SS, 316SS, MONEL, other
- Tab Handle : 304SS, 316LSS

**GASKET**
- Material : Asbestos, Non-Asbestos, Teflon
- Thickness : 1.5mm, 2.0mm, 3.0mm

**PRESSURE TAPS**
- Corner taps

**PLATE THICKNESSES**
- 3, 6, 9, 12mm

**TAP HANDLE**
- Welded to orifice plate
Description

The Holder Ring Assembly is a combination of a holder ring and an orifice plate designed for ring-type-joint (RTJ) flanges of ANSI or JPI Specifications. The holder ring has a function of holding the orifice plate and also a function as a gasket to prevent leakage of the process fluid. This metallic sealing system is applicable to a fluid of high temperature and high pressure. The pressure tapping system normally is of the flange tap type.

Specifications

**ORIFICE BORE TYPE**
- Concentric Square Edged Orifice
- Quadrant Edged Orifice

**FLOW CALCULATION STANDARDS**
- ISO 5167
- AGA 3,8
- General Application
- L.K.Spink
- ASME-MFC-3M
- JIS Z 8762

**FLANGE RATINGS**
- ANSI Class 300, 600, 900 etc.
- Ring type joint (RTJ)

**PRESSURE TAPS**
- Flange taps

**PLATE THICKNESSES**
- 3, 6, 9, 12mm

**TAB HANDLE**
- Welding to ring
- HOLDING RING
- Riveted to plate
- Types: Octagonal or oval

**DRAIN AND VENT HOLE**
- Per ASME recommendations
- Not drilled for orifice bores smaller than 25.4mm

**MARKINGS**
- Upstream side of tab handle stamped with “UPSTREAM” and with bore type and size,
- Tag number, quadrant edge radius and flange rating.

**SPECIAL MARKINGS**
- Special marking may be furnished to meet specific requirement

**MATERIALS**
- Plate: 304SS, 316LSS
- Holding Ring: Soft Iron, 304SS or 316SS
- Rivets: 304SS or 316SS
- Tab Handle: 304SS or 316SS

**NOMINAL PIPE SIZES AVAILABLE**

<table>
<thead>
<tr>
<th>Orifice Bore Type</th>
<th>Pipe Sizes</th>
<th>Pipe Diameter Given in the Applicable Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentric Square Edge</td>
<td>1 1/2 inches to 14 inches</td>
<td>40 to 350mm</td>
</tr>
<tr>
<td>Quadrant Edge</td>
<td>1 1/2 inches to 6 inches</td>
<td>40 to 150mm</td>
</tr>
</tbody>
</table>
## ORIFICE PLATE & RING ASSEMBLY

<table>
<thead>
<tr>
<th>SOP</th>
<th>10</th>
<th>A</th>
<th>1</th>
<th>A</th>
<th>1</th>
<th>A</th>
<th>1</th>
</tr>
</thead>
</table>

### DRAIN / VENT
- 1 = None
- 2 = Drain
- 3 = Ventool (Ex. d) IIC T6, IP65

### RING MATERIAL
- A = 304 SS
- B = 316 SS

### PLATE MATERIAL
- 1 = 304 SS
- 2 = 316 SS
- 3 = Titanium
- 4 = Monel

### BORE TYPE
- 1 = Concentric Edge
- 2 = Quadrant Edge
- 3 = Eccentric
- 4 = Segmental

### LINE SIZE
- A = 15A(1/2"
- B = 20A(3/4"
- C = 25A(1"
- D = 32A(1-1/2"
- E = 50A(2"
- F = 65A(2-1/2"
- G = 80A(3"
- H = 100A(4"
- I = 125A(5"
- J = 150A(6"
- K = 200A(8"

### TYPE (BASE MODEL)
- 10 = Orifice Plate
- 20 = Orifice Plate with Ring
- 30 = Orifice Plate with Holding Ring (Oval Type)
- 31 = Orifice Plate with Holding Ring (Octagonal Type)

---

When placing an order, selected ordering number should be indicated on the purchase order sheet.
Gas and Liquid Flows
High Pressure Drops
Cavitation and Flashing in Liquid Flows
Choked flow in gases.
Excessive Noise /Vibration

Restriction orifice plates have traditionally been used to reduce pressures in GAS AND LIQUID FLOWS by forcing the flow through a restricted bore. The precise pressure drop is produced by accurately calculating the orifice bore, having taken into account all the relevant process and flow conditions.

Where very HIGH PRESSURE DROPS in liquid flows are required MULTISTAGE RESTRICTION ORIFICES ASSEMBLIES may be required to achieve the desired pressure drop while preventing problem such as CAVITATION, FLASHING and high NOISE and VIBRATION levels.

CAVITATION is a potentially damaging, erosive condition which occurs when the internal pressure of the liquid passing through the orifice falls below its vapour pressure and vapour bubbles form. Further downstream from the orifice the pressure recovers sufficiently to collapse the bubbles with extreme violence. Cavitation calculations are performed during the design stage of a Multistage Restriction Orifice Plate calculate cavitation factors at each stage in the orifice assembly.

FLASHING is a similar phenomenon to cavitation except that the process pressure never recovers sufficiently to collapse the gas bubbles resulting in two phase flow-liquid and gas-downstream of the orifice. Erosion of pipe work and valves and other instrumentation can occur due to the impact of liquid droplets carried at high speed in the vapour flow.

CHOKED FLOW IN GASES is also known as critical flow—occurs when an excessive amount of pressure drop is attempted across a single orifice plate. When the downstream pressure is less than 52.8% of the upstream pressure, the flow through the orifice will become sonic, at which point no further increase in flow can be achieved by either increasing the upstream pressure or lowering the downstream pressure. A Multistage Restriction Orifice enables to reduce the pressure as it goes through each plate to prevent chocked flow occurring.
Multi-Stage Restriction Assembly
A multi-plate restriction assembly reduces the flowing pressure in stages as a means of reducing noise pollution or improving the durability of the restriction element. Flow is kept subsonic and non-cavitating at each stage by adding stages. Each assembly is custom-engineered by Seojin for specific operating parameters. Most assemblies are welded with non-removable plates. These assemblies are commonly used in “blowdown” applications in which gases are vented to atmospheric pressure with minimal emitted sound.
**Description**

The Conical Type (Restriction Orifice) is a device that performs as a reducing valve which decreases the pressure of fluid in the piping system, is used in almost all the fluid like liquid, gas, steam etc. When high-pressure fluids are reduced to low-pressure, it creates cavitation and this may result in damaging facilities by noise and vibration of the pipe.

The conical type orifice allows for the reduction of pressure by controlling the process condition to avoid cavitation.

**Principle**

The conical type orifice creates an increase in velocity by reducing the flow’s diameter. According to Bernoulli’s principle, this increase in velocity is accompanied by a corresponding decrease in pressure.

This pressure differential (\( \Delta P \)) and (Qv) has a proportional relation of \( Qv = K \Delta P \). In a regular flow volume, this pressure differential can be measured regularly. It is the same principle with the difference pressure flow meter and volume (Qv).

\[
Qv = C_d \cdot A_2 \cdot E \cdot \varepsilon \cdot \sqrt{\frac{\Delta P}{\rho}}
\]

If you want to decrease pressure \( \Delta P \) in a flux, you should determine the bore size of the orifice according to a formula like one above.

**Specifications**

<table>
<thead>
<tr>
<th>Application Fluid</th>
<th>Liquid, Gas, Steam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>304SS, 316SS, Monel, etc</td>
</tr>
<tr>
<td>Working Pressure</td>
<td>Unlimitted</td>
</tr>
<tr>
<td>Working Temperature</td>
<td>Max. 350 °C</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Within 5%</td>
</tr>
<tr>
<td>Evidence</td>
<td>ISO 5167</td>
</tr>
</tbody>
</table>
RESTRICTION ORIFICE PLATE

<table>
<thead>
<tr>
<th>SOP</th>
<th>40</th>
<th>A</th>
<th>1</th>
<th>A</th>
<th>1</th>
<th>A</th>
</tr>
</thead>
</table>

PIPE MATERIAL
- A = A106 Gr.B
- B = 304 SS
- C = 316 SS
- OP = etc.

PLATE MATERIAL
- 1 = 304 SS
- 2 = 316 SS
- 3 = Titanum
- 4 = Monel
- OP = etc.

FLANGE RATING
- A = JIS 10K
- B = JIS 20K
- C = JIS 30K
- D = ANSI #150
- E = ANSI #300
- F = ANSI #600
- G = ANSI #900
- OP = etc.

BORE TYPE
- 1 = Concentric Edge

LINE SIZE
- A = 15A(1/2"
- B = 20A(3/4"
- C = 25A(1"
- D = 32A(1-1/2"
- E = 50A(2"
- F = 65A(2-1/2"
- G = 80A(3"
- H = 100A(4"
- I = 125A(5"
- J = 150A(6"
- K = 200A(8"
- OP = etc.

TYPE(BASE MODEL)
- 40 = Restriction Orifice(Single Hole)
- 41 = Restriction Orifice(Multi Hole)
- 42 = Restriction Orifice(Multi Stage)
- 43 = Restriction Orifice(Conical Type)

When placing an order, selected ordering number should be indicated on the purchase order sheet.
Description

Orifice Flange Assemblies are used in conjunction with Orifice Plates for flow measurement of smaller or medium size pipes at lower or medium pressure ranges. The flange connection is of an RF type and the differential pressure tapping system is with flange taps.

Specifications

**ORIFICE BORE TYPE**
- Welding neck
- Slip-on
- Socket-weld
- Ring-joint welding neck

**NOMINAL DIAMETERS**
25mm(1 inch) to 500mm(20 inches)

**FLANGE MATERIAL**

**FLANGE RATINGS**
- JIS 10, 20, 30 etc.
- ANSI(or JPI) 150, 300, 600 etc.

**MATERIALS OF BOLTS AND NUTS**
- Nuts : A194-2H, A194-8, A194-8M
- Jack bolts and nuts : S25C, A307

**GASKET**
- Thickness : 1.5mm, 4.5mm
- Material : Asbestos sheet gasket, Spiral wound gaskets

**PIPING CONNECTION METHOD**
- ANSI 150# : Insertion welding type(Slip-on-type)
- ANSI 300#, 600# : Butt welding type(Welding neck)
- ANSI 600# : Butt welding neck(Ring-joint WN)

**DIFFERENTIAL PRESSURE PIPING CONNECTION**
Select referring to the model number construction table
Pressure connection holes in the pipe should be 1/2 inch for 3-inch and larger lines, 3/4 inch for 3-inch lines, and 1/4 inch for 2-inch lines. When flange taps are used, insert a drill of the proper size through the connection holes in the flanges and drill through the pipe. When connections in the pipe are used, weld half-couplings to the pipe at the proper locations, insert a drill through them, and drill through the pipe. Round off the edges of the holes slightly to be sure that no burrs remain in the pipe.

**Flange Tap**
Both upstream and downstream are located at a distance of 25mm from the orifice plate. This is also true of smaller pipes.

**Corner Tap**
Tapping for differential pressure is made at immediately upstream and downstream positions of the orifice. This system is used primarily for small pipes. (Smaller 2")

**Vena Tap**
The tap for the upstream side is located at a distance approximately equal to the pipe diameter. The downstream is located at the lowest pressure position.

**Radius Tap**
ID and 1/2D taps. This type of connection is a modification that has largely been replaced. The Vena Contracta taps, yields equally accurate results and have the advantage of the downstream connection being 1D above the upstream face of the orifice plate. But location of the upstream connection between 1/2D and 2D introduces only a small range of error. The downstream connection is located 1/2D downstream from the upstream face of the orifice plate.

**Pipe Tap**
The differential pressure is small. This tapping system is not very popular.
When placing an order, selected ordering number should be indicated on the purchase order sheet.