Orifice and Orifice Assemblies

Information on physics of designing General's Orifice assembly

General Instruments orifice plate is a device used for measuring flow rate. Either a volumetric or mass flow rate may be determined, depending on the calculation associated with the it. It uses the same principle, namely Bernoulli's principle which states that there is a relationship between the pressure of the fluid and the velocity of the fluid. When the velocity increases, the pressure decreases and vice versa.

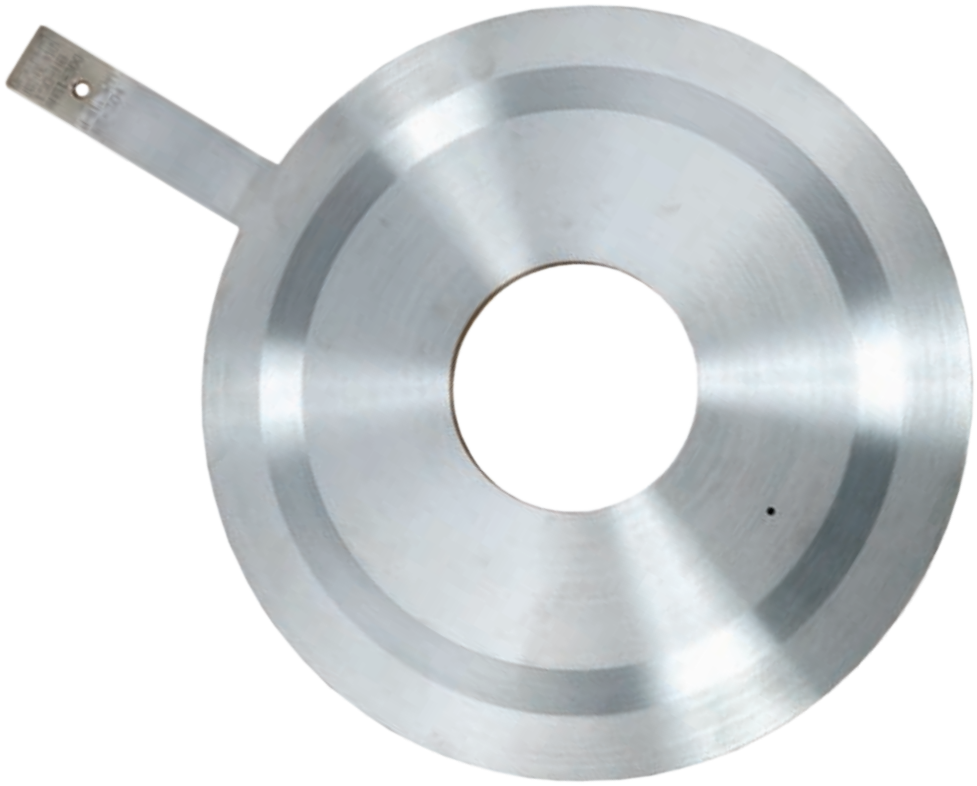
Description

General 's orifice plate is a thin plate with a hole in the middle or edge depending on design as per application. It is usually placed in a pipe in which fluid flows. When the fluid reaches the orifice plate, the fluid is forced to converge to go through the small hole; the point of maximum convergence actually occurs shortly downstream of the physical orifice, at the so-called vena contracta point. As it does so, the velocity and the pressure changes. Beyond the vena contracta, the fluid expands and the velocity and pressure change once again. By measuring the difference in fluid pressure between the normal pipe section and at the vena contracta, the volumetric and mass flow rates can be obtained from Bernoulli's equation.

Orifice assemblies manufacturing std. as per ISO 5167, AGA-3, and as per B16.5, B16.47, B16.36

Orifice plates are most commonly used primary elements for flow measurement in pipelines based on the principle of measurement of 'differential pressure' created when an obstruction is placed in the fluid flow, due to increase in fluid velocity.

Orifice Plates cover a wide range of applications of fluid and operating conditions. They give an acceptable level of uncertainities at lowest cost and long life without regular maintenance.

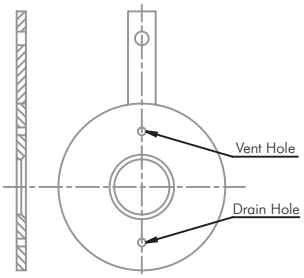


Orifice and Orifice Assemblies

Types of Orifice Plate

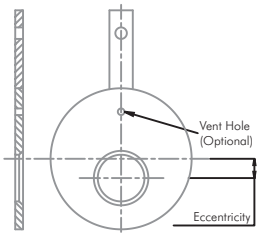
We manufacture orifice plates, restriction orifice plates, with or without carrier ring, meter run assemblies, integral orifice plates to suit customer's requirements.

We have fully equipped integrated designing, manufacturing and testing facilities which are among the best in country. Over the years we have manufactured and supplied orifice plate assemblies to many prestigious projects in the domestic as well as international market.



Square Edged Concentric

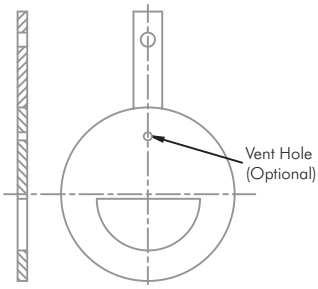
These are most commonly used for flow measurement. This has special features such as simple structures, high accuracy, and ease of installation & replacement. The orifice plates are correctly finished to the dimensions, surface roughness, and flatness to the applicable standard. These plates are recommended for clean liquids, gases & steam flow, when the Reynold number 75000.



Eccentric

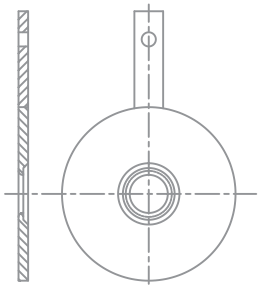
For liquids containing solid particles that are likely to sediment or for vapors likely to deposit water condensate, this orifice plate is used with its eccentric bore bottom flush with the bottom of the piping inside surface so that the sedimentation of such inclusions are avoided. Likewise, for gases or vapors, it may be installed with its eccentric bore top flush with the ID of the piping to avoid stay of gas or vapor in its vicinity.

Type of orifice plate	Reynolds	Application	Viscacity @ 30°C
Square edge concentric	5000 onwards	For all applications with clean of foreign particles	0.01cp to 10cp
Conical entrance	80 to 1500	High viscosity measuring capacity leading to ruling off application which requires accuracy at lowest reynolds, thus effectively rid off applications of magnetic and vortex	0.01cp to 150cp
Eccentric	3000 to 12000	For liquids containing solid particles that are likely to sediment or for vapors likely to deposit water condensate, also used for bottom flush application	0.01cp to 15cp
Quadrant edge	1500 to 9000	Viscous fluids and all and most for Fertilizer and petrochemicals	0.01cp to 40cp
Segmental	5000 to 20000	Sedimentation process application	0.01cp to 20cp



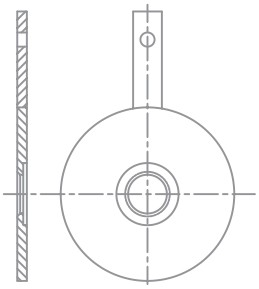
Segmental

Segmental orifice plates are most useful where there are substantial entrained water or air and also if there are suspension in the fluids. This avoids build up in front of the orifice plate. The orifice hole is placed at the bottom for gas service and top for liquids.



Quadrant Edge

The inlet edge of the bore of this orifice plate is rounded to a quarter circle. This orifice plate is usually used for viscous fluids & Reynolds number between 1500 to 9000.



Conical Entrance

These conical entrance orifice plates are used for low Reynolds number in the range of 80 to 1500 and give more constant or predictable discharge coefficient. At lower Reynolds numbers, the discharge coefficient of square edge orifice plate may change by as much as 30%. These are more usable for viscous service.

Orifice and Orifice Assemblies

General's Orifice Performance

Principally, General's orifice plate is a precision instrument. In best circumstances, the inaccuracy of Orifice plates can possibly fall in the range of 0.75-1.5%. However, there are numerous error causing conditions which can terribly affect the accuracy of General's Orifice plate.

Following factors are used to judge the performance of General's Orifice plate:

1. Precision in the bore calculations
2. Quality of the installation
3. Condition of the plate itself
4. Orifice area ratio
5. Physical properties of the fluid flow under measurement, refer the free length table mentioned below

Further class of installation depends upon following factors

- Tap location and circumstance. Generally, there are three ways to position a pressure tap.
- Provision of the process pipe
- Competence of straight pipe runs
- Gasket intervention
- Misalignment of pipe and orifice bores

Extra detrimental conditions consist of

- Dulling of the sharp edge or nicks caused due to corrosion or erossion
- Warpage of the plate because of waterhammer and dirt
- Grease or secondary phase deposits on any of the orifice surface

Any of the above said conditions has the tendency to affect the discharge coefficient of an orifice plate to a large extent.

Orifice Plates

Specifications
Design: Conforms to DIN 1952, BS 1042, ISO-5167
Types: Square edge concentric, Quadrant edged, Conical entrance, Eccentric, Segmental

Plate material: SS304, SS316, SS316L as standard. Hastelloy-C, Monel, PP, PVC, PTFE coated, etc. can be given on request.

Orifice Bore: In accordance with ISO-5167, BS-1042, ASME MFC 3M, R.W.Miller, L.K.Spink, AGA-3

Tab Plate: In the same material as plate & is welded to orifice plate. Tab plate integral to the Orifice plate (i.e. without welding) can also be offered as a special case.

Vent / Drain: Vent or Drain holes are provided as per customer's requirement. The diameter of the vent or drain holes are as per General's standard (Refer Annexures)

Flange Union: Weld neck, Slip on, Threaded, Socket welded with RF or RTJ facing - Orifice flanges are in accordance with ASME B16.36 with minimum flange rating of 300# for sizes up to 8" or male - female flanges in accordance with ASME B16.5,ASME B16.47 series A/B.

Pressure Tappings: Corner tappings are recommended for sizes upto 1 ½"; Flange taps from 2" to 16" ; D – D/2 taps for higher sizes.

Gasket: CAF as per IS: 2712 Gr 0/1 , SS spiral wound + CAF, SS spiral wound + Grafoil, SS spiral wound + PTFE are normally supplied as per process requirement. Other materials available on request.

For RTJ flanges the plate is fixed on the plate holder. The plate holder Softer than flange & acts as a gasket .

Studs / Nuts: ASTM A193 Gr.B7/A-194 Gr.2H as standard, Other material on request.

Jack Screw: ASTM A193 Gr.B7 as standard, Other material on request.

Other temperature and pressure combinations and your solutions, please revert to General Engineering and design team

Orifice assembly size and rating	½" to 64", and rating 150# to 2500#
Plate thickness defined	3.18, 6.35, 9.52, 12.7 as standard and other on request
Fastners	A193GrB7/ A194Gr2H and A193GrB8/ A194Gr8
Flanges MOC	SS316, A105, A182F11, A182F22, PP, PTFE, SS316L, SS304, SS304L, Hastealloy, Monel
Flanges type	Weld Neck, Slip on Socket Weld with RF/RTJ Facing
Orifice plate MOC	SS316, PP, PTFE, SS316L, SS304, SS304L, Hastealloy, Monel

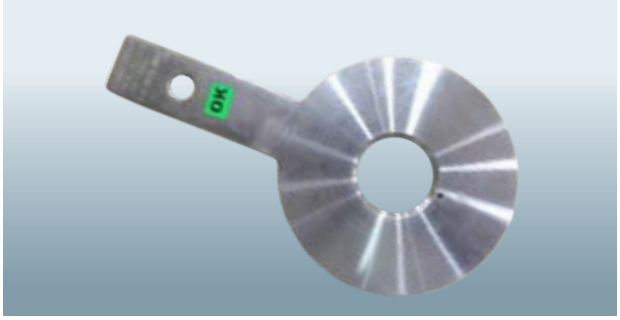


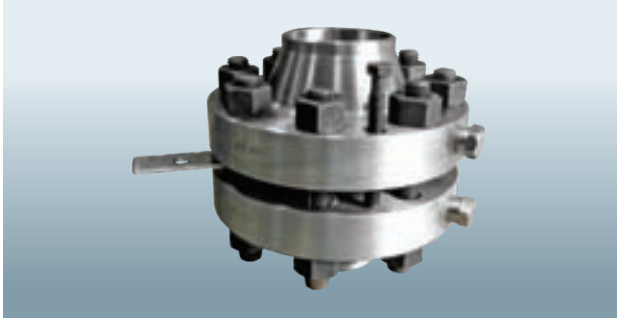


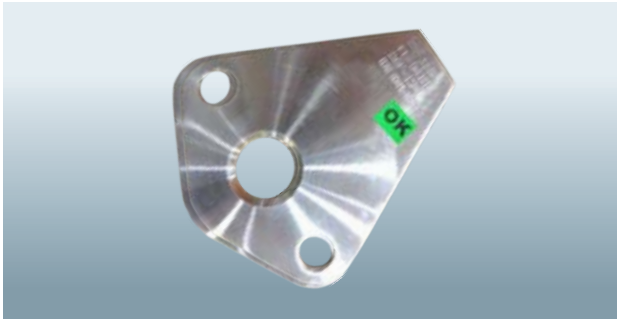
Sizing and Selection of Flow & Control Elements

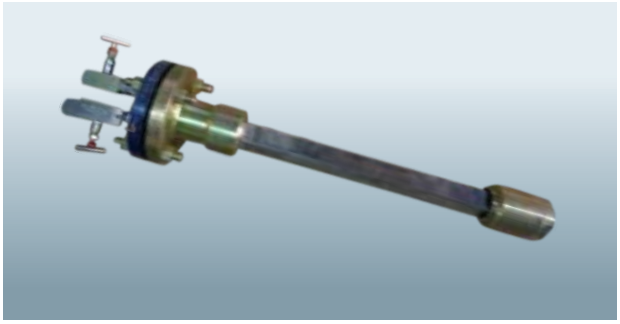
Sizing and selection of Flow Elements, Orifice, Averaging Pitot Tube & Control Valves

1. Media
2. Media pressure
3. Media density
4. Media temperature
5. Media viscocity
6. Pipe size
7. Flow rate thru pipe
8. Velocity defined for liquid at 6m/sec, for gas max upto 40m/sec, and steam upto 60m/sec
9. For higher differential pressure to be maintained, refer for either flow measurement or for pressure killing application
10. If for pressure killing, select restriction plates
11. Single and multistage will be defined based on the choking condition is, depending on flow rate
12. To control noise please consider multistage
13. To control and remove choking, consider multistage only
14. To practice higher efficiency of plant for pure gas and liquid applications, prefer averaging pitot tube
15. Multiport averager helps you with most precise and higher flow recovery coefficient
16. Higher flow recovery means low upstream and downstream free length
17. For solid laden liquids and gasses prefer our direct acting orifices, segmental and eccentric design plates
18. For high viscous medias prefer conical entrance type
19. With integral assemblies we offer most required processes medias for cold box applications





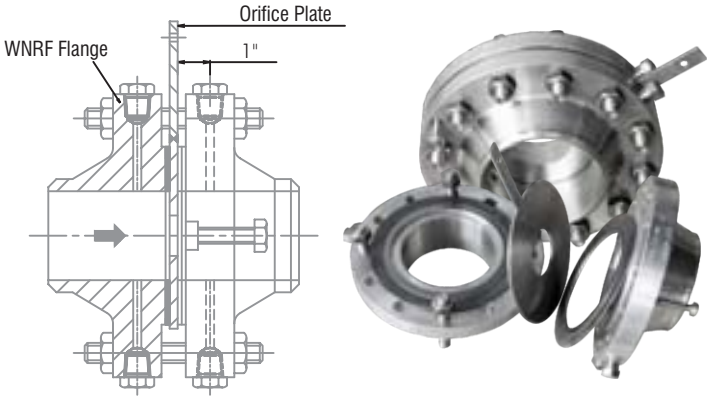




Orifice Plate Assembly

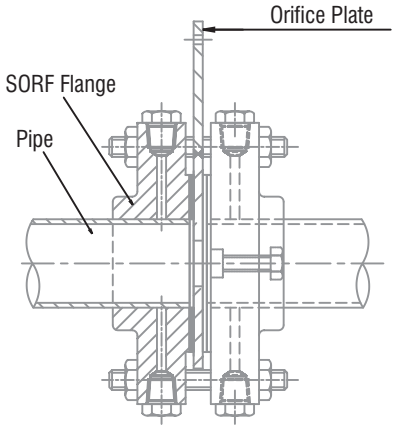
Various types of orifice assemblies

- The weld neck flange assembly is designed to transfer stresses to the pipe, thereby reducing high stress concentrations at the base of the flange. The pressure tappings are provided through the flange which are at a distance of 25.4mm (1") from the relevant face of the plate. Weldneck flanges are prefered since the joint between flange and pipe can be subjected to radiography, to ensure quality of welding joint



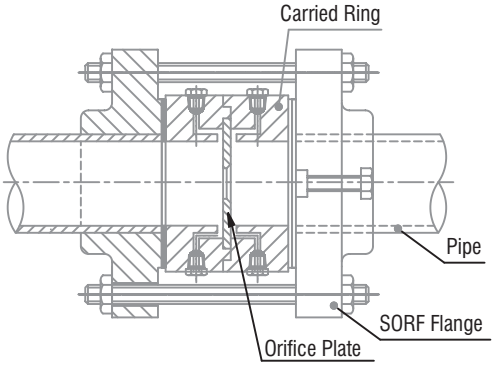
Orifice Assembly with WNRF Flange & Flange Taps

- The slip on flange has a low hub because the pipe slips into the flange prior to the welding. It is welded both from inside and out to provide sufficient strength and prevent leakage. The slip on flanges are bored slightly larger than the OD of the matching flange. SORF flanges are not preferred where pressure tapping through flange is required, since after welding in line blocks the tapping holes which need to be redrilled at site after welding in line.



Orifice Assembly with SORF Flange & Flange Taps

- Orifice assembly with carrier raing and flange union is provided to facilitate pressure tapping, by means of corner tappings. This construction is generally used for lower sizes (less than 2"). However carrier rings can be used for higher line sizes also.



Orifice Plate with Carrier Ring & Flange Union

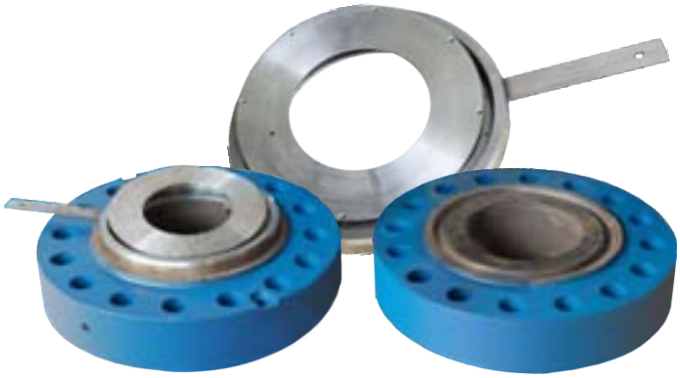
Carrier Ring

Orifice Plate Assembly

The Plate Holder Assembly is a combination of plate holder and an orifice plate designed for ring tongue joint (RTJ) flanges. The plate holder has a function of holding the orifice plate and also a function as a gasket to prevent leakage of the process fluid. The plate holder has a oval or octagonal ring for mounting between ring tongue joint flanges. 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.

Orifice plate is screwed to the plate holder. Generally the plate holder is of soft iron material. The Orifice plate is available in standard material such as SS316, SS304, SS316L, Monel, Hastelloy-C, etc. Other materials are available on request. The plate holder along with the orifice plate can be also machined from one piece.

RTJ holder material is selected so that the RTJ holder hardness is less than that of flange hardness.



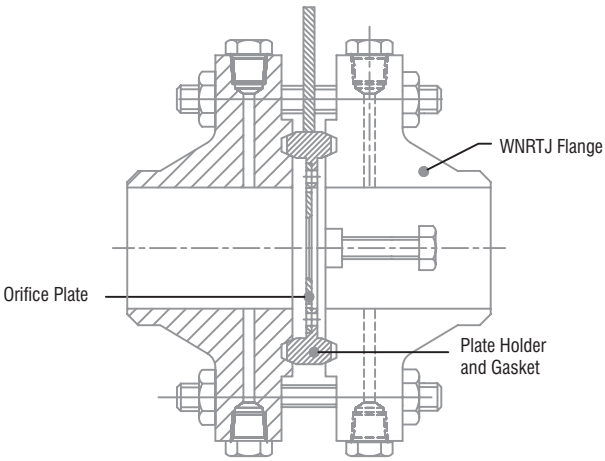
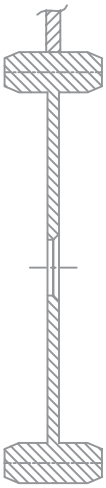
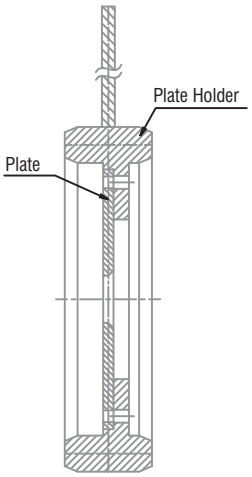


Plate with Plate Holder mounted in between RTJ Flanges



Integral RTJ

Integral RTJ with Female Groove



Orifice Plate with RTJ Holder

Single / Multistage Restriction orifice assemblies

General's Restriction orifice plate and its assemblies

The restriction orifices are used for reducing fluid pressure and are designed somewhat different from the orifice plates that are used for measuring flow rates. They are designed to slip between the piping flanges.

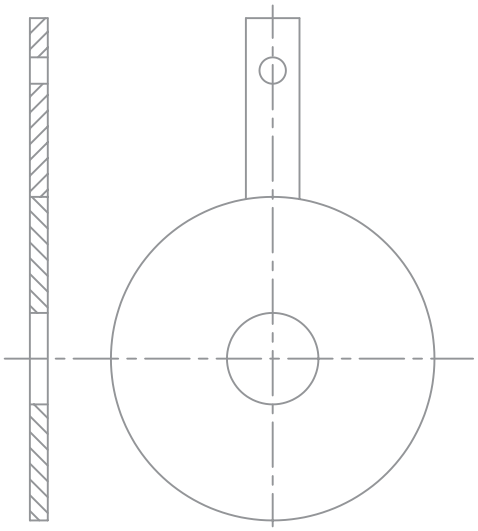


Fig 5.1

Multiple Restriction Orifice Assembly

While single restriction orifices are often sufficient to meet the requirements, there are situations where limitations arise due to process conditions making the single restriction orifices unacceptable. In such situations, use of multiple restriction in series is a better solution.

The foremost consideration for the case of multiple restriction is the pressure drop. This applies whether or not the fluid is liquid or vapor/gas. Higher pressure drop implies higher velocities resulting in vibration and noise problems.

The other consideration is not just about maximum permitted pressure drop and this is particularly for gas flow. If the process condition indicates that critical flow will occur with the use of single restriction plate, care should be exercised to avoid operating well beyond the critical pressure drop. Critical implies a pressure drop across the device exceeding 50 percent of the absolute upstream pressure at which point sonic velocity is reached.

Construction of Multistage Orifice Assembly comprises of multiple restriction orifice plates separated by a distance of one pipe diameter and welded with the pipes in between them. End connection is either suitable for butt welding or with end flanges. IBR Form IIIC certificate can be provided as per requirement.

FLOW DIVISION

Single / Multistage Restriction Orifice assemblies

Standard as per R.W. Miller / ISO5167, AGA-3, B16.5, B16.36, B16.47 Series B

General Instruments manufactured multistage orifice assemblies are another type of measuring flow with high differential pressure meters effectively removing cavitation and flashing conditions. It also helps in killing pressure and thus effectively acting as a pressure reducing element. These are basically used to detect flow of fluids, gasses, steam, steam water, acids, alkalies, crudes, high viscous fluids, fluids with solid particles, condensation liquids. General make of multistage assemblies lead to a precise measure of differential pressure leading to the most precise flow rate taking care of all factors of fluid cavitation related to its vapour pressure. The design is applicable from ½" to 64" of flow measurement. For higher sizes of impact and pressure reducing kindly do contact the design and engineering team of General. It is measured at right angles to the flow direction, In a averaging General make Multistage assemblies the kinetic energy of the flowing fluid is transformed into potential energy for measurement of fluid flow velocity by effectively abrupting to 40% recovery in between two stages and thus, effectively removing the choking content of the fluid in gas and steam and removing cavitation in especially liquid state thus essentially reducing industrial noise and restricting to below 80 decibels.

Applications

- Gas and Liquid Flows
- High Pressure Drops

Prevents

- 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 ORIFICE ASSEMBLIES may be required to achieve the desired pressure drop whilst preventing problems 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 RO to 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 - also know as critical flow - occurs when too large a pressure drop is attempted across a single orifice plate, or when too large flows are forced thru a lesser inlet pipe size. In such cases 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. General make multistage RO will enable staged reductions in pressure to prevent choked flow occurring.

General make Multistage ROs are manufactured from a wide range of materials and are engineered to meet specific project process conditions and requirements. Plates are usually welded into pipe with a separation of one pipe diameter, the number of plates and orifice bores being determined by calculation. Process connections to existing pipe work can be either standard process flanges or machined ends suitable for butt welding.

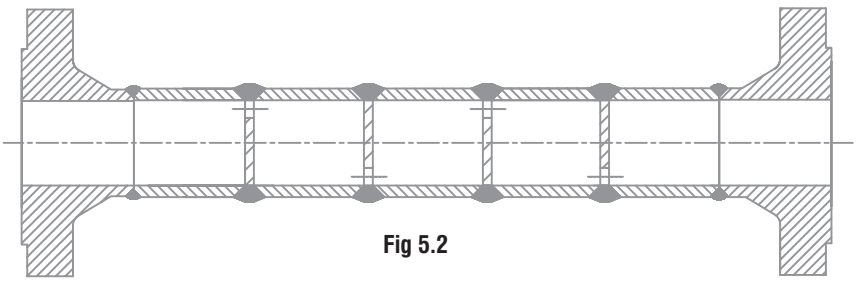


Fig 5.2

Multiple Restriction Orifice Assembly

Meter Run Assembly

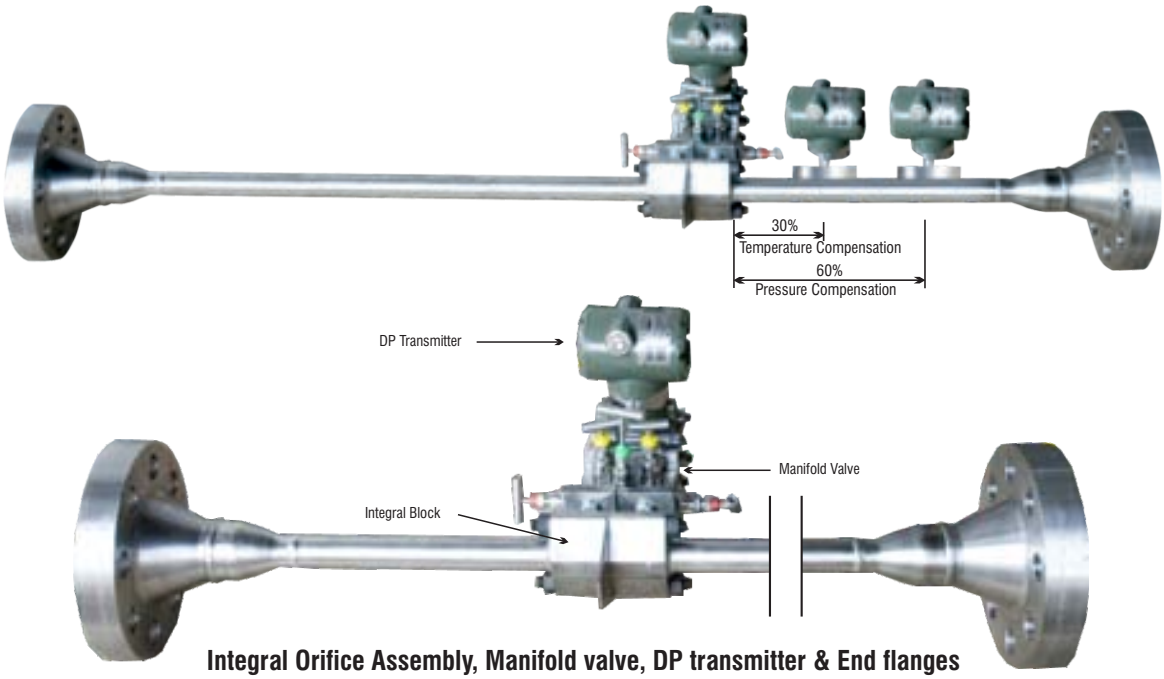
Integral assembly Std as per B16.5, B16.36, B16.47 Series B, ISO5167, AGA-3, ASME, MFC 14M 2003

General Instruments manufactured integral orifice assemblies are another type of measuring flow device, which caters to the principle of maintaining constant reynolds number through out the process of media entering and processed and finally out of the assembly.

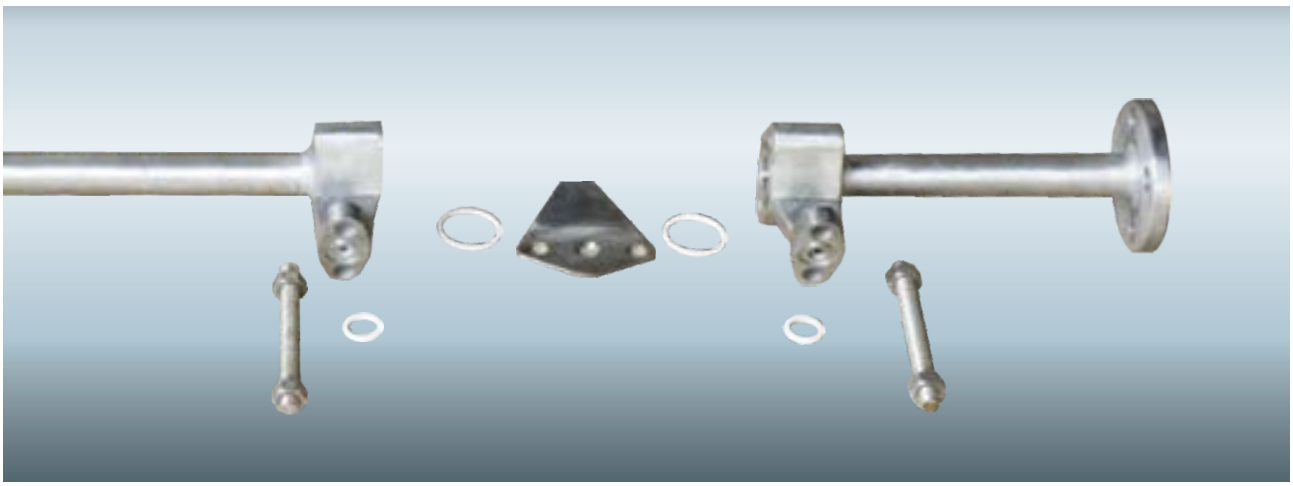
This is possible with the precision manufactured device wherein the input flange, with pipe chamber, the orifice assembly and the outlet pipe chamber and the subsequent flange for the flange end connection, all shall be attributed to constant reynolds number.

The type of integral assemblies General Manufactures:

a) Integral meter run assembly upto 2”



Integral Orifice Assembly, Manifold valve, DP transmitter & End flanges



Advantages of using Integral Meter run assembly:

Use of an integral orifice flow meter will eliminate the three measurement inaccuracies recorded in small orifice line installations.

- The Integral Orifice honed body reduces ID uncertainty
- By inserting precision bored upstream and downstream sections of pipe, the velocity profile distortion due to pipe roughness is reduced.
- The self-centering design of the Integral Orifice Plate eliminates plate misalignment.

Improves reliability and maintenance costs

The integral orifice flow meter eliminates impulse lines, reducing leak points by over 50% and decrease start-up time due to the flexibility of numerous process connection options. The direct mount design minimizes line plugging by eliminating long lines, small-bore ports, and crevices while providing consistently reliable installations.

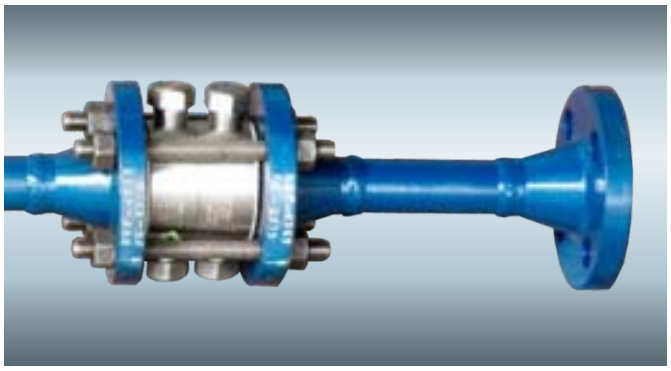
- Accuracy up to ±0. 5% of volumetric flow rate
- Integral manifold head allows direct mounting of DP transmitters
- Ideal fluid types: liquid, gas, and steam

Meter Run Assembly

Meter runs are supplied as a complete unit of normally 1M length to ensure the necessary straight pipe length to achieve highest possible efficiency.

These are available with line sizes mostly below 50mm with corner tap. These are used for the measurement of small flow rates precisely where high accuracy of flow rates is required.

IBR Form IIIC certificate can be provided for meter runs as per requirement.



Types of Meter Runs:

1. Orifice Flange union with Meter - run.
2. Orifice flange union with Carrier ring & Meter - run.

Generally Meter-run pipe is recommended with upstream length of 750mm and downstream length of 250mm.

Meter runs sizes above 50mm are also available as per the customers or process requirements.

MOC: Orifice Plate in SS 316, SS 304 & other on request.

End Connection: Socket Weld, Screwed and Flanged ends with meter run piping suitable to ANSI, IS & DIN flanges

We comply Meter Tube Internal Diameter Roundness Tolerance, in strct accordance as per American Gas Association Report No, 3 Part 2.

Any internal diameter measured in distance one pipe diameter will be less than the 0.25% of the mean diameter for the upstream side.

$$\left| \frac{\text{Any diameter within one D]-Dmean}}{D} \text{ X } 100 \right| \leq 0.25\%$$

Also the percentage difference between the maximum and minimum measured internal diameter through all upstream meter tube will be less than 0.5%

$$\left| \frac{\text{Maximum Diameter-Minimum Diameter}}{\text{Dmean}} \text{ X } 100 \right| \leq 0.5\%$$

For the downstream side any internal diameter measured will be less than 0.5% of the mean diameter for the downstream side.

$$\left| \frac{\text{Any downstream diameter D]-Dmean}}{D} \text{ X } 100 \right| \leq 0.5\%$$

FLOW DIVISION

Meter Run Assembly

Specification:

Material of construction of pipe chamber	SS316, SS316L, A106, SS304, SS304L, Monel, Hastalloy, PP, PTFE
Material of orifice plate	SS316, SS316L, SS304, SS304L, Monel, Hastalloy, PP, PTFE
Material of construction of the end connection	SS316, SS316L, A106, SS304, SS304L, Monel, Hastalloy, PP, PTFE
End connections	Flanged, BWE
Line size assemblies	1/2 to 2" for integral meter run assemblies and till 40" for meter run
Manifold block	3 way or 5 way in SS316 or SS316L or in A105
Isolation valve	Ball, needle, globe, 1/2" NPT F in A105, SS316, SS316L, SS304, SS304L, monel, PP, PTFE
Pressure Rating	150# to 2500#
Application	Integral meter Run - where direct mounting of DPT is required. Meter tube - where high accuracy measurement required each as gas metering, custody transfer and application
Orifice plates	Square edge, concentric, segmental, eccentric, quadrant edge
Media	Steam, steam water, water, acids, mixed phase, air, gasses, liquids all forms, liquids not less than Reynolds 1250

Flow Calibration Test Bench for Flow Elements and Control Valves

The bench is marked with calibrated pressure gauges and differential pressure gauges from General instruments to note the readings.

The assembly is further connected to noting the flow readings through a magnetic flow meter which is noted upto the range of 8000LPM of flow. The reading in magnetic flow meter which works at 230 VAC supply and the magnetic field is generated on passing of water and thus recording the flow rate in the LCD assembly. The magnetic flow meter is further able to transmit 4 top 20 mA signal to a recorder which records the differential pressure reading and the flow reading and is able to generated the all important flow versus DP curve to indicate the calibration result. The differential pressure reading transmitted is done by HART protocol out put to the recorder which also as the input of the magnetic flow meter.

The process is first done and completed by inserting the calibration of an assembly as follows:

Online chartless recorder for HMI system converting analog reading results for online pressure and flow changing results

Calibration of Orifice Assembly

Plate OD in mm	Plate bore in mm	Media	Media pressure in bar g	Media temperature in deg cent	Beta value practical reading	Free length recorded upstream in mm	Free length recorded downstream in mm	Pressure reading in upstream in bar g	Pressure reading in downstream in bar g	Flow reading noted in LPM in magnetic flow meter	DP reading in mmwc noted in DP gauge/ Transmitter	Calculated C value on noting the reading	Calculated C value via ISO 5167 method of calculation with actual parametric values of application

Calibration of Valve Assembly

Valve size	Valve seat bore in mm	Valve opening defined at 20%, 40%, 60%, 80% and at 100%	Valve Kv value	Differential pressure recorded in mmwc	Pressure in upstream of valve in bar g	Pressure in downstream of valve in bar g	Flow reading noted in LPM in magnetic flow meter	DP reading in mmwc noted in DP gauge / Transmitter	Calculated Kv value on noting the reading	Calculated Kv value via the IEC 60534 std with actual parameter of the assembly

The calibration of the valve is done based on the same method as explained above, Here the orifice assembly in the above method is replaced with the valve. Here one change is that there is no free lengths required.

The valve is operated at 20%, 40%, 60%, 80% and at 100% by either

Table 9.3

Type	By which the openings can be had
Hand operated valves	Manually adjusting the handwheel
Pneumatically operated valves	By adjusting the compressor air to the valve actuator and by noting the desired spring range in the actuator
Electrically operated valves	By having 3 phase or single phase connection to the actuator and here it is only done at 100% as the operations for electrical actuator is only with and for on - off conditions
Hydraulically operated valves	By having 3 phase or single phase connection to the actuator, the intermediate levels are possible when switching off the supply at the desired opening levels

Flow Calibration Test Bench for Flow Elements

Flow Calibration bench for Orifice and Valves:

General Instruments Consortium enters into a new age of flow calibration bench. The unit is now ready for:

Table 9.1

Flow Calibration	Orifice assembly upto 12"	Upto 8" from beta value 0.15 till 0.9 and 10" and 12" till beta 0.15 to beta = 0.5	Accuracy, max upto 0.5%	Hysteresis is max upto 0.2%	Repeatability = 0.25%	For 10" and 12" for beta = 0.55 till 0.8, the accuracy shall be max upto 1.5%	Standard being followed is under ISO 5167 and IEC 60534-2, also confirming to the basic BS code 1042	Conditions applicable for volumetric designing and provisions under gravimetric conditions available on demand
Flow Calibration	Valves with size upto 12"	For kv value equal to 1440 m3/hr	Accuracy, max upto 0.5%	Hysteresis is max upto 0.2%	Repeatability = 0.25%	No restrictions till 12" size	Under strictly to IEC 60534-2	Strictly to volumetric conditions as per required IEC 60534-2

The orifice assembly or the flow control element, valve, is calibrated under fluid mechanics standards of ISO 5167 and IEC 60534 standards. The process and the procedure of the measuring flow calibration of the device and the design is as per the international standards applicable for volumetric and gravimetric conditions

The flow calibration bench for upto 12" size, is applicable for pressure rating upto 3 kg /cm^{2}g and for all ambient conditions. The testing media is water. The calibration unit is under free length or straight length as per the ISO standards for mounting in such conditions applicable for orifice assemblies with water as media and with calculated beta value to decide the free length for calibration of sensors. For valves, the condition is kept at ambient conditions with water and based on IEC 60534 standard the flow coefficient value of the valve is matched with desired flow rate applicable under differential pressure conditions, under applicable and available free or straight lengths

The bench gets the water from an underground tank with an overall capacity of (7500mmX1500mmX2000mm)…m3 which is having a magnetic level gauge mounted to check the level of water. The level in turn helps to clear the pressure applicable under the centrifugal pump which is mounted to the side to generate the desired and the requisite pressure for the flow assembly, either valve or orifice.

Table 9.2

Adjustment of pressure at downstream of assembly	Differential pressure at the assembly maintained
2.5 kg/cm^{2}g	5000mmwc
2.55 kg/cm^{2}g	4500mmwc
2.6 kg/cm^{2}g	4000mmwc
2.65 kg/cm^{2}g	3500mmwc
2.7 kg/cm^{2}g	3000mmwc
2.75 kg/cm^{2}g	2500mmwc
2.8 kg/cm^{2}g	2000mmwc
2.85 kg/cm^{2}g	1500mmwc
2.9 kg/cm^{2}g	1000mmwc
2.95 kg/cm^{2}g	500mmwc

The differential pressure in the assembly is created by either manually adjusting the input pressure, with adjustable valves at the input line to the device for calibration or by pneumatically adjusting the variations thru control pneumatic actuators adjusting to set points .

The differential pressure is maintained and fixed for the assembly under measurement, by adjusting the downstream valve and is adjusted at

Radial metering system with calibrated pressure gauge, magnetic flow meter and DP gauges