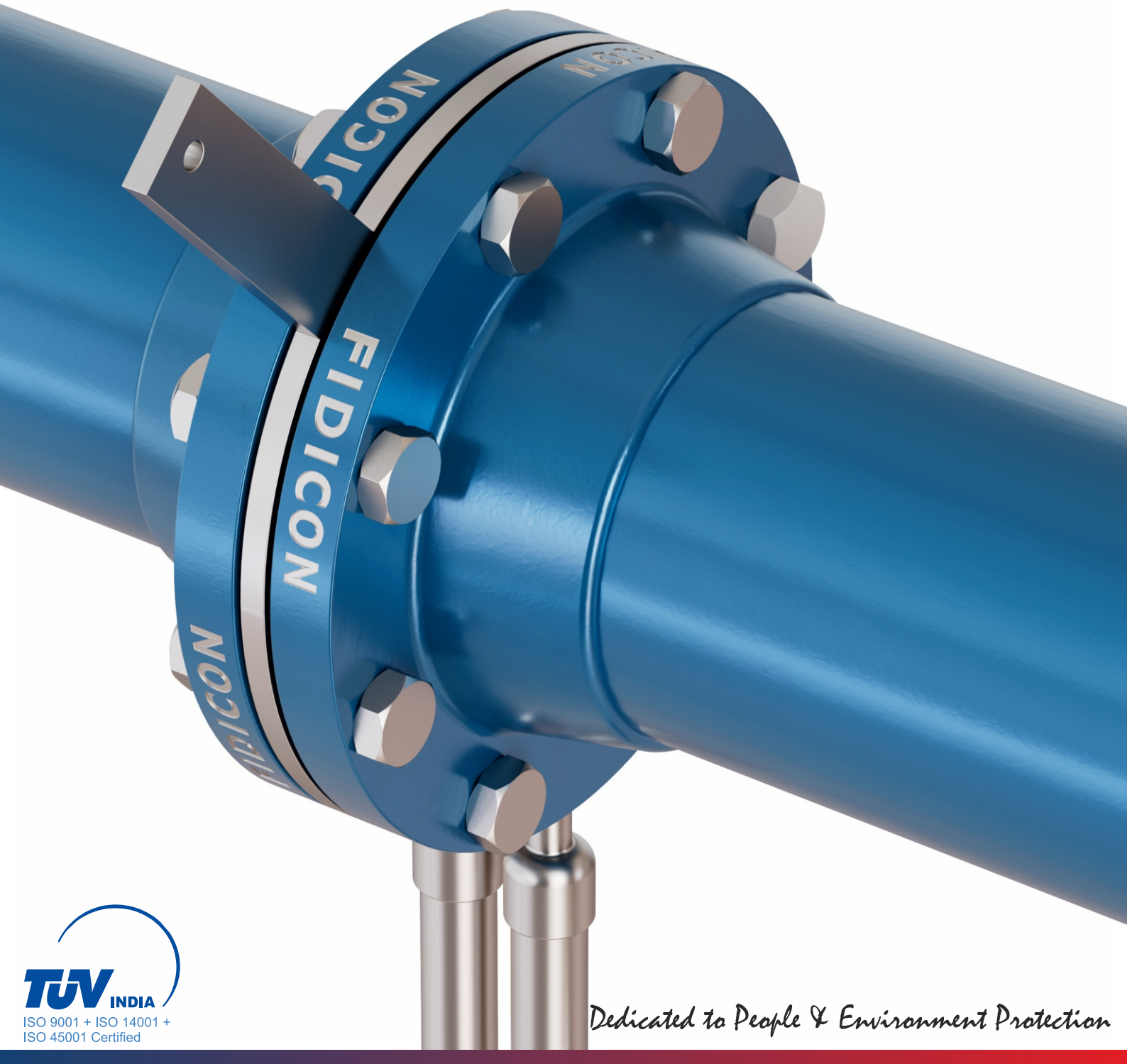
FIDICON
DEVICES INDIA PRIVATE LIMITED
Dedicated to People & Environment Protection

ORIFICE FLANGE ASSEMBLY

FDI - OFA - 206



TÜV INDIA
ISO 9001 + ISO 14001 +
ISO 45001 Certified

Dedicated to People & Environment Protection

INTRODUCTION

ORIFICE PLATE

Depending on the calculation associated with the orifice plate either a volumetric flow or mass flow rate may be determined whenever needed. Measurement of flow rate using orifice plate involves measuring fluid flow through the difference in pressure from the upstream side to the downstream side of a partially obstructed pipe. A precisely measured obstruction achieved using the plate obstructing the flow, narrows the pipe and forces the flowing fluid to constrict.

The heart of the orifice meter is the Orifice plate-which restricts the flow and develops the differential pressure which is proportional to the square of the flow rate. The Flow measuring accuracy depends entirely upon the quality of orifice plate, how it is installed and maintained.

The orifice plates are made using various materials as per ISO/ISA/AGA/API/ANSI standards.

An orifice plate is a simplest and low cost product. In simple term it is a plate with a hole of a specified size and position cut in it, which may then be clamped between flanges in a pipeline.

The velocity increase that occurs in the flow as it passes through the hole in the plate which results in pressure drop being developed across the plate. The fluid flow jet continues to contract after passing through this restriction until a minimum diameter known as the vena contracta is reached.

When a fluid (whether liquid or gas) passes through the orifice, its pressure builds up slightly upstream of the orifice but as the fluid is forced to converge to pass through the hole, the velocity increases and the fluid pressure decreases.

The flow reaches its point of maximum convergence- the vena contracta, a little downstream of the orifice. The velocity reaches its maximum and the pressure reaches its minimum. Beyond that, the flow expands, the velocity falls and the pressure increase. The flow rate can be obtained from Bernoulli's equation using coefficients established from extensive research by measuring the difference in fluid pressure across taping upstream and downstream of the plate.

INTRODUCTION

WORKING PRINCIPLE

The whole principle is based on Bernoulli's principle, and it states that for a flow of a nonconducting fluid, an increase in the speed of the fluid occurs simultaneously with a decrease in pressure.

The orifice plate which is fixed at a section of the pipe, creates an obstruction to the flow by provides an opening (in the form of an orifice) to the flow passage.

A fluid whose rate of flow is to be measured using the orifice plate is based on the principle that when an orifice plate is placed in a pipe carrying the fluid, it causes a pressure drop as explained in the paragraph above which varies with the flow rate. This pressure drop is measured using a differential pressure sensor and when calibrated this pressure drop becomes a measure flow rate.

OPERATION OF ORIFICE PLATE

The details of the fluid movement inside the pipe and orifice plate have to be understood.

The fluid having uniform cross section of flow converges into the orifice plate's opening in its upstream. When the fluid comes out of the orifice plate's opening- Its cross section is minimum and uniform for a particular distance and then the cross section of the fluid starts diverging in the downstream.

At the upstream of the orifice, before the converging of the fluid takes place, the pressure of the fluid (P1) is maximum. As the fluid starts converging, to enter the orifice opening its pressure drops. When the fluid comes out of the orifice opening, its pressure is minimum(p2) and this minimum pressure remains constant in the minimum cross section area of fluid flow at the downstream.

APPLICATION

- The eccentric and segmental orifice plates are used to measure flow rates of fluids containing suspended materials such as solids, oil mixed with water and wet steam.
- The concentric orifice plates are used to measure flow rates of pure fluids and has a wide applicability as it has been standardized.

ADVANTAGES

- It has easy method to measure flow rate.
- It has predictable characteristics and occupies less space.
- Can be used to measure flow rates in large pipes.
- High-quality & High Accuracy
- A Wide Range
- Very Reliable
- Low Pressure drops across the meter
- All Mechanical units can be installed in remote locations

INTRODUCTION

TYPES OF ORIFICE PLATE

1.) Concentric Orifice Plate

- Concentric orifice plates are must commonly use for flow measurement & have special features such as simple structures, high accuracy, and ease of installation & replacement.
- These are correctly finished to the dimensions, surface roughness, and flatness to the applicable standard.
- These are recommended for use in clean liquids, gases, and steam flow, when the Reynold number 7 ranges from 1000 to 10000.

2.) Eccentric Orifice Plate

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

3.) Segmental Orifice Plate

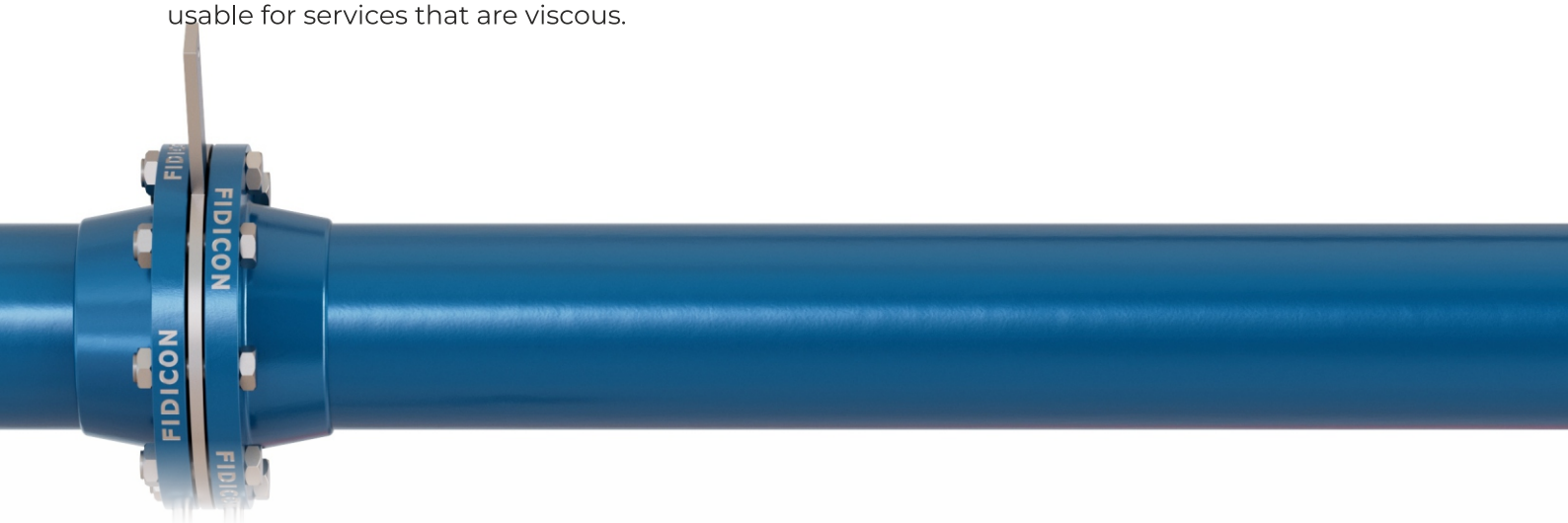
- Segmental orifice plates are most useful where there is suspension in the fluids or impurities are also there. This avoids build up in front of the orifice plate. The orifice hole is placed at the bottom for gas service and top liquids.

4.) Quadrant Edge Orifice Plate

- 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 2000 to 10000.

5.) Conical Entrance Orifice Plate

- These Conical Entrance Orifice Plates are used for low Reynolds number in the range of 80 to 2000 and give more constant or predictable discharge coefficient. At Lower Reynolds number, the discharge coefficient of square edge orifice plate may change by as much as 30%. These are more usable for services that are viscous.



INTRODUCTION

ORIFICE FLANGE ASSEMBLY

Orifice Flange Assembly is used as a metering device, in order to measure flow or differential pressure along the Line, the Beta Ratio (d/D) defines the Maximum Flow that will be allowed through the orifice flange assembly.

Orifice Flange Assembly will act as a source to Allow Measurement of Flow or Pressure by installing the metering or bypass lines with the reference to ISO 5167 design & installation guidelines, the flow or pressure from the process line will translate proportional to the metering or bypass line area and such ratio (as per flow continuity equation) flow will be used as maximum flow or pressure range for the measurement device.

These are used for measuring flow of various Liquids, Gases & Steam. The measurements obtained by these give an acceptable level of certainties at minimum cost and long life without regular maintenance. Based upon the working principle of measurement of 'Differential Pressure' created when an obstruction is placed in the fluid flow, due to increase in fluid velocity, Orifice Plates are most commonly used as primary element for flow measurement in pipelines. The orifice plate dimension is based on BS/ISO- 5167 specification.

The use of the orifice flange assembly negates the requirement for further pipe drilling ensuring the quality of the tapping to ISO 5167-2 and minimizing the errors of the system. When assessing the overall accuracy of the flow meter, the weld beads and condition of the upstream piping should be considered.

When fluid is flowing from main pipeline, Orifice plate restricts the flow and develops the Differential Pressure which is proportional to the square root of the flow rate.

Orifice plate with flange assemblies is employed for measuring the rate of flow or quantity of moving fluids like liquids, gases or vapours.

When orifice plate is in use in a pipe line- through which a fluid is flowing, static pressure difference exists between the upstream side & the downstream side of the device & is geometrically similar to one on which direct calibration has been made. The conditions of use being the same, the rate of flow may be determined from the knowledge of the circumstance under which the device is being used.

Two orifice flanges are called an orifice flange union. Each flange comes with two pipe taps for measuring the pressure drop of the flow through an orifice plate.

Support assembly consist of the following three items:
1) Gasket
2) Carrier Ring
3) Stud and Bolts

INTRODUCTION

FACTORS FOR DESIGN & SELECTION

- Pipe Internal Diameter
- Coefficient of thermal expansion for pipe and orifice
- Meter range
- Normal Flow
- Density (operating, NTP)
- Viscosity
- Differential Pressure
- Specific Heat Ratio
- Operating Pressure
- Operating Temperature
- Pipe ID at operating Temperature
- Distance of tap
- Reynolds number
- (CeB (bitta)) ^2, Original
- Empirical value of B(bitta)
- Iterated value of B(bitta)
- Pressure Ratio
- Expansion factor
- Velocity approach factor
- Discharge coefficient

LIMITATIONS

- The Vena-Contracta length depends on the roughness of the inner wall of the pipe and sharpness of the orifice plate. In certain cases, it becomes difficult to tap the minimum pressure (p2) due to the above factor.
- Pressure recovery at downstream is poor, that is, overall loss varies from 40% to 90% of the differential pressure.
- The orifice plate gets corroded and due to this after sometime, inaccuracy occurs, moreover the orifice plate has low physical strength.
- In the upstream straightening varies are a must to obtain laminar flow conditions.
- Gets clogged when the suspended fluids flow.
- Bulky, especially in the larger sizes.
- A sudden change in the flow rate can damage the meter.
- Only for limited ranges of pressure and temperature.
- The Fluid must be clean for measurement accuracy.
- Need to be replaced after specific time.
- Require a good maintenance schedule and are high repair and maintenance meters

TARGET CUSTOMERS

- Water suppliers
- Natural gas industries
- Petrochemical industries
- Oil industries
- LPG suppliers
- Refineries
- Power Industries

INTRODUCTION

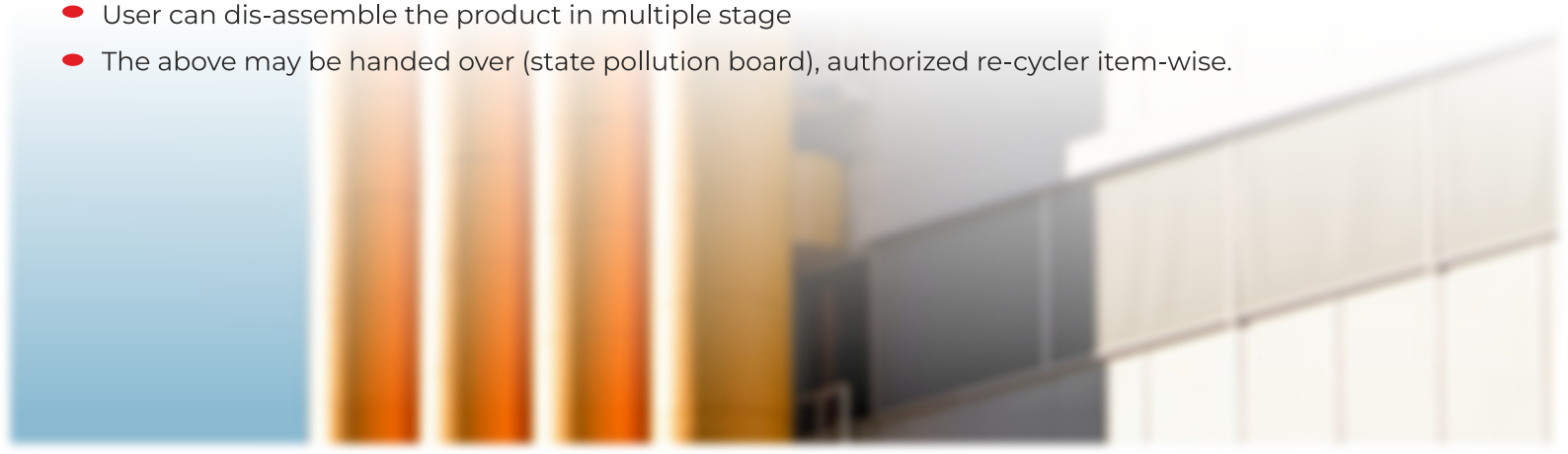
INSTALLATION

There are a few key general considerations when installing an orifice plate:

- Determine the location where the orifice plate will be installed.
- The orifice plate should be installed in a straight section of pipe wherein no fittings, elbows, or other obstructions within a certain distance of the plate is there. This distance is known as the "pipe run" and is typically at least five pipe diameters upstream and downstream of the plate.
- Clean the pipe thoroughly to remove any debris or contaminants that may interfere with the accuracy of the flow measurement.
- Install the orifice plate in the pipe using bolts, clamps, or a flange. Care to be taken to ensure that it is perpendicular to the flow of the fluid and the sharp edge or throat is facing directly into the flow.
- Install at the appropriate elevation to ensure that the pressure taps are located at the correct heights.
- It is important to properly seal the orifice plate to prevent leaks. This can be done with gaskets or by using a pipe flange with bolts and nuts to secure the orifice plate in place.
- Install a differential pressure transmitter downstream of the orifice plate to measure the pressure drop across the plate. The pressure drop is used to calculate the flow rate through the orifice plate.
- Calibrate the orifice plate and differential pressure transmitter according to our instructions. This typically involves flowing a known volume of fluid through the orifice plate and measuring the resulting pressure drop.
- The section of the pipe in which the primary element is installed can be horizontal, inclined or vertical.
- The direction of the flow is immaterial except when a foreign substance such as sediment or vapor is carried in suspension.
- In this case it is preferable to install the primary element in vertical section of the line with the flow in such a direction that the foreign substance will readily carry-on trough the primary element, i.e., upward in the case of vapor and downward in the case of sediment.

RECOMMENDED DISPOSAL

- Give it back to us & we will take care of recycling & possible disposal.
- User can dis-assemble the product in multiple stage
- The above may be handed over (state pollution board), authorized re-cycler item-wise.



ORDER GUIDE & RECOMMENDED SPARES

ENQUIRY SPECIFICATIONS:

[1] Service Media Details.
[2] Size/Connection
[3] System Operating and Design Pressure.
[4] System Operating and Design Temperature.
[5] Material Specifications (Body, Internal)

RECOMMENDED SPARES

[1] Orifice Plate
[2] Gasket

OTHER RANGE OF PRODUCTS

[1] Flame Arrester
[2] Breather Valve
[3] Level Indicators
[4] Rotameters
[5] Emergency Relief Valve
[6] Gauge Hatch
[7] Strainers
[8] Pressure Reducing Valve
[9] Safety Relief Valve
[10] Flowmeters
[11] Level Switches
[12] Pressure Reducing Station
[13] Level Gauge, etc.

Any Query?
Contact us to Discuss,
Phone No: +91-2646-222238/223412
Mobile No: +91-9824418777
sales@fidicondevices.com
info@fidicondevices.com
Address: Plot No. 1706/12, GIDC Ankleshwar,
Dist.: Bharuch, Gujarat, India 393002.