

SINGLE & MULTISTAGE RESTRICTION ORIFICES

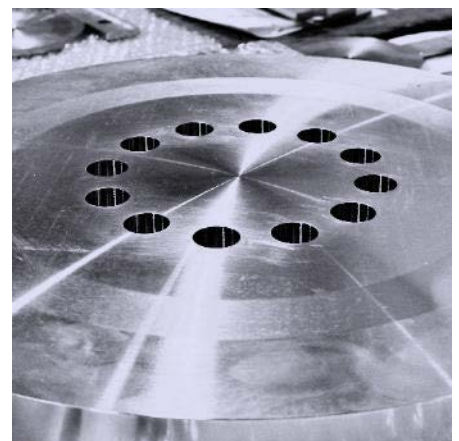


These devices are designed to reduce the fluid pressure. The table here below summarizes typical applications and calculation criteria.



TECHNICAL SPECIFICATIONS

APPLICATIONS	Oil & Gas / Petrochemical Industries / Power Stations
TYPE OF ELEMENTS	Single Stage Restriction refer to pipe taps configuration in-ISO 5167 and in Miller Engineering Handbook, Critical Restriction are typically sized according to Miller Engineering Handbook. Multistage Restriction are sized according to Tecnomatic certified calculations.
MATERIAL	All material requested by the customer / Material Specifications: all / Main material Reference: ASTM-ASME Code.



**FACTORS
FOR SIZING
RO DEVICES**

PRESSURE DROP: For sizing and selecting the restriction orifice, the pressure drop is a critical parameter. The required minimum thickness of a RO device is dependent on the pressure drop across the device.

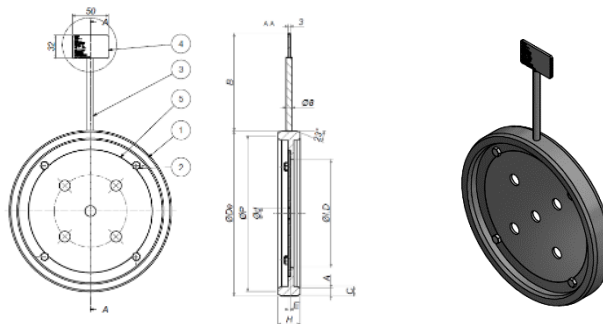
FLOW RATE: As the pressure drop is dependent on the flow rate changes, the restriction orifice needs to be sized for a normal flow rate. For critical RO, the downstream flow rate should be considered.

SONIC FLOW: Choked or sonic flow conditions may arise due to a decrease in density and an increase in velocity when a gas accelerates through a restriction. A Sonic flow in the pipeline generates high noise and vibration in the pipeline that may cause mechanical failure. To avoid this, the maximum pressure drop across a single-stage restriction orifice plate must be limited to a critical pressure drop.

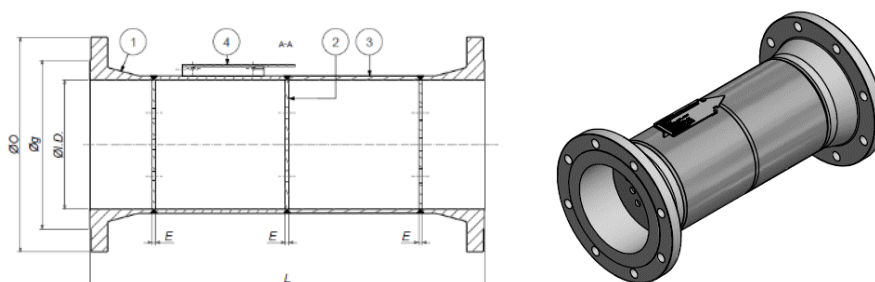
CAVITATION: In liquid flow restrictions with very large pressure drops, cavitation may occur. While passing through the restriction orifice, the velocity of liquid drops, and pressure increases. Due to these, vapor bubbles can collapse and flashing can occur. This phenomenon is known as cavitation. To avoid cavitation, the restriction orifice should be sized to maintain the cavitation index less than the incipient cavitation index of the RO plate. Inlet pressure, outlet pressure, and vapor pressure are the parameters for the cavitation index, and the incipient cavitation factor will be dependent on the beta ratio of the plate.

NOISE LEVEL: Noise levels in RO can be predicted by calculating sound power generated due to pressure reduction. Next, the transmission losses can be subtracted to find the sound level at any pre-decided location.

SAMPLE OF SINGLE RESTRICTION ORIFICE PLATE



SAMPLE OF MULTISTAGE PRESSURE REDUCER



CLASSIFICATION OF FLUIDS: GAS				
DP < critical DP (see note 1)	DP > = DP critical			
	PROCESS		BLOWDOWN (when it is not necessary to control the discharge pressure)	FLARE (controlled discharge with downstream pressure limit)
	CONTINUOUS SERVICE	INTERMITTENT SERVICE	BOTH SERVICES	BOTH SERVICES
SINGLE RESTRICTION	MULTISTAGE	MULTISTAGE OR SINGLE RESTRICTION	CRITICAL RESTRICTION	MULTISTAGE (DOWNSTREAM PRESSURE < = 10 Bar)
SINGLE HOLE (NOISE LEVEL < = 85 Dba)	SINGLE HOLE (NOISE LEVEL < = 85 Dba)	SINGLE HOLE (NOISE LEVEL < = 85 Dba)	SINGLE HOLE (NOISE LEVEL < = 85 Dba AND FLOW RATE)	SINGLE HOLE (NOISE LEVEL < = 85 Dba)
MULTI HOLE (SEE NOTE 2 AND NOTE 3)	MULTI HOLE (SEE NOTE 2)	MULTI HOLE (SEE NOTE 2)	MULTI HOLE (SEE NOTE 2)	MULTI HOLE (SEE NOTE 2)

CLASSIFICATION OF FLUIDS: LIQUID			
CAVITATION NUMBER > 2,5	CAVITATION NUMBER < = 2,5 (see miller eng handbook)		
	PROCESS		BLOW DOWN
	Little saturation pressure	High saturation pressure	
SINGLE RESTRICTION	MULTISTAGE (Normally, in this case, multistage reduce all required DP)	MULTISTAGE (Normally, in this case, multistage reduce almost all required DP leaving a suitable back pressure to avoid Cavitation)	SINGLE RESTRICTION (with allowable DP calculation)
SINGLE HOLE (NOISE LEVEL < = 85 Dba)			
MULTI HOLE (SEE NOTE 2)			

NOTE 1: Critical DP approximately a half of upstream pressure

NOTE 2: Multihole applicable to reduce noise when noise level by single plate > 85 Dba

NOTE 3: Multihole also applicable (in case of critical restriction) to reduce plate thickness

**TYPE OF
MULTISTAGE
CONSTRUCTION**

With body by bar stock
With body from pipe

**MULTI-HOLE
SINGLE STAGE
RESTRICTION
ORIFICE**

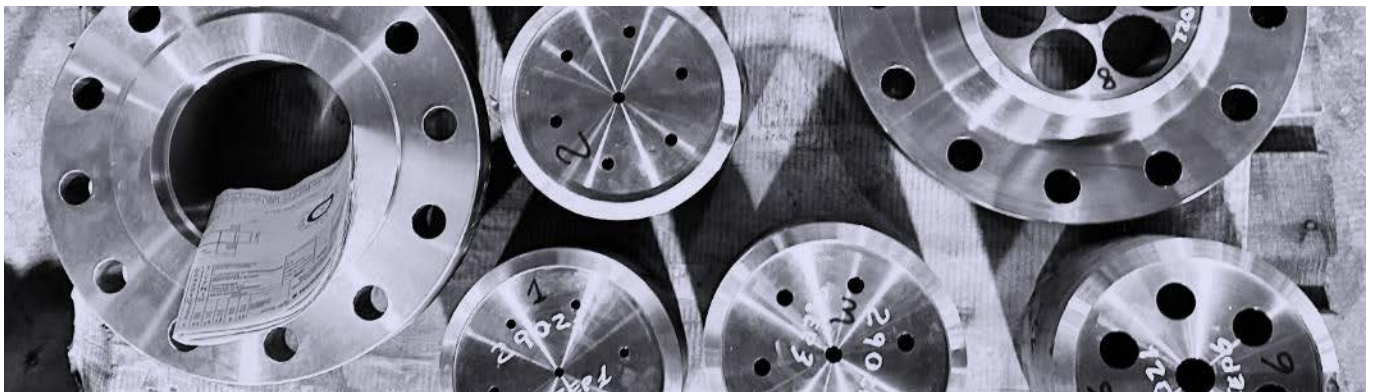
To reduce the noise generated, single-stage multi-hole restriction orifice plates are used. As the high-velocity flow at the RO inlet is distributed through several holes, the noise is reduced. To avoid the cavitation problem, multi-hole restriction orifices are used. The flow distribution through multiple holes improves the cavitation factor which in turn reduces the overall noise.

**MULTISTAGE
RESTRICTION
ORIFICE
ASSEMBLY**

Multistage restriction orifices are widely used for very high-pressure reduction when a single-stage RO is not capable. It consists of a number of single-stage RO devices. The design can be single-hole or multi-hole. The restriction orifices in a multistage RO are usually arranged in an eccentric manner. The minimum distance between each stage is usually the internal diameter of the pipe.

CALCULATION

Accuracy (referred to the pressure drop): +/- 2% up to 1 1/2"; +/- 1% for 2" and above
Gas Service: multistage calculation is performed to avoid to have sound velocity in the vena contracta section of each stage
Liquid Service: multistage calculation shall be carried out to avoid cavitation



EXAMPLE OF CODIFICATION

