



Critical flow nozzles of the SNZ series (sonic nozzles) can adjust flows of air or gases with a very high stability. Therefore they are extraordinary convenient for calibration of flow meters in volume flow or mass flow, like gas meters, LFEs, mass flow meters for example and other types of flow meters.

- Disc, Screw-In, Plug-In and Flange Nozzles
- Throat Diameters from 10 μm to 100 mm
- Nominal Widths from DN 4 to DN 400
- Connection via Adapter, DIN or Special Connector
- Vacuum or Overpressure Operation
- Short Response Time and High Accuracy
- Very Well Long-Time Stable Because No Moving Parts

Technical Description

The setting of a fixed volume flow results from a physical effect that occurs on critical flow through a restriction or nozzle, respectively:

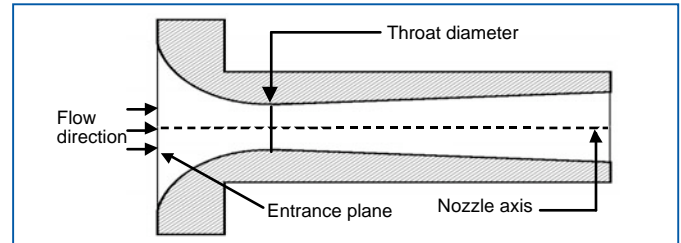
If the absolute inlet pressure in front of the nozzle is at least twice as large as the outlet pressure, the gas is accelerated such strongly that it gains speed of sound at the narrowest point of the nozzle but cannot exceed this velocity. Thus volume flow does not change any more also if the pressure increases. But mass or standard volume flow remains variable because these quantities depend on the gas density, which depends itself on pressure and temperature.

Vacuum operation is preferred for these nozzles because the density of the atmosphere at the inlet side is very constant and perturbations at the outlet side cannot propagate through the restriction.

In order to work correctly a critical flow nozzle has also to satisfy geometrical boundary conditions. Optimal free and undisturbed oncoming flow is given, if "unlimited space properties" prevail at the inlet region of the nozzle: any wall must not be nearer to the axis of the nozzle and the entrance plane than 5 times the throat diameter. But critical flow operation is also possible for inlet diameters with nominal widths of at least 4 times the throat diameter.

Requirements for geometry and other boundary conditions are defined by **standard DIN ISO EN 9300**. The standard SNZ series' nozzles with throat diameters from 0,1 to 100 mm correspond to this standard. Nozzles with a throat diameter smaller than 0,1 mm are manufactured analogous to this standard and satisfy its requirements nevertheless, if possible.

For use as calibration standard SNZ series' nozzles are supplied with DAkkS (Deutsche Akkreditierungsstelle) or factory calibration certificate according to requirements of PTB (Physikalisch-Technische Bundesanstalt).



More information and schematic figures about the nozzle types, mounting options and connections on the next page.

The nozzles are available in two designs: for one-piece nozzles a complete section of the piping, including nozzle, thread(s) and/or flange(s) etc., is machined from bar. Especially if small throat diameters come together with larger nominal widths the more cost-saving two-piece design is the better solution: a standard piping component is, if necessary, machined in a way that a nozzle body can be mounted inside. For this the SNZ series provides disc, screw-in or plug-in nozzles.

With both designs of the SNZ series' nozzles measuring sections can be configured considering a large number of mounting options and connections as well as nominal widths from DN 4 to DN 400. Besides special tube and block adapters for nozzle bodies, equipped with standard metric or inch threads as required, also DIN, KF, ISO-K flanges, as well as Swagelok, AN-Union, VCR and many other special connections are possible. However not all nozzles can be realized with all connections.

Specifications

Flow Rates

Setpoint nom. values: 0,6 l/h to 6000 m^3/h (Air equivalent)

Nominal Widths

Piping nominal width: DN 4 to DN 400

Throat diameter: 10 μm to 100 mm

Accuracy

Fabrication accuracy: $\pm 5\%$ of setpoint value (standard)

Calibration accuracy: $\pm 0,25\%$ o.R. for $Q < 10 \text{ Sm}^3/\text{h}$
(best possible) $\pm 0,12\%$ o.R. for $Q \geq 10 \text{ Sm}^3/\text{h}$

Calibration periods: 5 years for $Q < 2 \text{ Sm}^3/\text{h}$
(best possible) 10 years for $Q \geq 2 \text{ Sm}^3/\text{h}$

Pressure Ranges

Inlet pressure: 1 bar to 7 bar absolute

Temperature Conditions

Operating: 0 .. +50 $^{\circ}\text{C}$

Media Compatibility

Air and gases compatible with stainless steel.

Material

The nozzle bodies are made of stainless steel by default, other materials on request.

Special Features

Calibration Options

Type: Overpressure or vacuum operation calibration

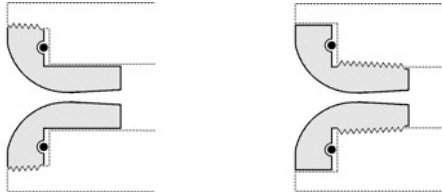
Medium: Air or pure gases

Certificate: DAkkS or factory calibration

Nozzle Types

Screw-In Nozzles

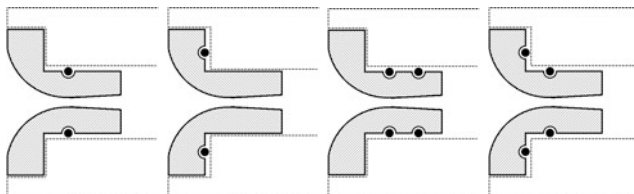
Throat diameter: $\leq 2,5$ mm
 Air flow: ≤ 3600 l/h
 Nominal widths: DN 4 to DN 25
 Sealing: 1 x O-ring
 Mounting: Screw-in into tube or block adapter



Standard metric or inch threads at outer edge or shank are available.

Plug-In Nozzles

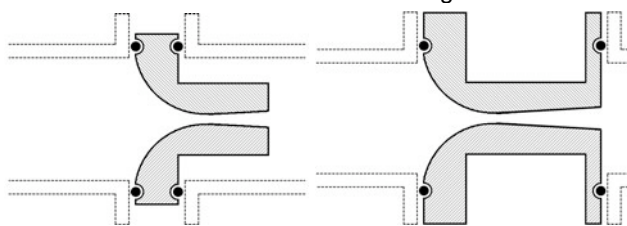
Throat diameter: ≤ 25 mm
 Air flow: ≤ 350 m³/h
 Nominal widths: DN 10 to DN 100
 Sealing: 1 x O-ring or 2 x O-ring
 Mounting: Insertion in tube/block adapter, flange



The two-O-ring design makes it possible to measure the pressure between the O-rings to perform a leak test.

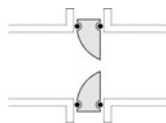
Flange Nozzles

Throat diameter: ≤ 100 mm
 Air flow: ≤ 6000 m³/h
 Nominal widths: DN 25 to DN 400
 Sealing: 1 x O-ring or 2 x O-ring
 Mounting: Between pipe flanges or as intermediate flange



Disc Nozzles

Throat diameter: ≤ 2 mm
 Air flow: ≤ 600 l/h
 Nominal widths: DN 4 to DN 8
 Sealing: Metallic or 2 x O-ring
 Mounting: Replaces a sealing washer



Combination of Nozzle Types and Mounting Options

Nozzles and nozzle measuring sections usually are manufactured customer specific. Therefore it is possible to combine the different nozzle types with the adjoining mounting options and connections. The choice of the connectors depends on maximum pressure and flow range as well. We will gladly assist you in details on this matter.

Mounting Options And Connections

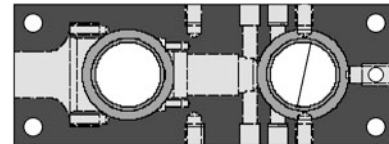
Tube Adapter

Tubes for nozzle bodies in nominal widths from DN 10 to DN 25. O-ring sealed insert. As connections standard metric or inch threads up to G1" are available.



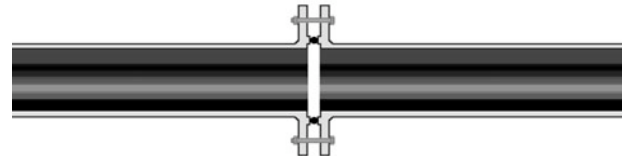
Block Adapter

Block for nozzle bodies in nominal widths from DN 10 to DN 50. O-ring sealed block rows. Individual blocks with adapters for standard metric or inch threads.



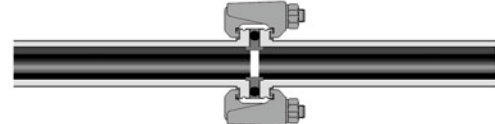
DIN Flange According to DIN 2500 and Following

DIN flanges with clamping screws for nominal widths from DN 25 to DN 400 and for different pressure rates. Sealing: O-ring or flat sealing.



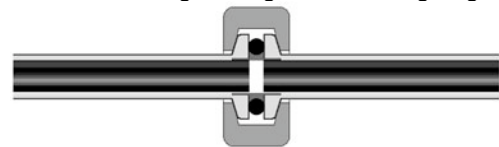
ISO-K Flange According to DIN 28404 and ISO 1609

Clamping flange with claw-clamps for nominal widths from DN 63 to DN 250. Sealing: O-ring between an inner centring ring and an outer supporting ring.



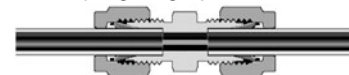
KF Flange According to DIN 28403 and ISO 2861

Small flange with clamping ring for nominal widths from DN 10 to DN 50. Sealing: O-ring on a centring ring.



Swagelok Connection

Screw joint for nominal widths of DN 6 and DN 8. Sealing: 2 conic clamping rings pressed into one another.



AN-Union Connection

Screw joint for nominal widths from DN 4 to DN 8. Sealing: The taper presses the tube into an opposite sleeve of the same shape.



VCR Connection

Screw joint for nominal widths of DN 4 and DN 8. Sealing: Metallic disc in the contact region.

