Laval nozzles

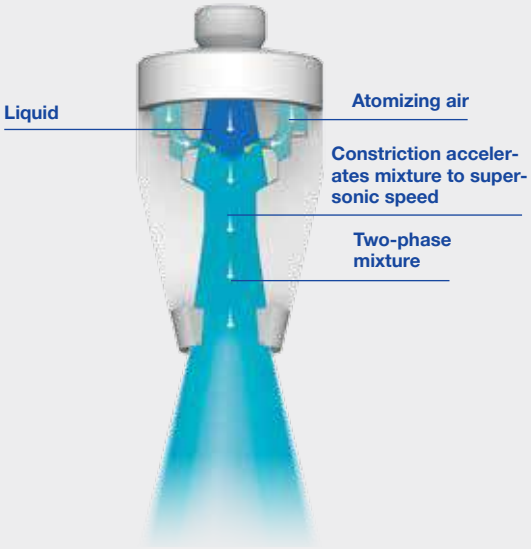
Twin-fluid nozzles for a wide droplet spectrum in special applications

Lechler Laval nozzles atomize liquids as a fine full cone. These twin-fluid nozzles work according to the supersonic principle.

A dual-phase mixture is created from atomizing air and liquid in the mixing chamber inside the nozzle. The shape of the nozzle causes this mixture to be accelerated to supersonic speed, resulting in an extremely fine atomization of the droplets.

By changing the air/liquid ratio, the droplet size and the droplet spectrum can be adapted within a wide range. The large free cross sections of the nozzle also allow atomization of viscous or solids-laden liquids.

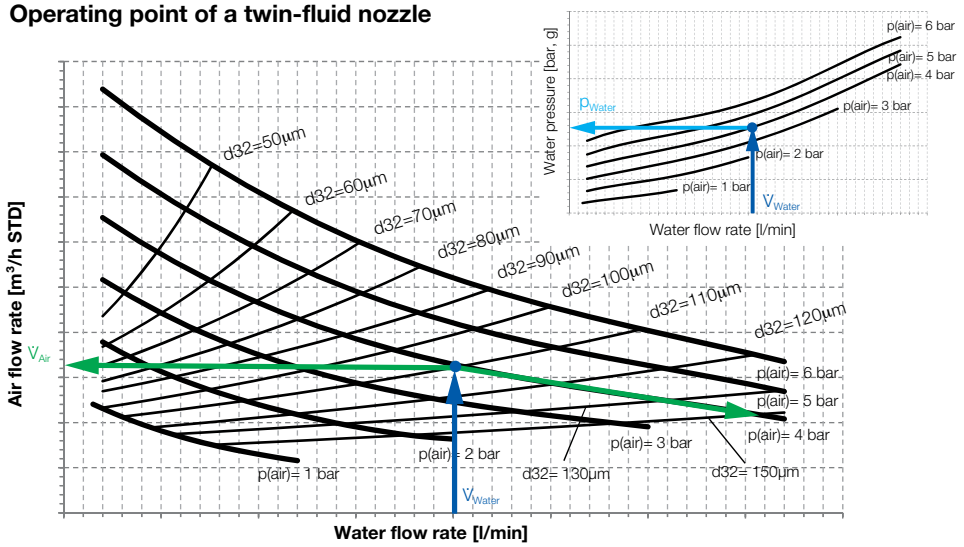
Choosing the right material prevents wear even where abrasive media are present, and enables use at high temperatures.



Scheme of the Laval nozzle

Spray pattern of the Laval nozzle

Operating point of a twin-fluid nozzle



Use:

- Gas cooling in gas-bearing pipes (ducts) and medium-sized and small gas cooling towers
- Injection of solids-laden water
- Introduction of lime water in the desulfurisation process
- Injection of aqueous ammonia or urea solution for the DeNOx process (SNCR/SCR)
- Chemical process engineering (spray dryers etc.).

Properties

Small spray angle (15°), suitable for small cross-sections and horizontal ducts

Adjustment of the droplet spectrum by changing the air/fluid ratio

Clog-resistant thanks to large free cross-sections without internal fittings

Very large turn down ratio of 20:1 (in some cases up to 40:1)

Very fine droplet spectrum

Typical pressure range
Liquid 1-6 bar, g
Atomizing air 1-6 bar, g

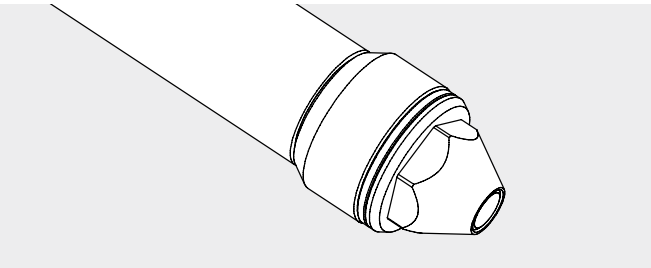
Special twin-fluid nozzles for DeNOx applications

Laval nozzle

In DeNOx applications with SNCR processes, small Laval nozzles are usually used. These nozzles are characterized by a high discharge velocity, enabling the optimum droplet spectrum to be introduced into the reactor with a great penetration depth. Our research has shown that the discharge velocity has a greater effect on the denitrification process. Moreover, these nozzles without internals are extremely insensitive to clogging and can be precisely controlled.

Special properties

- **Small spray angle** (15°), suitable for small cross-sections and horizontal ducts
- **Turn-down ratio** of 20:1 (in some cases up to 40:1)
- **Typical pressure range** Liquid 1-6 bar, g Atomizing air 1-6 bar, g
- **Adjustment of the droplet spectrum** by changing the air/fluid ratio
- **Very fine droplet spectrum**



Spray pattern of a Laval nozzle

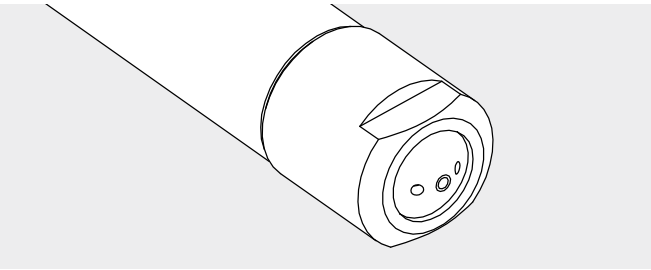
For SCR processes and special SNCR processes there are special nozzles which have been developed to meet the specific requirements. The same principles regarding control and operation apply for all twin-fluid nozzles, irrespectively of the type.

Laval flat fan nozzle

The Lechler Laval flat fan nozzle atomizes according to the principle of internal mixing. The air/fluid mixture exits via three outlet holes creating a wide and flat spray with an even better surface coverage. The droplet spectrum and the pulse of the droplets can be adapted by changing the air/fluid ratio.

Special properties

- **Wide and flat jet,** spray angle 60°
- **Turn-down ratio** of over 10:1
- **Typical pressure range** Liquid 1-5 bar, g Atomizing air 1-5 bar, g
- **Spray alignment possible**
- **Adjustment of the droplet spectrum** by changing the air/fluid ratio



Spray pattern of the flat fan nozzle

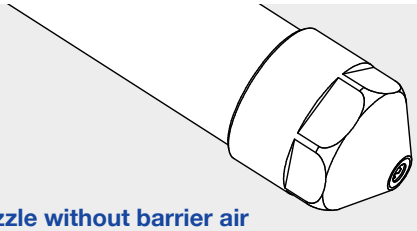
1AW nozzle

The Lechler 1AW nozzle works according to a newly developed and patented atomization principle. It divides the supplied atomizing air into a primary and secondary air flow. Thanks to the specific inflow geometry, the secondary air exits through an annular gap causing a very fine atomization in the edge region of the spray.

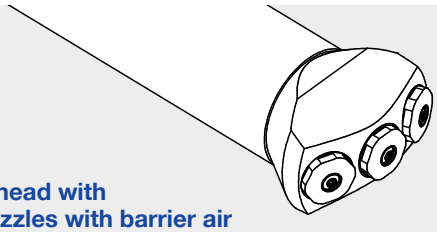
This twin-fluid nozzle enables finest droplet spectra and shortest evaporation distances while also allowing very good controllability of the flow rate. Cluster heads designed specifically for these nozzles multiply the flow rates and adapt the spray pattern to the requirements at the point of injection.

Special properties

- **Spray angle of the individual nozzle** 15° as full cone
- **Particularly fine droplets** thanks to tertiary atomization
- **Turn-down ratio** of 10:1
- **Design** as single or bundle nozzle lances
- **Typical pressure range** Liquid 1-5 bar, g Atomizing air 1-5 bar, g
- **Adjustment of the droplet spectrum** by changing the air/fluid ratio



Single nozzle without barrier air
Spray angle 15°; full cone



Cluster head with three nozzles with barrier air
Spray width approx. 55°, spray depth approx. 15°; flat fan

Spray pattern of the 1AW nozzle