

MAKLAD-INJECTOR

The Patented Innovation (EU-Patent 1034029, US-Patent 6523991)

How the injector works

The steam nozzle accelerates the injection steam up to supersonic velocity and puts it under atmospheric pressure at the nozzle outlet. In this area of low pressure (mixing zone), fluid can be added continuously to the steam, without needing a feed pump. By adding fluid, the steam starts to condense. The steam condensation produces a shockwave front. In the shockwave zone, all the steam condensation and the pressure increase takes place. The steam bubbles implode at a very high speed against the fluid at the shockwave front, with the result of very high homogenisation. The energy produced by the steam condensation heats the fluid.

The final temperature of the exiting fluid is controllable automatically by a steam valve and a temperature sensor at the injector outlet. The effect of the fluid homogenisation is controllable by the steam injection value.

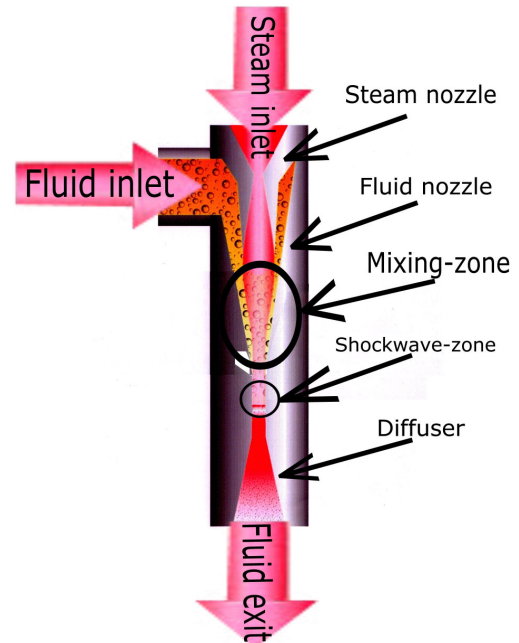
If the back-pressure at the Injektor outlet is higher than the increasing pressure at the shockwave front, the injector needs a feed pump at the fluid-inlet side.

Innovative Aspects

The injector-technology is innovative because it combines several process steps into one single step. There is a big reduction in equipment and production machinery, compared to existing technologies. Furthermore, higher product quality can be achieved. The new injector can also be applied for industrial food production, where conventional equipment has failed.

Principal Advantages

The energy efficiency of the new injector is superior to conventional process technology, because the same amount of steam - used in conventional process equipment for heating only - performs heating, homogenisation, and pressure increase, in one process step. Hence, the costly homogeniser and booster pump become superfluous by the use of the new injector-technology, and equipment costs and associated energy-consumption are saved. (e.g. for the hourly production of 10000 litres of milk, approximately 75 kWh are saved). Moreover, service costs and plant down-time are reduced, compared to conventional homogeniser-technology, since moving and highly-loaded parts are eliminated. An additional advantage of a system with the new Injektor is the drastically reduced plant size.



Injektor's technical data:

Steam: any quality and any pressure, $m_{\text{steam}}/m_{\text{fluid}}$: up to 30%.

Fluid: any fluid with viscosity, up to 10000 cP; solids content more than 50%, any inlet temperature.

Maximum final fluid-temperature at the exit: approx. 10°C below the steam injection temperature.

Fluid-temperature increase from input to output in one step: up to 130°C.

- The injector is capable of all temperature ranges from pasteurization (72°C) up to sterilization (150°C).
- The Injektor's capacity ranges from experimental size (200 l/h), up to production size (50000 l/h).
- It is hygienically designed and can be CIP-cleaned.
- Injector-material: Stainless-Steel and Teflon-Coating.
- It works very quietly, without vibrations.
- The accuracy of temperature control is $\pm 1^\circ\text{C}$.
- The product-quality stays at the same level during the production, without burning.
- The cleaning-periods are reduced by up to a Factor 10, compared to conventional systems;
- The working-periods without cleaning are exceeded by up to a Factor 10.