Helmut Kämpken GmbH

Operating manual
for
Steam Injectors / Mixing Nozzles
1. Product Description

1.1 Prescribed use

Steam Heaters
Steam Injectors are often used to heat water or other liquid media in the production cycle. These Steam Heaters usually work in closed circuits, in tanks and other pipelines. Heating processes can find place in only one step or in closed circuits with a defined Start- and Final Temperature.

Pipeline mounting
Steam Injectors can be mounted in pipelines with looses or fixed flanges according to DIN or ANSI-Standards.

Mounting inside of a vessel
Kaempken Steam Injectors also can be installed below liquid/water level to directly heat water or other water compatible liquid media inside containers, vessels or tanks. The steam will be quietly induced into the liquid and completely condensed. The suction effect of the injector causes a medium flow inside the vessel and this causes a uniform temperature inside the container.
**Hotwaterstation**
A one time passing waterflow with a large $\Delta t$ can be heated with these stations. To receive an even steam pressure admission several steam injectors are arranged in series and are controlled by a thermostatic control valve.

**Range of application of Steam Injectors / Mixing Nozzles**
- Heating of liquid media by means of steam
- Recooling of superheated steam
- Mixing of different media
- Heating of Suspensions and Emulsions
- Heating of pulp for paper industries
- Feeding of gases (CO$_2$)

**1.2 Structure**
Kaempken steam heaters accomplish the requirements of silently feeding steam into the medium yet achieving maximum heat transmission.

The medium is hereby accelerated in a venturipipe. A cone shaped counterpiece forms an annular slot between cone and the outside of the nozzle's diameter.

Steam is tangentially fed into the outer jacket of the housing and is able to escape through the annular slot. In doing so the circular steam ray/annular jet covers the to be heated medium and condenses the same.

The injectors are particularly advantageous because of their mounting size and thus they can be installed inside any vessel, tank or container.

The Injectors for pipeline mounting are fitted with loose or fixed flanges in DIN or ANSI standard.

They are manufactured in the sizes DN 15 (¹/₂") until DN 300 (12") on the water side.

The standard execution is PN 16 (until DN 150 or 6") or PN 10 = 150# (from DN 200, 8" till DN 300, 12"). Higher pressure groups like PN 40 or 300# are also available.

The injectors for vessel mounting are fitted with a steam flange or pipe thread.

RKE 50/25 in clamping execution for pipeline mounting
RFF 80/40 with fixed flanges for pipeline mounting
IGE 65/25 with threaded standpipe for vessel mounting
1.3 Description of functions

**Steam Injectors / Mixing Nozzles**

The medium to be heated is accelerated in a venturi nozzle. A tapered counterpiece is of such embodiment that an annular slot is formed between the cone and the outer nozzle diameter.

The steam is fed tangentially into the outer jacket of the housing and escapes through the annular slot. At the stage an annular jet covers the product and condenses the same. The condensation still finds place in the steam injector and not in the following pipeline. The steam quantity can be controlled from 0 - 100%, because the injector is able to suck in also a very small quantity of steam.

On the waterside the control range is restricted.

A velocity of 0,8 - max. 3,0 m/sec is necessary.

We propose to choose the size of the steam injectors in that way that the velocity is 1,5 m/sec.

**Recooling of superheated steam**

In case of cooling superheated steam, the steam flows through the venturi nozzle and the water will be fed by the tangential standpipe.

By a temperature control unit the water quantity can be controlled exactly.
1.4 Technical specifications

Main measurements Steam injectors/Mixing nozzles

Mounting in a pipeline

Execution for fixing between flanges

DN 1: 25 - 50

RKE = pipeline mounting, clamped execution only
RFF = pipeline mounting, fixed flanges
RLF = pipeline mounting, loose flanges

on request execution in reflected image arrangement

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<tr>
<th>DN 1(ASA)</th>
<th>25(1&quot;)</th>
<th>40(1 1/2&quot;)</th>
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<td>102(92,1)</td>
<td>165(177,8)</td>
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<td>220(228,6)</td>
<td>250(254)</td>
<td>285(279,4)</td>
<td>340(342,9)</td>
<td>395(406,4)</td>
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<td>Steam throughput with 85 p.s.i. (kg/h)</td>
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Mounting inside of a vessel

Proposal for the assembly

Flange DN 80, PN 16

IGE = inside mounting, steam connection with threaded tube
IFF = inside mounting, steam connection with fixed flanges
ILF = inside mounting, steam connection with loose flanges

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**Data, concerning the capacity of steam injectors**

**control range 0 – 100 %**

**Determination of the steam quantity:**

\[ G_{\text{steam}} = \frac{Q \times \Delta t}{500} \]

\[ G = \text{steam quantity kg/h} \]
\[ Q = \text{quantity of water to be heated up in liters} \]
\[ \Delta t = \text{Temperature difference °C} \]
\[ \text{water inlet/outlet} \]

**Consultation of the throughput curves for steam**

**Example:**

It is intended to determine the size of a steam injector for a steam throughput of 1500 kg/h for a hot steam overpressure of 4.3 bars and a counterpressure of 2.8 bars, required for the system.

Trace down vertically from that point where the curve for the operating pressure intersects the horizontal pressure head line. It can be seen that this quantity of steam is fed by an injector DN 150/65. Dots beneath the critical pressure ratio bring about the maximum output of the injector with the operating pressure.

In our example: For a counterpressure of 1.9 bars = 2.400 kg/h.

**Dimensioning of the steam injector**

The flow speed on the water side shall not fall below 1.3 m/second.

The temperature rise for the maximum quantity is 18 °C, for each circulation.

Some quantity of water with largest \( \Delta t \) which will circulate only once will be heated up by a hot water station. The steam injectors are switched in series. They comprise a thermostat for charging the injectors uniformly.

**Material**

- stainless steel
- nickel alloys
- PTFE
- special-coating
2 EC Declaration of conformity

in accordance with EG-Directive 97/23/EG from May 29, 1997

The manufacturer: Helmut Kämpken GmbH
Kupferfeld 7
D-53819 Neunkirchen-Seelscheid

hereby declares that the products described below

Steam injection nozzles models:
- RKE, RFF, RLF, IGE, ILF, IFF
- Nominal bore from DN 15(½") to DN 300 (12")
- Design Pressure PN 16 (up to DN 150, 6")
- Design Pressure PN 10 (from DN 200, 8")

complies with the health and safety protection requirements of the following EC directives:
EG-Directive 97/23/EG from May 29, 1997
- Category I
- Modul A, A1

Harmonised standards used:

National standards and technical specifications used:
AD 2000, AD-HP 0, AD-B, AD-W AD-code of practice

This declaration of conformity is void if changes are made to the construction of the machine which affect the technical specifications and prescribed use as indicated in the operator's manual, i.e. which essentially change the machine!

Neunkirchen-Seelscheid, January 01, 2001 (Signature)
Marcel Fischer, General Manager
3 General safety instructions

3.1 Operator’s duty of care

Steam Injectors / Mixing Nozzles were designed and built on the basis of a risk analysis and under consideration of all relevant harmonised standards as well as further national standards and technical specifications. The machine thus conforms to the current level of technology and guarantees the highest possible degree of safety.

This level of safety can only be achieved in practice if all necessary measures are observed in dealing with the machine. It is therefore part of the duty of care of the machine’s operator to plan these measures and check that they are executed correctly.

In particular the operator must ensure that

- the components are used only as prescribed (cf. chapter "Product description")
- the components are not be used with a higher pressure than the design pressure. We propose to use pressure relief valves.
- the components are not to be used with a higher temperature than the design temperature. The temperature should be controlled constantly by the operator. If it is possible that persons could be in contact with the heated water or penetrating steam we propose to install safety temperature control valves.
- the components are only used with the defined fluids.
- the flow direction is in compliance with the stipulated flow direction which is marked on the housing
- the tightness of the components will be controlled at regular intervals especially if very corrosive or abrasive media will be used.
- occurring vibrations or oscillations, caused by unfavourable operating conditions, will be eliminated by the use of compensator pipes or tubes.
- the components are operated only in a fault-free, operational condition and in particular the safety devices are regularly checked to ensure that they function as stipulated
- the components are not exposed to excessive loads (forces and moments from the pipeline). According to the installation conditions the distance of the supports and the flexibility of the pipeline should be calculated.
- the flange connections are located at a clearly visible place and within easy reach.
- connecting pipelines are fitted with the correct counterflanges with the same nominal
bore and pressure group. All Screws/Nuts and Gaskets must be mounted.

- **supports** are calculated adequate

- there are no unforeseen **additional forces**

- a safely pressure **draining off** is possible and will be proceeded. During the production it is prohibited to loosen any bolted connection.

- the **surface** of the components is insulated to invoid any contact with hot parts.

- any necessary **protective equipment** or apparel for the operating, maintenance and repair personnel is available and is used

- the **operating manual** is always legible and is available in full at the machine's location

- the machine is operated, maintained and repaired only by sufficiently qualified and authorised **personnel**

- these personnel are regularly instructed in all matters relating to occupational safety and environmental protection and are familiar with the operating manual and in particular the **safety instructions** it contains

- all **safety instructions and warnings** on the machine are visible and legible and are not removed.
3.2 Explanation of the safety symbols used

The safety symbols together with accompanying text must warn of residual dangers which cannot be avoided when using the machine. These residual dangers relate to:
- persons
- the machine
- other property and objects
- the environment.

The present operating manual contains the following safety symbols.

These symbols indicate above all danger to the life and health of persons, but danger to the machine, property or the environment is also possible.

![Attention ! Hot surface](image1)

![Attention ! Hot Liquids and steam](image2)

![Use Eye - Protection](image3)

![Irritant](image4)
3.3 Basic safety measures

Keeping information available:

This operating manual must be kept near the machine. It must be ensured that all persons who have to perform activities on the machine can consult the operating manual at any time. In addition to the operating manual, job control statements within the meaning of the Health and Safety at Work Act and the regulation governing the use of tools and equipment must also be provided.

All labels on the machine which display safety and operating instructions must always be kept legible. Worn or damaged labels must be replaced immediately.

Before starting:

Familiarise yourself sufficiently with
- the machine's operating and control elements
- the machine's fittings
- how the machine works
- the immediate environment of the machine

Installation

- During the installation all steam and water piping must be closed with the help of shut-off valves (Danger of burning)

Attention! Hot Liquids and steam

Use Eye - Protection
Before every starting the following procedures have to be carried out:
- The tightness of the installation has to be controlled during the start-up
- The valves of the water should be opened before the steam valve
- Check to make sure that all safety devices are fitted and functioning.
- Check the machine for visible damage; any defects found must be corrected immediately or reported to the supervisor - the machine may only be operated if it is free of faults.
- Make sure that only authorised persons remain within the operating area of the machine and that no other persons are endangered when the machine is started up.

**In normal operation:**

While the machine is in operation, no safety devices may be removed or deactivated.

The operating personnel must make sure that no unauthorised persons remain within the operating area of the machine.

At least once a week, the following checking activities must be performed:
- The tightness of the installation has to be controlled
- The function of safety devices has to be controlled
- The injector must be controlled relating to defects
Changes to the machine:

For safety reasons, no unauthorised changes may be made to the machine - this also applies to welding work on bearing parts.

All planned changes must be authorised in writing by the company Helmut Kämpken GmbH. If any changes or repairs will be done by unauthorized personnel all warranties are invalid.

Parts and special fittings which were not supplied by us are also not approved by us for use in/on the machine.

3.4 Requirements of operating personnel

The machine may only be operated by persons who have been specially trained, briefed and authorised. These persons must be familiar with the operating manual and act in accordance with it. The respective areas of authority of the operating personnel must be clearly defined.

All control and safety devices must be operated only by persons who have been suitably instructed.
4. Special types of danger

Thermal danger:

When working on Steam Injectors there is a risk of
- burning through contact with steam and hot product

Attention ! Hot Liquids and steam

- burning through contact with hot surfaces

Attention ! Hot surface
Danger from processing materials and other substances:

While the machine is running, dangerous waste gases, steam, dust, vapours, liquids, ... can escape. Adequate ventilation or filtering must therefore be guaranteed.

As a special protective device against the chemicals used, a rinsing facility for the eyes must be installed.

When working on Steam Injectors there is a risk of
- having contact with irritant or aggressive product

![Image showing a cross with the word "Irritant" below it.]

Danger from noise:

The continuous sound pressure level at the workplaces of the operating personnel is ....... 70 - 85 dB(A).

Depending on the local conditions, higher sound pressure levels can occur, which can cause deafness, loss of balance or diminished alertness. In this case the operating personnel must be provided with adequate personal protective equipment.

Remember that while the machine is running voice communication and acoustic signals, e.g. hooting of vehicles, are impaired.

Observe the noise provisions in the job control statement for your workplace and use the personal protective equipment prescribed.

![Image showing ear protection with the text "Use Ear - Protection".]
5. Transport

Watch out for the following special dangers when transporting the machine:

- Protruding sharp edges can cause cuts.

- Suspended loads can fall, thus endangering lives. Never stand under suspended loads!

- Use only the original packaging.

- Read the chapter "General safety instructions".

- The surfaces of the Injectors always have to be covered with suitable caps.
6. Setting up the machine

When setting up the Steam Injectors, you must observe the following safety instructions in order to avoid lethal injury, damage to the machine and other material damage.

- The steps involved in setting up the machine - assembly and installation - may only be carried out by qualified persons taking into account the safety instructions.
- Before you begin setting up the machine, it must be checked for any damages incurred during transport.
- Shut-Off Valves of water and steam must be closed
- The pipelines have to be discharged and the flanges must be closed with the help of gaskets.
- The Injector has to be installed in a correct flow path and with the required sealings.
- Any installation position of the injector can be chosen.
- We propose to install the injectors with zinc-coated screws. Using stainless steel screws can lead to grinding of the material.
- We propose the installation of a non-return valve behind the steam valve.
- All steam pipelines should be insulated to avoid contact with the hot pipeline.
- Read also the chapter "General safety instructions".

![Diagram of steam and water flow](image-url)
7. Putting the machine into operation

When putting the machine into operation, you must observe the following safety instructions in order to avoid lethal injury, damage to the machine and other material damage.

The machine may only be put into operation by qualified persons taking into account the safety instructions.

- Make sure that only authorised persons remain in the machine’s operating area and that no other persons are endangered when the machine is put into operation.

- Before starting the machine for the first time, make sure that all tools and foreign parts have been removed from the machine.

- Read the chapter "General safety instructions".
- Generally we propose:
  - Shut - Off Valves of water and steam must be closed
  - The tightness of the installation has to be controlled during the start-up
  - The valves of the water should be opened before the steam valve
8. Operating the machine

The Operating of steam Injectors will normally be performed by the central control room of the company so that specific operation instructions of the complete installation have to be observed.

When operating the machine, you must observe the following safety instructions in order to avoid lethal injury, damage to the machine and other material damage.

- The machine may only be used as prescribed.

- Before starting the machine, check the tightness of the installation.

- Read the chapter "General safety instructions".

Watch out for the following special dangers while operating and during normal running of the machine:

- Using the machine for applications other than those for which it is intended can cause lethal injuries to persons and damage to the machine.

- Negligent use of the personal protective equipment can lead to severe bodily injuries.

- Incorrect behaviour in the event of a malfunction can lead to serious personal and material damage. You must therefore familiarise yourself with the provisions for cases of malfunction.
9. Supplementary informations

Do you have any questions or requests? We will be glad to help you.

Our company address is:

Helmut Kämpken GmbH
Kupferfeld 7
D-53819 Neunkirchen-Seelscheid
Germany

You can reach our central customer service department under
Tel.: +49 (0)2247 / 6534
Fax: +49 (0)2247 / 74241

Here you can also get help in finding the right specialist to answer your question.

For questions on Steam Injectors / Mixing Nozzles you will get the best help from
Mr. Fischer or Mr. Baumgarten
Tel.: +49 (0)2247 / 6534
Fax: +49 (0)2247 / 74241
E-mail: fischer@kaempken.de
You can also visit our homepage:
http://www.kaempken.de

Here you will find current informations concerning Steam Injectors / Mixing Nozzles