Körtting
steam jet compressors

Steam jet steam compressors for process engineering applications
Steam jet compressors

Steam jet compressors are part of many process engineering applications. Using them reduces the energy consumption of the process and cuts the machinery’s operational costs sustainably. Also known as thermocompressors or vapour compressors, steam jet compressors compress steam flows in various processes in a simple way.

How they work

As steam jet compressors are part of the jet ejector group, they don’t require any mechanical drives. In order to achieve a pumping action, they use the energy from steam at a high level of pressure as the drive medium.

This steam is released in a motive nozzle to bring it up to the maximum speed. The pressure drops at the outlet of the nozzle so that the steam to be compressed can be drawn in. Both flows are combined in the downstream mixing section. When the two flows are mixed, some of the motive flow’s kinetic energy is partly transferred to the suction flow. The mixed flow is then slowed down in the subsequent diffusor and an increase in pressure occurs at the same time. This steam mixture is used in the process downstream at the higher pressure level.
Advantages

Körting steam jet compressors offer a whole range of benefits:

- low steam consumption
- long service lives
- the motive steam flow can be controlled by valve or nozzle needle
- there are no movable parts in contrast to mechanical compressors
- little maintenance is required
- exceptional reliability
- quick to adapt to new operating conditions
- high-quality manufacturing based on global design codes (i.e. AD 2000, EN 13445, Manufacture Licence ML (China), TR (Russia) or ASME (USA) and others)
Precise design

In order to ensure consistent and reliable operation, a steam jet compressor needs to be designed for the entire area the machinery operates in. Körting Hannover AG’s research and development department has been carrying out measurements on special test rigs for many decades. The measurements taken are then incorporated in the in-house database. These figures are the basis for designing dependable and energy-efficient steam jet compressors. These results are combined with CFD (computational fluid dynamic) calculations. This allows us, for example, to optimise flow areas. By meticulously capturing and analysing characteristic curves during the testing process and carrying out CFD calculations, Körting leads the market on steam jet compressors across the world.

Design and operating point of a steam jet compressor

<table>
<thead>
<tr>
<th></th>
<th>( p_s )</th>
<th>( p_{tr} )</th>
<th>( t_{tr} )</th>
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\( \dot{m}_s \) suction flow
\( p_s \) suction pressure
\( t_s \) suction flow temperature
\( p_{tr} \) motive pressure
\( t_{tr} \) motive flow temperature
\( \dot{m}_{tr} \) motive flow
\( p_d \) discharge pressure

![Graph showing the design and operating point of a steam jet compressor](image-url)
Excellent flexibility when modifying machinery

Most items of equipment, such as evaporators for the food industry, are operated for decades. Should machinery be modified or operating conditions change, Körting steam jet compressors can often be adapted to suit the new situation. This cuts the investment costs of the conversion and ensures production can continue efficiently.

Control capability

The way steam jet compressors operate can be influenced by changing the motive steam flow. This can be effected in two ways:

Control valve

A standard control valve can be inserted in the motive steam pipe. This valve changes the steam flow that’s fed to the steam jet compressor. If the motive steam flow is decreased, lower motive pressure is generated in front of the motive nozzle. In the process, the pressure to accelerate the steam in the motive nozzle drops the more the motive steam flow is reduced. As a result, the control range is limited. By comparison, control via a nozzle needle delivers better results and lower energy consumption in part-load operation.

Nozzle needle control

A nozzle needle, driven by an actuator, changes the diameter of the motive nozzle and therefore the motive steam flow. In contrast to the control valve in the motive steam pipe, using a nozzle needle ensures consistent motive steam pressure. Therefore, particularly in the lower part-load range, this means much lower energy consumption.

The controllable version is used particularly frequently in the pulp and paper industry. You can find more information about this application in the Körting brochure Thermocompressors for the paper industry.
Multi-jet steam compressors

Multi-jet steam compressors are used in evaporators for the food industry in particular. Their more compact design cuts down on weight and space requirements. Single and multi-jet steam compressors are equally as efficient in a broad range of applications. The motive steam consumption of the multi-jet version is only lower in a few occasional exceptions.

Materials

Steam jet compressors can be made in the following materials:

- cast iron
- carbon steel
- stainless steel
- Special materials (Titanium, HASTELLOY® etc.)
Applications

Thanks to their exceptional design, steam jet compressors are used in many areas of process engineering.

Food industry

Steam jet compressors are used to save live steam in evaporators that concentrate food (e.g. for dairy products, fruit juices, coffee, sugar cane and sugar beet juice). Multi-stage falling film evaporators are the most widely used type of evaporator in this area. They concentrate the product gently in the vacuum even at low temperatures. The result is a high-quality, flawless product.
Chemical industry

In the chemical industry, machinery to produce lyes (e.g. caustic soda), acids (e.g. citric acid), saline solutions, alcohols, synthetic glues and natural organic products are areas where steam jet compressors are used. They can still suction off column overhead steam and pump back the mixed flow for heating in the column.

Low-pressure steam supply networks

Used as heat pumps, steam jet compressors can compress low-pressure steam so that its pressure increases. This higher pressure steam can be fed into a central steam network or used again in other processes. They can be used in similar ways in virtually all areas of industry where steam is required in large quantities (e.g. in the paper industry).

Paper industry

In the pulp and paper industry, steam jet compressors are called thermo-compressors. In paper machinery, they ensure drainage of the drying cylinders in paper-machine drying units or compress low-pressure steam for use in steam supply networks. With nozzle needle control, they react flexibly to different operating parameters and also significantly cut running costs.
Seawater evaporator

When desalinating seawater in evaporators (MED), Körting steam jet compressors recompress steam to heat an evaporator stage.
Steam jet chilling plants

To cool the refrigerant water, steam jet compressors are used in special chilling plants. For more information on the Körting steam jet chilling plants see the separate brochure and www.koerting.de

Crystallisation plants

Steam jet compressors are used for concentrating liquids in crystallisation plants that simultaneously cool and thicken the solution.

You can find detailed information on all applications and practical questionnaires to fill in to obtain a quote quickly at www.koerting.de