EJECTORS

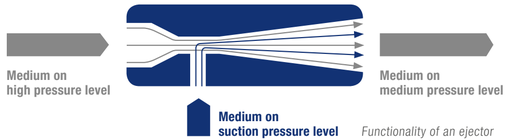
INCREASED EFFICIENCY AT A HIGH LEVEL

Ejectors can increase plant efficiency. They are a kind of jet pump and work according to the Venturi principle: here the propellant mass flow enters the mixing chamber on the high pressure side through a jet and generates a vacuum at the suction port. This is then used to transport a gaseous or liquid medium from the suction pressure level to the medium pressure level. The work done in this process can be used in different ways:

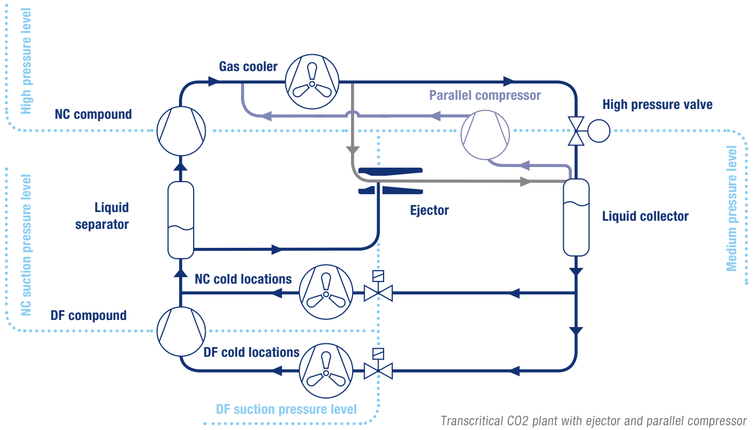
Gas ejectors pre-compress the suction gas by transporting it from the suction pressure level to the (higher) medium pressure level. The pre-compressed gas is transported to the high pressure level by means of a second compressing stage (parallel compressor). The parallel compressor works more efficiently than a refrigerator compressor because it has a lower pressure difference to overcome.

Liquid ejectors enable the partially flooded operation of cold locations that leads to increased performance of the cold location evaporator. This increased performance means that the suction pressure level can be raised (~3% higher efficiency per K increase). The task of the liquid ejector is to transport the liquid that is generated in the suction gas in this operating mode back to the medium pressure container.

With the HCO_2-G4, plant concepts can be realised with both stepped and continuous ejectors for transporting gas and liquid.



Functionality of an ejector



Transcritical CO2 plant with ejector and parallel compressor

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EFFICIENT PROCESS CONTROLLING OF CO_2 PLANTS

FRIGOLINK HCO_2-G4

WURM SYSTEME

PERFECTLY EQUIPPED

FOR THE CHALLENGES WITH CO_2

Natural refrigerants are becoming increasingly significant as a replacement for F-gases, which are harmful to the ozone layer and the climate. One of these is R744 (CO_2), which has become a firmly established "green" solution on the market on account of technological progress and optimisations in recent years. Today, transcritical CO_2 plants are an efficient alternative to F-gas plants in both economic and ecological terms.

As a company, we bear a special responsibility for our environment and the climate. We started with the control of transcritical CO_2 plants as far back as 2006. Since then, we have continuously monitored and driven on the technological development of transcritical CO_2 technology. This also, of course, applies to current themes such as ejectors and integral systems. So far, well over 1,500 transcritical CO_2 plants have been equipped with Wurm control systems.

The sum of all these experiences has been incorporated into the development of the new HCO_2-G4 in order to provide a comprehensive solution for the efficient control of transcritical CO_2 plants.

The HCO_2-G4 is a highly scalable system and can be tailored to your requirements. Whether it is parallel compression, ejectors, heat recovery or air-conditioning operations, the HCO_2-G4 can always provide a fitting solution to all these tasks.

THE HCO_2-G4

BASIC AND ADDITIONAL FUNCTIONS AT A GLANCE

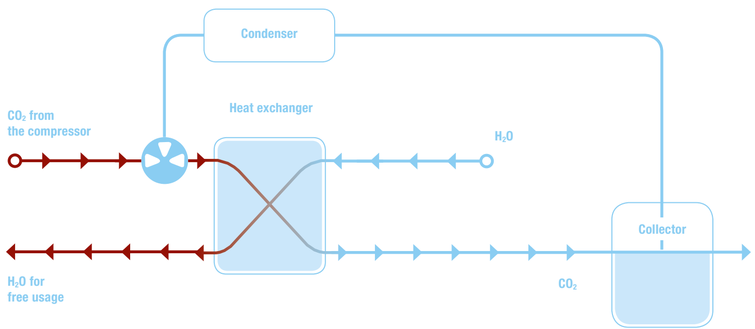
High pressure, medium pressure	○ Process control depending on optimum plant efficiency ○ Automatic rerouting to provide maximum refrigerating capacity for peak load operation ○ Operation of redundant vents ○ Vent calibration according to operating time (step losses)
Gas cooler fan	○ Constant control via 0..10 V or modbus ○ Cleaning function via rotation reversal of the fans ○ Spraying system / supplementary cooling ○ Partial area deactivation in HR and winter operation
Parallel compression	○ Control and monitoring of up to 2 compressors ○ Monitoring of pressure and suction gas ○ Parameterisable load shedding for FI and compressor stages
Ejectors	○ Control of up to 3 liquid ejectors ○ Control of up to 7 gas ejectors ○ Stepped or continuous activation (or a combination of both)
Heat recovery	○ 7-step sequence for the needs-based recovery for 2 HR registers ○ Stepped or continuous pump control ○ Optional heat-up mode
Heat volume calculation	○ Integrated calculation of heat volume recovered via HR ○ Analysis and evaluation of the HR systems by FRIGODATA ONLINE using a scoring method taking into account heat volumes, requirements and malfunctions
Heat generation	○ Control of a heat pump evaporator integrated into the gas cooler ○ Control of up to two external heat pump evaporators ○ Decoupling of refrigerator or freezer compressors via the CAN bus with stepped or continuous control
Air conditioning	○ Air-conditioning operation at medium-pressure level via thermosyphon or high-pressure expansion ○ Air-conditioning system with external cold locations (release) ○ Activation via external demand and/or TU and TA ○ Integrated overload protection for the refrigeration compound ○ Combinable with parallel compression and HR operation
Protection mode, commissioning	○ Parameterisable protection mode for blocking individual functions for service and maintenance and in case of malfunction ○ Time-controlled commissioning mode with target values for high-pressure, medium-pressure and gas cooler control
Peripheral functions	○ Collector filling level control ○ Desuperheating freezer pressure stage, after-injection ○ Oil feedback

HEAT MANAGEMENT

7 STEPS TO THE PERFECT HEAT VOLUME

Heat recovery
The HCO_2-G4 makes an HR solution available that is flexibly adjustable to demands. For example, two complete units can be controlled that generate heat for heating water and heated process water at the same time. The 7-step heat recovery sequence enables needs-based heat recovery. The sequence starts with the recovery of the desuperheating heat. The recovered heat is successively increased by means of increasing pressure and activating a gas cooler bypass until finally the entire waste heat of the refrigeration plant stays in the system and is no longer discharged into the environment. If further heat is required, more heat sources can be resorted to as an option and can, if necessary, be controlled using the HCO_2-G4. The recovered heat makes a significant contribution to energy efficiency.

Heat volume calculation
A heat volume meter is integrated into the HCO_2-G4 that requires no additional sensors. Only the information already available in the control system is required. In combination with our web platform, FRIGODATA ONLINE, the heat recovery is analysed and evaluated using a scoring method. Taking heat volumes, demands, operating times and malfunctions into consideration, the HR function is made transparent and makes fast error analysis possible if required.



Operation of the heat recovery