Better performance and efficiency from chillers

Advantages and functions of an open flash economizer

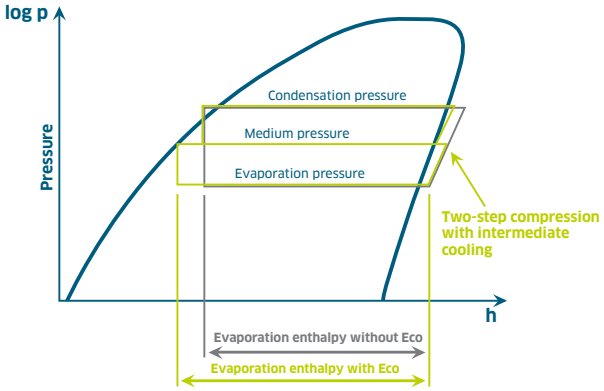
An open flash economizer can be used for both water-cooled and air-cooled compact machines, and also for split cooling systems. To optimise the cooling output, ENGIE Refrigeration equips all QUANTUM and QUANTUM-G models, as well as the SPECTRUM chiller, with open flash economizers.

Effect	Benefits for customer	Explanation
INCREASED COOLING OUTPUT	• Lower investment costs per kilowatt of cooling output (€/kW)	• Thermodynamic optimisation of the one-step cooling circuit through the integration of a mean pressure level with flash gas extraction, resulting in higher specific evaporation enthalpy
SMALL INSTALLATION AREA	• Higher cooling output per m^2 of installation area	• The optimum integration of the open flash economizer means that the installation dimensions of the chiller remain the same
INCREASE IN ENERGY EFFICIENCY (EER value increases by up to 20%)	• Lower operating costs at full load	• Less technical work is required for the two-step compression process in comparison with the one-step compression process
HIGHER ESEER VALUE	• Lower operating costs at partial load	• The benefits of the economizer affect all operating points
OPTIMUM OPERATING BEHAVIOUR AT ALL LOAD LEVELS	• Maximum possible efficiency gain under all operating conditions guaranteed (e.g. changing cooling and heating media temperatures) • Maximum possible efficiency gain with partial load guaranteed	• Open flash economizer is inherently the thermodynamically optimum solution • Flash gas in saturation state; extraction without superheating • No efficiency-lowering suction gas superheating, with superheating control required

Increased cooling output

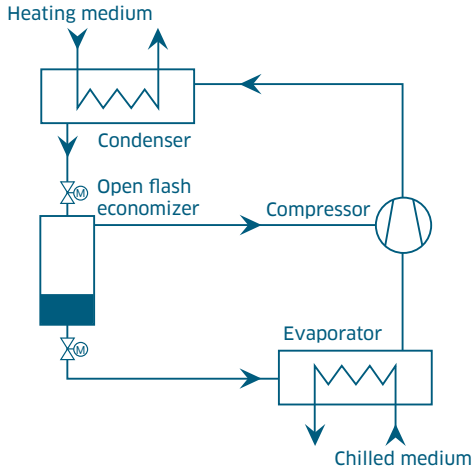
Cooling process in log p h diagram with open flash economizer (Eco) (green) and without economizer (grey). The higher evaporation enthalpy causes an increase in the cooling output. The size of this increase depends on the evaporation and condensation temperatures, and on the relationship between the condensation pressure and the evaporation pressure.

In general: the higher the pressure ratio, the higher the proportional gain in output and efficiency.



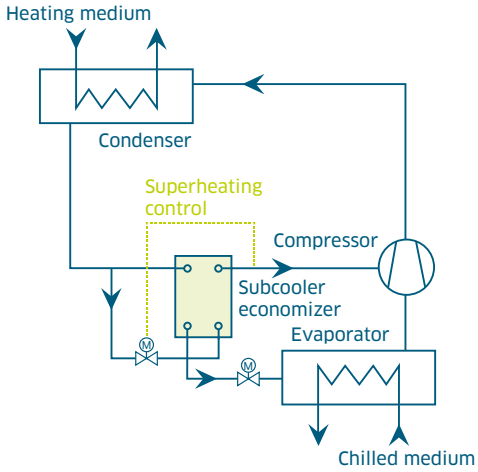
Comparison between open flash economizer and sub-cooling economizer

Cooling process with open flash economizer



An **open flash economizer** is an empty vessel without any heat exchanging devices through which a refrigerant flows. In the process, the refrigerant from the condenser is regulated by an expansion valve and flows into the open flash economizer. This creates flash gas and the liquid refrigerant. Both phases occur in the saturation state, which is achieved automatically at all operating conditions. The liquid refrigerant flows into the evaporator and evaporates at increased evaporation enthalpy. The flash gas is extracted via the mean pressure connection of the compressor and is compressed to the condensation pressure again. No additional control unit is required as the open flash economizer always operates optimally.

Cooling process with sub-cooling economizer and superheating control



The **principle of the sub-cooler** is that the refrigerant flow from the condenser is divided before it enters the heat exchanger. A partial mass flow is regulated and evaporated in the heat exchanger on the secondary side, whereby the main refrigerant flow is sub-cooled on the primary side. The problem here is:

- A heat exchanger continually experiences exchange and pressure losses
- The evaporating refrigerant must be expelled in a superheated state to avoid introducing liquid into the compressor
- Exchange losses and superheating reduce the potential efficiency gains
- Every deviation from fixed setpoints (e.g. due to fluctuating heating and cooling media temperatures or at part loads) reduces the effectiveness

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