experience meets innovation

Ammonia Absorption Refrigeration

BL thermodynamics

bl-thermo.com

Ammonia Absorption Refrigeration

Ammonia Absorption Refrigeration Plants (AARP) are heat driven refrigeration systems for industrial purpose. In other words, with **AARP** you can turn heat into cold.

Working data of our **AARP**

Refrigeration temperature range:	0°C to -60°C
Capacity range :	200 kW to several MW
Heat sources temperature (required):	higher than 80°C
Coefficient of performance (COP):	25% to 60%

Available plant formats

Ready to connect - Turnkey single skid module:	200kW to 800kW
Multi-skid modules to be connected on-site:	800 kW to 3000 kW
Loose components for on-site assembly:	3 MW and more..

Advantages of **AARP**

- The use of heat to satisfy cooling needs leads to substantial reductions of energy costs
- Higher reliability and lower noise and vibration level than conventional compression systems
- Ammonia is a natural refrigerant which does not harm the ozone layer nor accelerates the greenhouse effect

Wide range of applications

- food production and storage
- freeze-drying applications
- chemical industry
- general waste heat or cogeneration(CHP/CCHP) applications

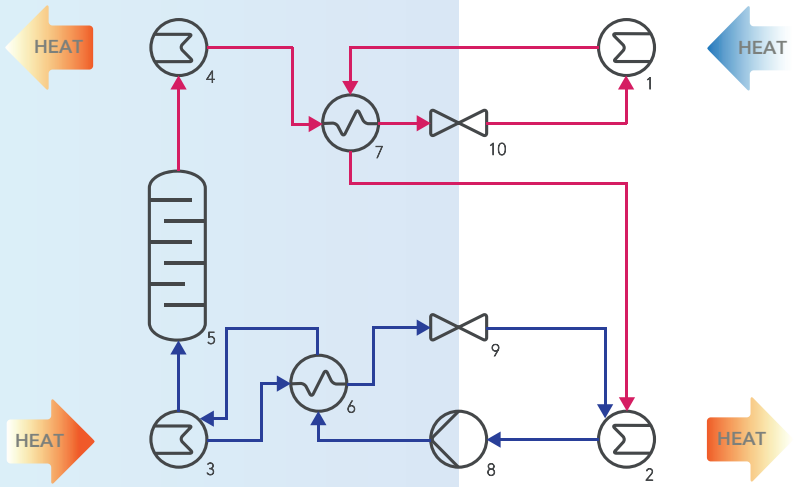
i.e.: The use of the heat of a biogas driven CHP to produce the needed refrigeration in a dairy production turns a farm into a highly efficient and eco-friendly power producer.

Simplified block diagram of a single stage ammonia absorption refrigeration plant with the main components.

An ammonia absorption refrigeration plant consists of two circuits, the ammonia circuit described with the red lines and the water-ammonia solution circuit with the blue ones. Ammonia changes state from liquid to gas in the evaporator (1) producing the refrigeration capacity.

The natural tendency of water to absorb ammonia permits it to collect the ammonia vapor by the weak solution in the absorber (2). The absorption of ammonia vapor in water is exothermic, the heat produced has to be dissipated to grant a continuous and high absorption capacity of the solution. The enriched solution coming from the absorber is pumped (8) to the desorber (3).

The solution is boiled, leading to the NH3 evaporation. This vapor is purified in the column (5), liquefied in the condenser (4) and is ready to evaporate again in (1). Two additional heat exchangers (6) and (7) improve the efficiency of the system.

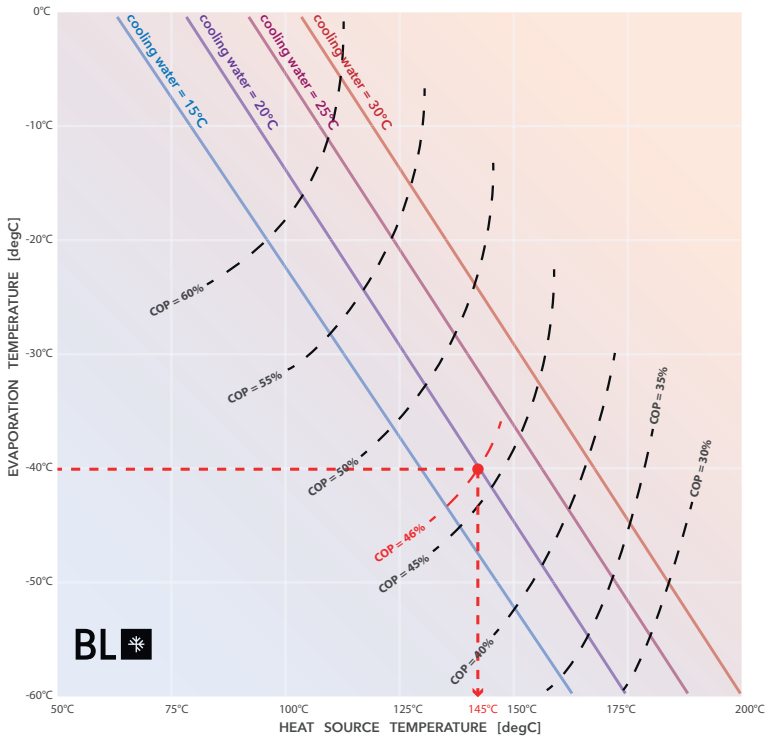


Performances and temperatures relations of **AARP**

The coefficient of performance is the ratio of refrigeration output divided by heat input (COP). This chart describes the relation between temperatures and COP.

For example: The need of refrigeration is 1000 kW at -40°C. The ambient conditions allow a cooling water temperature of 20°C.

Following the chart,
the heat source must be at least 145°C with a result of 1000 kW / 46% = 2174 kW heat input.



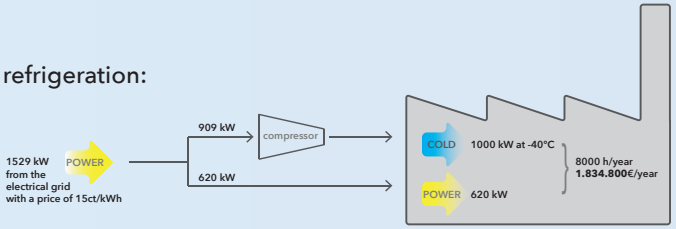
Reduction of energy costs

The simplified example below, shows an industry application with the need for 1000 kW cooling and 620 kW electrical power.

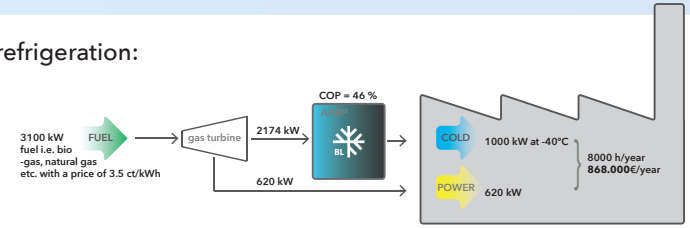
It compares the use of an electrically driven compression system and the combination of a gas turbine with an AARP for the simultaneous production of the needed cooling capacity and electrical power.

With the current energy price* of 0.15€ /kWh electrical power and 0.035€ /kWh for natural gas, after one year of operation the saving of the energy costs are 966.800 €.

Case with conventional refrigeration:



Case with absorption refrigeration:



average prices in Europe, source Eurostat (2019)

→ This example compares electricity to primary energy as inputs for refrigeration systems, an overall assessment of primary to final energy consumption would highlight a lower energy consumption level with an **AARP** technology.

When the primary energy consumption can be replaced by the use of a waste heat source, then the benefit in cost and CO^2 emissions are even more significant.

Experience meets innovation

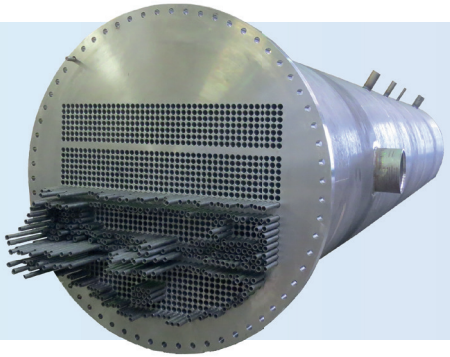
The company, founded in 2019, is an initiative of a group of engineers with more than 30 years of experience in the design, development, implementation and commissioning of ammonia absorption refrigeration systems and heat pumps. Including the build-up of more than 40 absorption plants all around the globe.

Together with highly skilled engineers from different fields we are now committed to the innovation and modernization of the absorption refrigeration sector.

We are international

We are a multicultural team of engineers from different backgrounds, native from Germany, France and Spain. We are based in Aachen at the meeting point of three countries from where we operate worldwide.

Process engineering expertise
and absorption technology
Made in Germany



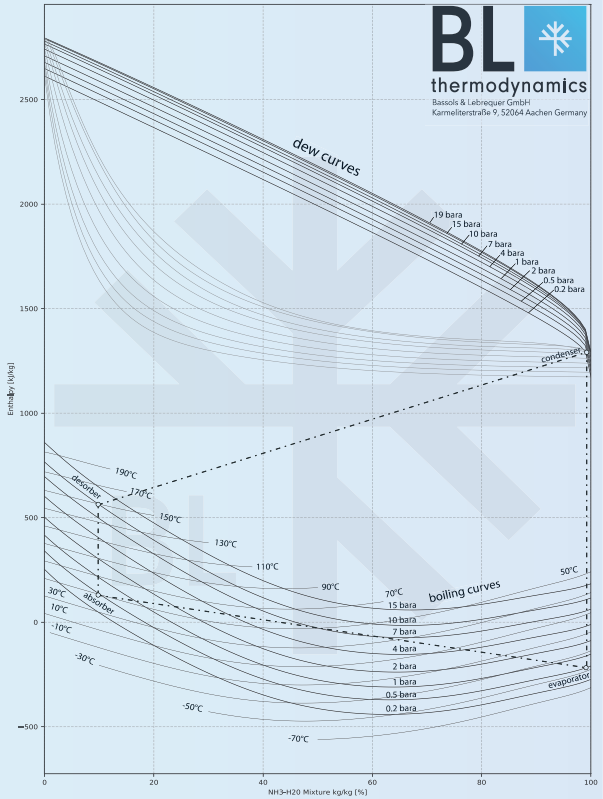
BL thermodynamics is supported by:

Siemens PLM Software SIEMENS · EnergieAgentur.NRW · isap · python powered · KWK NRW Strom trifft Wärme · AC²

Developing sustainable refrigeration systems

The dynamic region of Aachen, the proximity to research centers and the university RWTH is an inspiring surrounding for a growing and innovative technological company like BL thermodynamics.

h,x - chart for the mixture of ammonia & water



Bassols & Lebrequer GmbH
Karmeliterstraße 9
52064 Aachen
Germany

https://bl-thermo.com
info@bl-thermo.com
Tel.: +49 241 47593380

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