RHP1000 R600aDC

Reversible ORC and Heat Pump Unit

Product code KC.0101.00027.00 · Module of the BI-K Energy RHP Platform

Product description

The RHP1000 R600aDC is a reversible thermodynamic unit specifically designed for data-center cooling, waste-heat recovery and district-heating integration.

The system uses R600a (isobutane) as the working fluid and can operate in two complementary modes by reversing the thermodynamic cycle:

- Organic Rankine Cycle (ORC) mode, recovering heat from the data center, generating electricity and rejecting the remaining heat to the ambient environment.
- Heat Pump (HP) mode, recovering heat from the data center and upgrading it to a higher temperature level suitable for supplying a district-heating network.

1.210 kW_{th}

Heat delivered at 90°C, HP mode condenser output

COP 5,8

HP mode, source 65/58°C, sink 82/90°C

71,6 kW_{el}

Net electrical power, ORC mode, ambient heat sink

ORC mode

During normal data-center operation, the RHP1000 R600aDC can operate as an Organic Rankine Cycle (ORC).

The unit receives heat from the data-center liquid-cooling circuit and uses it as the thermal source of the ORC cycle. This thermal energy is converted into electrical power, while the heat available at the ORC condenser is rejected to the ambient environment. The electrical power generated is supplied to the data-center electrical system, reducing its net electricity demand.

HP mode

When the thermodynamic cycle is reversed, the RHP1000 R600aDC operates as a heat pump.

Heat is again recovered from the data-center liquid-cooling circuit, but instead of being rejected to the ambient environment through the ORC cycle, its temperature is increased by the heat-pump cycle.

The upgraded thermal energy is then transferred to a district-heating network, where it can be used for space heating, domestic hot-water production or other thermal applications.

Applications

The reversible architecture allows the same RHP1000 R600aDC unit to select the most appropriate operating mode according to ambient conditions, district-heating demand and energy-management requirements.

- When district-heating demand is low or absent, the system can operate in ORC mode, using the data-center waste heat to generate electricity while rejecting the residual heat to the ambient environment.
- When useful heat is required by the district-heating network, the thermodynamic cycle can be reversed and the system operates in heat-pump mode, upgrading the data-center waste heat to the temperature required by the heating network.

This reversible configuration transforms the data-center cooling system from a conventional heat-rejection system into an integrated energy-recovery platform capable of producing either electricity or useful high-temperature heat from the same waste-heat source.

The RHP1000 R600aDC therefore provides a flexible interface between the data center, the electrical system, the ambient environment and the district-heating network, allowing the most appropriate form of energy recovery to be selected according to operating and energy-market conditions.

Platform integration

One RHP1000 module per MW of IT load. Modules share a single 600–800 V DC bus and are balanced so that at least one module runs in ORC mode while the others provide cooling.
Thermal UPS: on grid loss the ORC module keeps powering the heat pumps of the other modules, so cooling continues without interruption and without dedicated cooling batteries.

Environmental considerations

R600a (isobutane), a natural, non-fluorinated working fluid with zero ODP and an extremely low GWP, providing a long-term alternative to synthetic fluorinated refrigerants

Strengths

Reliable, Smart, Flexible, Efficient

Electrical connections and approvals

Electrical connections: 600-800 V DC

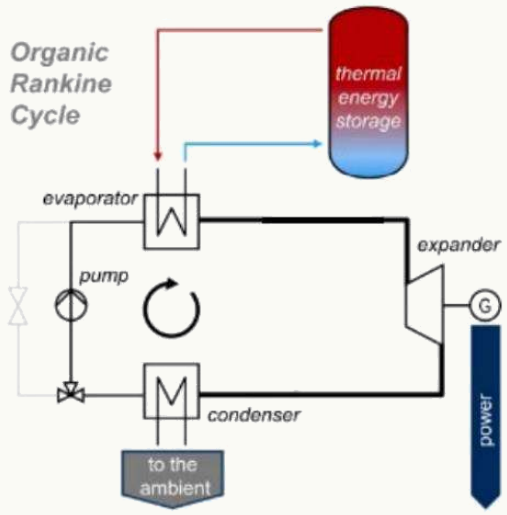
Product approvals: The unit is designed for conformity with the applicable European requirements, including the Low Voltage Directive, EMC Directive, Pressure Equipment Directive and Machinery legislation, as applicable to the final configuration. Grid connection requirements according to CEI 0-21 are available on request, where applicable.

Dimensions, weight and connections

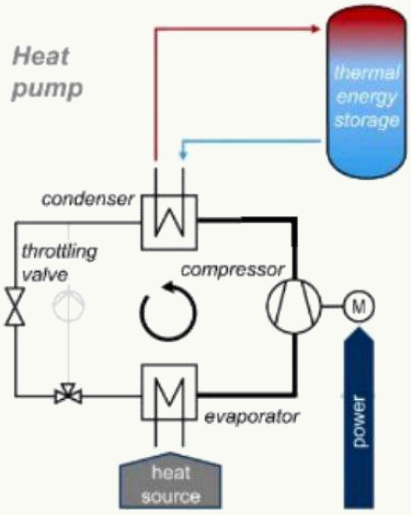
Parameter	Value	Unit
Dimensions (L × W × H)	**2710 × 2013 × 2148**	mm
Weight	**1600**	kg
High-temperature ring connection	**Flange DN150**	–
Low-temperature ring connection	**Flange DN100, PN40**	–

Operating modes

ORC mode



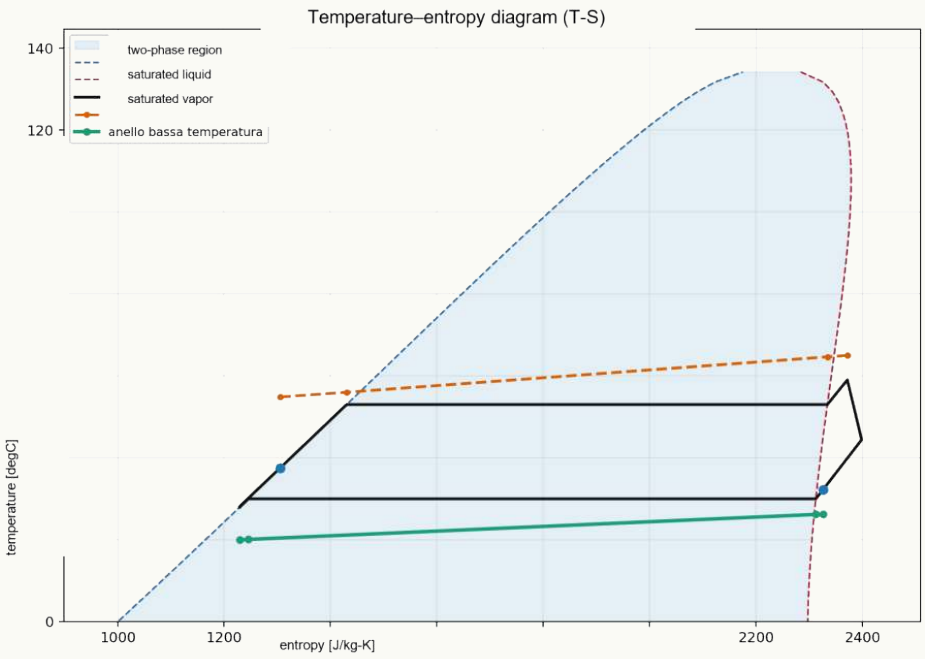
HP mode



Nominal performances in ORC mode

Parameter	Value	Unit
Gross electrical power	**80,9**	kW_{el}
Net electrical power	**71,6**	kW_{el}
Net efficiency	**3,8**	%
Evaporator inlet thermal power	**1915,3**	kW_{th}
Condenser outlet thermal power	**1834,0**	kW_{th}
High-temperature loop inlet temperature	**65,0**	°C
High-temperature loop outlet temperature	**54,9**	°C
High-temperature loop maximum inlet temperature	**75,0**	°C
High-temperature loop temperature difference	**10,2**	°C
High-temperature loop nominal fluid flow rate	**45,0**	kg/s
Low-temperature loop inlet temperature	**20,0**	°C
Low-temperature loop outlet temperature	**26,3**	°C
Low-temperature loop maximum inlet temperature	**40,0**	°C
Low-temperature loop temperature difference	**6,3**	°C
Low-temperature loop nominal fluid flow rate	**70,0**	kg/s

Thermodynamic diagram in ORC mode

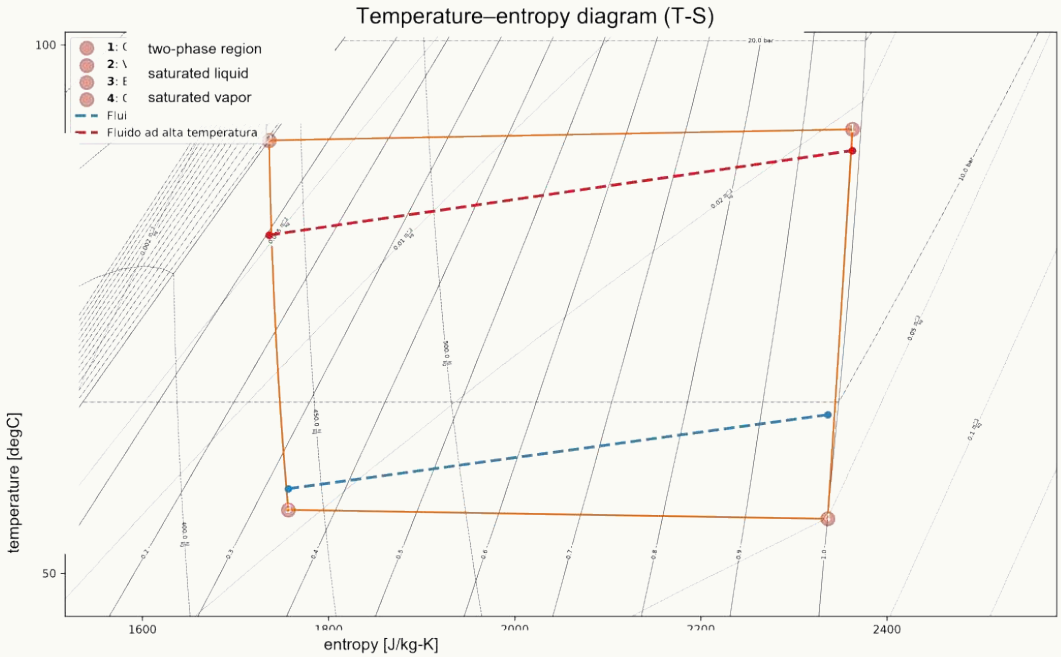


Temperature–entropy (T–s) diagram, nominal ORC operating point

Nominal performances in HP mode

Parameter	Value	Unit
Total electrical power drawn from grid	212,1	kW_{el}
COP	5,8	–
Evaporator inlet thermal power	1002,3	kW_{th}
Condenser outlet thermal power	1210,0	kW_{th}
High-temperature loop inlet temperature	82,1	°C
High-temperature loop outlet temperature	90,0	°C
High-temperature loop maximum inlet temperature	124,0	°C
High-temperature loop temperature difference	8,0	°C
High-temperature loop nominal fluid flow rate	36,0	kg/s
Low-temperature loop inlet temperature	65,0	°C
Low-temperature loop outlet temperature	58,0	°C
Low-temperature loop maximum inlet temperature	65,0	°C
Low-temperature loop temperature difference	7,0	°C
Low-temperature loop nominal fluid flow rate	37,4	kg/s

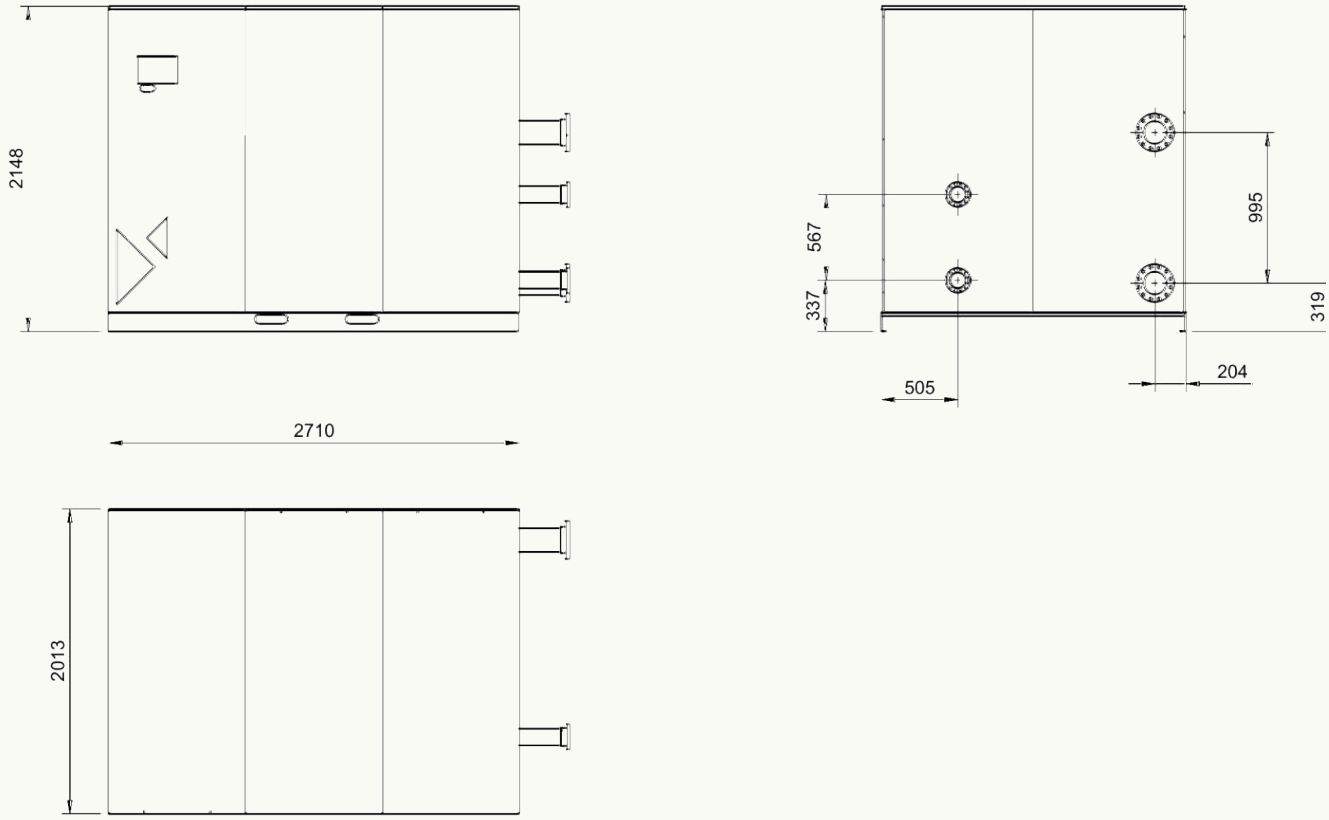
Thermodynamic diagram in HP mode



Temperature–entropy (T–s) diagram, nominal heat-pump operating point

Overall dimensions drawing

Dimensions in mm. Connections: high-temperature ring on the top side, low-temperature ring on the front side.



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RHP1000 R600aDC product technical data sheet, Rev. 22 Sep 2026. Performance data refer to nominal conditions and are subject to revision.