XVW Description

Condensed water chiller for cooling water or water mixtures and antifreeze agent, for industrial or process cooling systems.
The refrigerant used can be R1234ze, R134a or R513A.
The XVW chiller is available for cooling with tower water system (version C) with dry-cooler (vers. D) for heating processes (vers. W) dedicated to district heating (vers. K.).
XVW groups are mounted in a robust self-supporting structure painted with RAL9002e and RAL7031 epoxy powders.

Base unit description, complete with:

- Can be selected for the use of R1234ze, R134a or R513A.
- Double refrigerant circuit.
- Two compact semi-hermetic screw compressors with integrated oil separator. Partitioning is either drawer type or continuous by inverter technology.
- Shell and Tube heat exchangers with copper tubes to maximize heat exchange. Single-phase circuit evaporator characterized by pure countercurrent between refrigerant and water. Dual-pass single-circuit capacitor.
- Electronical expansion valve including optimized software to track the performance of the refrigerator load in any condition of use.
- Solid cartridge dehydrator filter (interchangeable on all sizes).
- Flow and humidity warning light.
- Refrigerant pressure probes.
- Refrigerant charge

- Water side temperature probes and evaporative temperature monitoring to avoid possible icing of the user circuit.
- Flush switch or electronic side use to prevent water flow too low.
- Hydraulic connections to the outside with Victaulic couplings.
- On all programmable microprocessor control units + graphical keypad you can control the unit alarms and parameters of the refrigerator circuit.
- Standard power supply 400/3/50 +N.
- Safety devices according to EN 97/23 / EC - PED.
- IP54 electric panel with door locking block and quick access panel control board made in accordance with EN 60204 CE, wired according to EEC directive 73/23, 89/336 on electromagnetic compatibility and the rules that can be connected . It is equipped with an active air circulation system with motor units and an autonomous heating system designed to avoid the formation of internal condensation.
- For R1234ze use: active cabinet protection against low flammability of the coolant in question. Optional remote electrical panel and quick cable connection, for possible compliance with local safety standards.
- Numbered cables for the electrical cabinet.
- Standard packing with polyethylene tape protection as a barrier against weather and UV rays. Lifting hoists available as standard.

Optional dehydrator filter intercept kit made by means of solenoid valve and ball valve which allow the filter to be cut off when replacing the solid cartridge.

Optional silenced execution with soundproofing of metal box compressors.

Detailed description

Structure

All XVW units are provided with a strong self-supporting metal structure treated with epoxy-coating painting and in RAL 7031 color.

The acoustic insulation is available with high efficiency soundproofing compressor hoods.

Refrigerant circuit

The refrigeration circuit is entirely built in the factory using only primary brand components and qualified operators according to the PED Pressure Equipment Directive for all brazing operations. All sizes are provided with two refrigerant circuits with one compressor each circuit: this allows a high system redundancy.

The main components of the refrigeration circuit are:

- Compact semi-hermetic compressors
- Shell and tube heat exchangers with copper pipes
- Electronic expansion valve
- Solid cartridge filter drier (interchangeable on all sizes). Optional drying filter interception kit realized by

solenoid valve and ball valve that allow the filter to be filtered in case of replacement of the solid cartridge

- Refrigerant flow and humidity indicator light
- Refrigerant pressure probes
- Water side temperature probes and evaporation temperature monitoring to avoid the possibility of icing of the user circuit
- Safety devices according to the PED Pressure Equipment Directive

Compressors

The compressors are compact semi-hermetic double-screw compressors with integrated oil separator.

The compressors are provided as standard with oil charge certified for use with HFO refrigerant, internal motor high temperature probe, suction and discharge temperature probe, integrated oil level sensor, carter heater, oil drain valve, antivibration dampers, discharge shut off valve, suction refrigerant filter, discharge check valve. As an option is available also the suction shut off valves.

The compressors come complete with discharge line shut-off valve (standard) and suction line shut-off valve (optional) to simplify ordinary and extraordinary maintenance operations.

The compressors include oil sensors that monitor critical situations, such as too little or too much oil in the compressor casing. This enables the unit to operate safely and at maximum efficiency levels under any operating condition. The sensors' oil monitoring function is active; this means that proper oil management is ensured not according to a fixed time frame but based on actual presence.

The compressor modulation can be managed with the internal slide according to step-type modulation or continuous-type modulation.

The compressor can be coupled with an external inverter driver, in order to ensure continuous modulation from 30 to 60 Hz, optimized efficiency in all operating conditions and a precise regulation od cooling capacity. The use of an external inverter in addition minimizes the inrush current of each compressor, thus ensuring very low LRA values.

The inverter is connected to the main unit control through bus connection. This features give the possibility to read all inverter parameters through controller display and send them to BMS or to a remote location via Ethernet connection, when present.

The inverter driver is available on request with "Low Harmonic Distorsion" version. This execution gives the possibility to reduce the inconvenience of harmonic currents down to 5%, providing as a result the reduction of operating costs and the increasing of the lifecycle of the unit.

Low noise execution

The low noise execution can be selected in order to reduce the unit sound power. In the XVW unit the noise comes from the two compressors and the low noise option has the aim to reduce this sound power. It is made with multi-layer compressor hoods, with a total thickness of 60 mm. In particular the layers are the following:

- two 25 mm-height layers of sound reduction fibers
- two layers of high density rubber
- one layer of anti UV rays external protection

Evaporator heat exchangers

Each unit is provided with shell&tube evaporator with internal copper pipe bundle and external steel mantle. Each evaporator is provided with two refrigerant circuits and single passage water circuit, in order to optimize the heat exchange efficiency. The particular design of water circuit ensures small pressure drops for all operating conditions, in order to reduce the operating costs of pumping groups.

Condenser heat exchangers

Each condenser is a shell&tube heat exchanger with internal copper pipe bundle and external steel mantle. The condenser is provided with single refrigerant circuit and double passage water circuit.

The particular design of water circuit ensures small pressure drops for all operating conditions, in order to reduce the operating costs of pumping groups.

Hydraulic circuit

The units are equipped with hydraulic connections to the outside with Victaulic connections (option), paddle or electronic flow switch (option) on source and user side to avoid too low water flow. The water side temperature probes and the evaporation temperature monitoring ensure complete protection and avoid the possibility of icing of the evaporator.

Electrical box

IP54 switchboard with door lock switch and waterproof panel for quick access to the control keypad made in compliance with EN 60204 CE, wired in compliance with the EEC directive 73/23, with the directive 89/336 on electromagnetic compatibility and with the standards that can be connected to it. It is equipped with an active air circulation system with moving units and an autonomous heating system to prevent the formation of internal condensation. The cables for the electrical panel are numbered.

The electrical box is designed and provided with all loads physically separated from control and signal components in order to avoid any electromagnetic interference.

The electrical box is provided with the following features:

- All wires labeled according to the wiring diagram and colored according to the standard for easier maintenance and troubleshooting
- Electrical components labeled according to the wiring diagram. Label is attached also on the bottom plate for easier maintenance.
- All the auxiliary components and control are supplied by a low voltage isolation transformer to increase the safety
- Standard power supply 400V 3 ~ 50Hz + N (optional without neutral). On request the following special power supplies are available: 200-208-230-440-460-480 3 ~, 50 or 60 Hz, with or without neutral
- All power loads are protected from excessive heat and short-circuit currents with circuit breakers.
- Ventilated and heated panel to control the internal temperature / humidity in all the climates
- All panel and distribution components with IP2x protection degree in all directions for protection against accidental direct contacts

The unit electrical box is provided with hard-wired interface to the BMS on a labeled terminal board with the following standard functions:

Digital inputs:

- Remote on-off,
- Selection of secondary setpoint,
- Emergency stop due to acritical external alarm
- Cooling capacity limitation

Analog inputs:

- Remote setpoint variation via 4-20 mA or 0-10 V or 0-5 V signal (configurable)

Digital outputs:

- General alarm
- Compressor state
- Control of external user and / or dissipation pumps
- Control of external hydraulic 2-way valves for hydraulic sectioning in installations with several units in parallel on user and / or dissipation side. Valves are managed with necessary delay and anticipation time for the start/stop of pumps and compressors
- Alarm free contacts

Analog outputs:

- 0-10V signal for the modulation of pumps or valves for constant delta T control or constant output temperature on the user
- 0-10V signal for pumps and / or modulating valves for condensation control with the possibility of sequential control of valve and pump for optimal control of source side water

Control/software

Standard functionalities available listed below :

- Antifreeze protection function with resistances and circulation pump is activated and available during off- periods of the unit;
- User pump(s) modulation to control the leaving water temperature or temperature difference between inlet and outlet and in order to reduce operating costs;
- Pump(s) and compressors rotation to equalize the number of working hours;
- Balanced load distribution among all active refrigerant circuits, manage automatically by the software
- Fans control and modulation in order to optimize the unit working parameters and reduce the unit noise levels when night mode function is activated;
- Night mode function in order to reduce the noise level; Night mode can be activated from digital input, timetable or external temperature signal. In parallel to the night mode function, it is possible to activate the reduction of cooling capacity according to timetable in order to reduce the sound power.
- Oil recovery system management and oil minimum and maximum level signals and alarms management;
- Capacity limitation set and control; This limitation can be activated through digital input, set as fixed value or depending on the timetable.
- Limitation of maximum absorbed current and network parameter analysis (with “Electrcial energy meter option”)
- Alarm of main components management (compressors, pumps, fans, electronic valve drivers)
- Adiabatic circuit on/off signal based on external ambient temperature and fan speed. In order to optimize the adiabatic effect, the adiabatic kit is activated only when the fan speed is higher than 85% of maximum speed;
- Remote on/off and remote setpoint management;
- LAN connection is available as a standard feature and gives the possibility to connect also units of different types, in order to increase load balancing among units, system redundancy and efficiency.
- Flow meter and energy meter management. If installed also the network analyzer, the COP calculation is available.
- Alarm history up to 100 events and for each alarm event a photograph of the machine status is saved: high pressure, low pressure, liquid temp., Temp. suction, compressor temp., temp in / out exchangers, EEV opening, fan speed, compressor / fan status, status of digital inputs / outputs of the control and expansions
- Management of the bypass circuit for the modulation of the load.
- Envelope and prevent control with specific actions on the compressors and / or on the pumps
- Selection of which alarms to send in supervision based on the degree of "severity" and distinguishing whether permanent or transient

- In the case of an inverter, a bus connection for monitoring the electrical quantities of the inverter and distinguishing all the specific alarms

Energy management (option)

Each chiller can be integrated with electricity and thermal energy meter, directly connected to the main controller, in order to provide instantaneous and historical information of performance, thermal energy production, power absorption.

The energy measurement is performed with a magnetic flow meter, capable to measure different type of fluids including pure water or water with antifreezing additives, and a couple of PT1000 probes for temperature measurements. A flow meter and a couple of probes is available for each water flow.

The absorbed electrical power and energy is measured through a grid analyzer that provide information about power absorption, energy absorption, cos(phi) value, voltage and frequency.

Fast restart (option)

With FAST option the unit is provided with a separated low voltage (24 V) or 230 V power supply dedicated for microprocessor control and separated from main loads power supply. In this way the control can be supplied by an UPS external source or a small UPS internal source (option) to ensure power continuity of the unit microprocessor. With FAST restart option the unit can reach 100% of cooling capacity in maximum 120 s after power restore, ensuring the maximum cooling availability to the system in short time.

Dual power supply (option)

The XVW chillers are available with Dual Power Supply option. This gives the possibility to connect the unit to a primary and secondary power supply line. The Dual Power Supply device is an automatic transfer switch, designed according to IEC 60947 conformity standards, and ensures a fast switch between main and secondary line on the basis of power availability and user parameter set.

The Dual power supply design is available with or without neutral pole according to main power suppl, and it is provided with a manual handle selector for easy maintenance operations.

Regulations

The unit complies with the following harmonized standards:

- 2014/68 / EU (PED Pressure Equipment Directive);
- EN 378-2: 2017 (Refrigeration systems and heat pumps - Environmental safety requirements - Part 2: Design, construction, testing, marking and documentation);
- 2006/42 / EC (Machinery Directive);
- 2014/30 / EU (Electromagnetic Compatibility);
- 2014/35 / EU (LVD) (Low Voltage Directive);

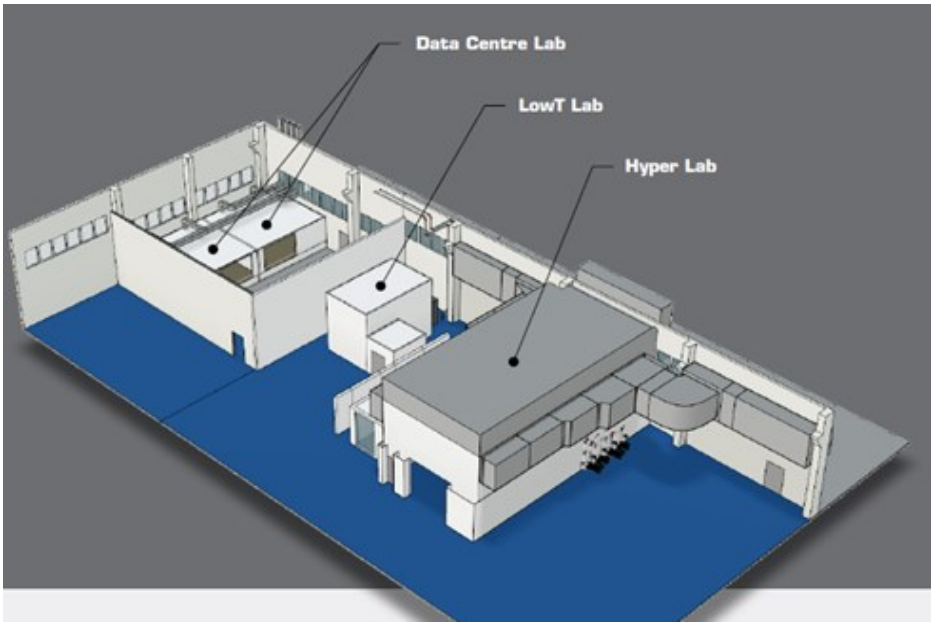
- EN 13136: 2014 (Refrigeration plants and heat pumps - Pressure limiting devices and related pipes - Calculation methods);
- EN 60204: 2016 (Safety of machines - Electrical equipment of machines);
- EN 61000-6-2 (2006) (Electromagnetic Compatibility (EMC) - Generic standards - Immunity);
- EN 61000-6-4 (2007) + A1 (2013) (Electromagnetic compatibility (EMC) -General standards- Emission for industrial environments).

FAT Factory Acceptance Test and Acoustic Test

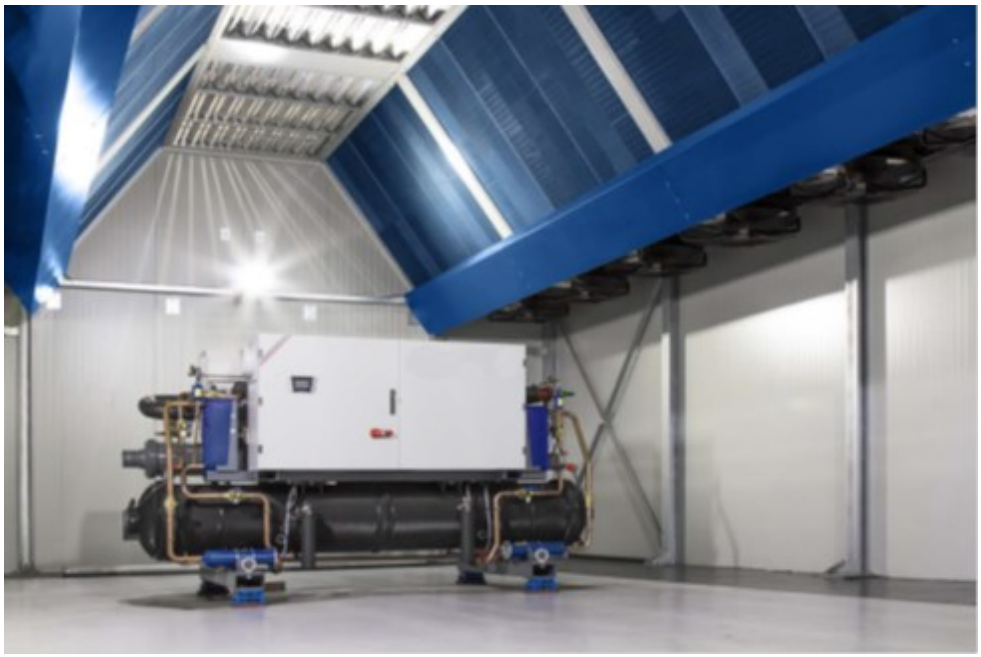
For each unit part it is possible to require a specific FAT (Factory Acceptance Test) procedure inside the Hyper Lab. The Factory Acceptance Test can witnessed by all the stakeholders of the project and provides as a result a report with all data recorded during the different performance tests. All performance test are available up to 2,5 MW of cooling capacity. The performance test is available for unit working at 100% load of for every possible partial load.

In addition to the FAT performance test THERMO-TEC can provide an Acoustic Test performed, according to International standards, in a dedicated area. The Acuostic test can be provided with unit working at full load or each possible partial load. The provided data are sound pressure level values directly measured and sound power levels calculated according to EN regulation.

All thermodynamical, water flow data and acoustic values are measured and recorded with certified measurement tools.



Structure of Laboratories



Example of water condensed unit inside Hyper Lab

HiNode system manager (option)

HiNode is a smart system manager that ensures optimization and management of cooling and heating production system.

Using smart and complex algorithms, HiNode system manager distributes the thermal loads to all active units present in the plant, increasing when possible the contemporary production of cooling and heat recovery, in order to reach the highest seasonal energy efficiency. It is possible to set which ones of all the present units are active and which are not available for cooling production. HiNode system manager increases the redundancy of the system and the precision of cooling capacity control. Thanks to the load sharing logic among all available units, it increases the energy efficiency of each unit thanks to a higher heat exchange efficiency and higher partial loads operation.

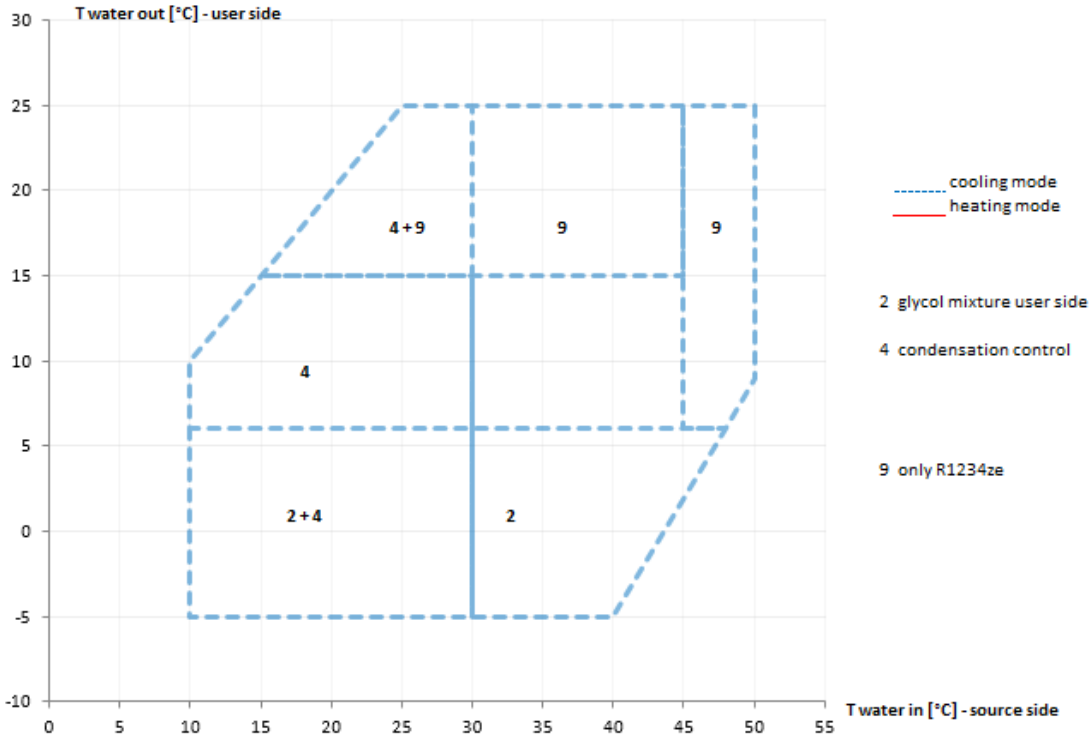
HiNode communicates with all chiller units through a bus connection and can be interfaced to a high level BMS in order to exchange all operating and performance data of cooling units (in combination with Energy Management option). All most common communication protocols are available: e.g. modbus RTU on RS485, Bacnet, Konnex, LonWorks, modbus via IP, Bacnet via IP.

XVW Operating envelope

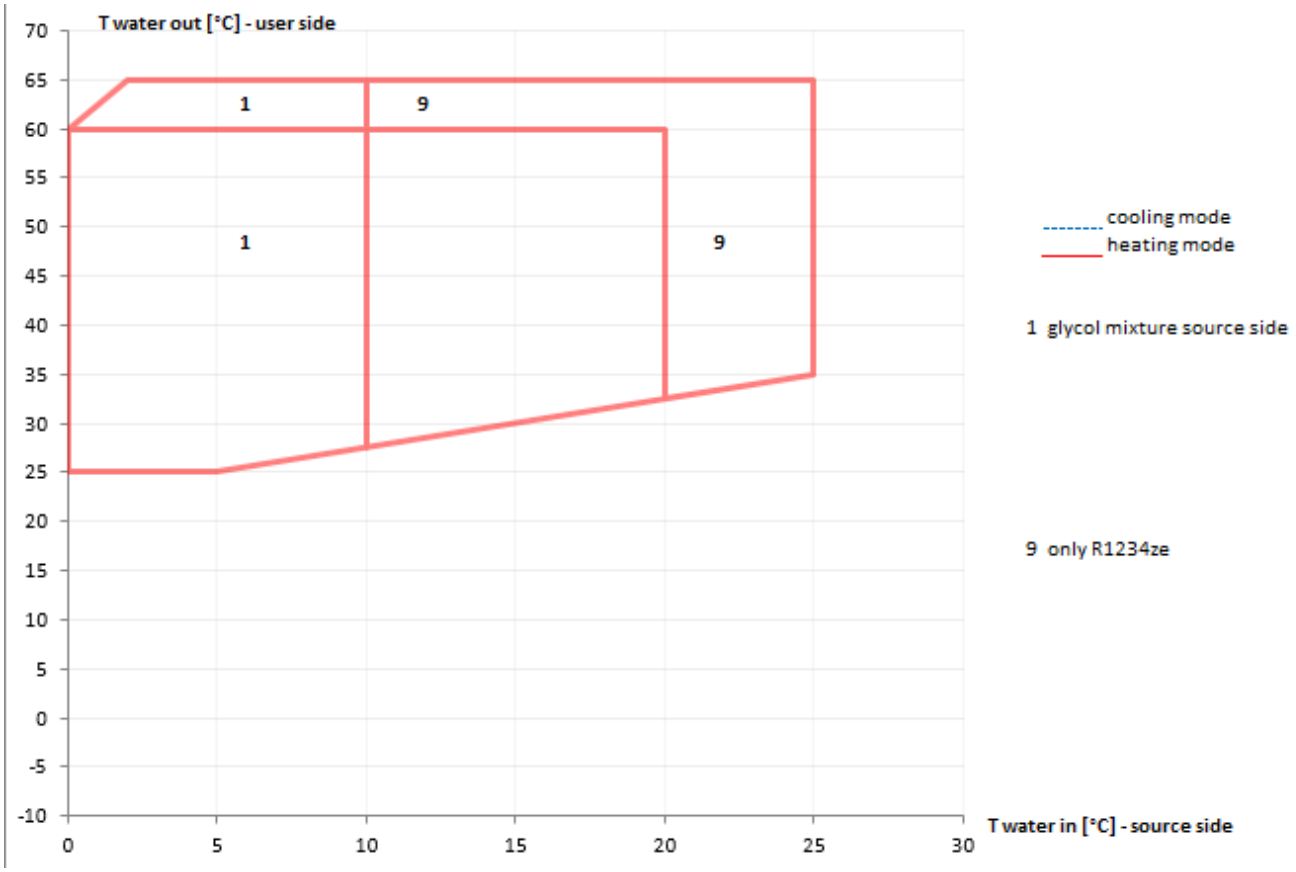
The following graphs show the operating envelope of the XVW units according to the different following versions:

- XVW D = Only cooling unit
- XVW W = Only heating unit
- XVW K = Only heating unit for high temperature water production

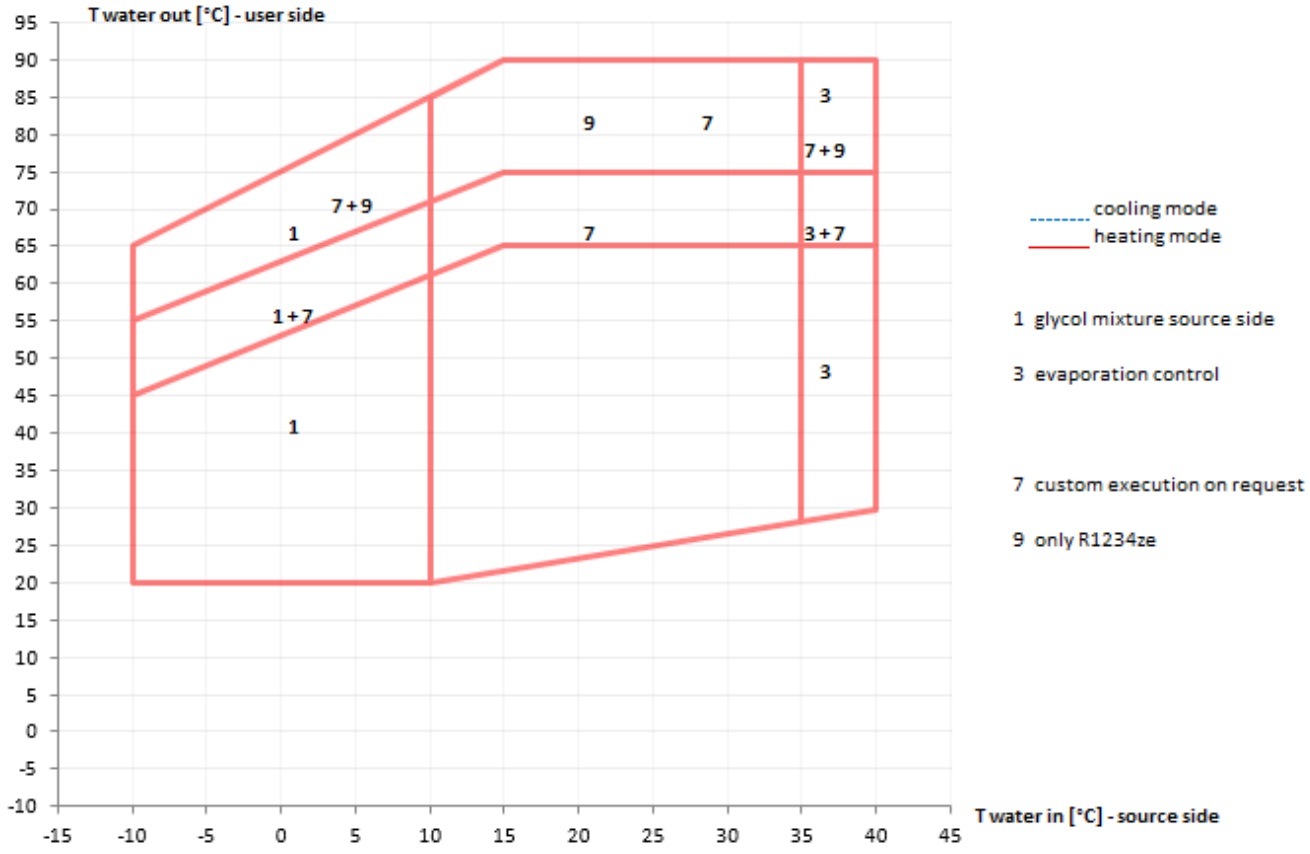
XVW D



XVW W


T water out [°C] - user side
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
0
5
10
15
20
25
30
1
9
1
9
T water in [°C] - source side
cooling mode
heating mode
1 glycol mixture source side
9 only R1234ze

XVW K


T water out [°C] - user side
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
T water in [°C] - source side
9
7
3
7+9
7+9
1
7
3+7
1+7
3
1
cooling mode
heating mode
1 glycol mixture source side
3 evaporation control
7 custom execution on request
9 only R1234ze