Galletti
AIR CONDITIONING

GB **TECHNICAL MANUAL**



HWMC

10 kW - 29 kW

Total heat recovery reversible multi-purpose heat pumps - DC INVERTER

CE

R410A

Inverter Technology

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Galletti S.p.A. via L.Romagnoli 12/a
40010 Bentivoglio (BO) Italia

CE 0425

Made in Italy
CATEGORIA 2

Serial number
Code
Date of production
Cooling capacity (W)
Heating capacity (W)
Power supply
Power input (kW)
Weight (kg)
Max power input (kW)
Max running amperage (A)
HP Power input (kW)
Refrigerant
Max refrigerant pressure (bar)
Max refrigerant temperature (°C)



UNIT IDENTIFICATION

The unit data are reported on the rating label in this page.

The label shows the following data:

- Series and size of the unit
- Date of manufacture
- Main technical data
- Manufacturer
- The label is applied on the unit, usually on the enclosing panels beside the condenser coil

IMPORTANT: NEVER REMOVE THE LABEL

- Serial number of the unit
- The serial number permits to identify the technical characteristics and the components installed
- Without this datum it will be impossible to identify the unit correctly

TRANSLATION OF ORIGINAL INSTRUCTIONS

- For any further information, contact the manufacturer: info@galletti.it
- To get the weight of the unit, refer to the User Manual, Rated technical data table.

THE WATER CHILLERS AND HEAT PUMPS COMPLY WITH DIRECTIVE 97/23/EC (PED) THROUGH MODULE D1, APPROVED BY THE NOTIFIED BODY ICIM NO. 0425.

The technical and dimensional data provided herein may undergo changes in connection with product improvements.

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1 THE SERIES: ADVANTAGES OF THE BLDC INVERTER TECHNOLOGY

The actual thermal load of an air conditioning system is less than 60% of the rated load capacity 90% of the time.
In low-powered installations with a small number of indoor units and a low water content, operation under partial load conditions is particularly critical.
In order to ensure that the system works correctly, it is thus necessary to vary the power output by the chiller.
The inverter controller acts on the compressor rpm by modulating the refrigerant mass, cooling capacity and input power.
The operating logic of the HWMC series allows the water outlet temperature to be precisely regulated and adapted to thermal loads:
The PID control algorithm makes it possible to regulate the water temperature within ± 15%.
The inverter controller allows to adjust the capacity and the input of the compressor to the actual thermal load and makes it possible to considerably reduce electrical intakes at the compressor start-up (reduction of starting currents) and during the operation under partial loads. The spinning airtight scroll compressors (for models from HWMC 13 to HWMC 29) or Twin Rotary compressors (for models HWMC 10) are equipped with motor protection against overheating and overcurrents.

Mounted on anti-vibration supports, complete with oil charge, they are enclosed in a soundproofed compartment and equipped with an automatically controlled oil heating system to avoid oil dilution by the refrigerant when the compressor is stopped.
The compressor motor is a permanent magnets, brushless, alternating current motor controlled by a trapezoidal wave driver operating in the frequency field ranging from 30 to 110 Hz (BLDC “Brushless Direct Current” Technology).
The electronic control system allows the setpoint to be adjusted automatically according to the outdoor temperature in order to reduce consumption and broaden the working temperature range.

The condensation control adjusts fan speed to actual operating conditions. This results in better working conditions, reduction of sound levels under partial load conditions and possibility of operating in cooling mode beyond conventional working limits (up to an outdoor air temperature of -10°C).
The advanced control of water flow rate prevents starts with fluid temperatures that are outside the operating range and protects the compressor for its entire service life.
During heat pump operation, the exclusive smart defrost system can correctly identify an impairment of performance in the outdoor exchanger due to the formation of ice and minimise the process time in relation to normal operation of the unit.

- **PERMANENT MAGNETS ELECTRIC SYNCHRONOUS MOTOR**
- **LOWER MOTOR INERTIA EFFECT**
- **COMPACT DIMENSIONS**
- **LOWER NOISE EMISSIONS**
- **NO ROTOR LOSSES DUE TO CURRENTS AND INDUCTION -> HIGHER EFFICIENCY AT PART LOAD**
- **HIGHER COMPRESSOR ISENTROPIC EFFICIENCY**





The multi-purpose units of the HWMC series are suitable for summer cooling, winter heating and DHW production all year round.

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1 THE SERIES

The ever-increasing need to reduce energy consumption and increase production efficiency of chilled water for air conditioning and hot water for heating and the domestic water supply, combined with the need to make these processes independent of each other and the operating season, finds its full achievement in the new Galletti MULTI-PURPOSE HWMC units. We will use the term “multi-purpose” that in the accepted meaning, refers to a unit that is capable of complete heat recovery during the summer period (not temporarily reversing the cycle, for the purpose of producing domestic hot water, with the resulting inevitable losses in efficiency and comfort). Therefore, this is the so-called “4-pipe” unit that must be hydraulically connected to two distinct systems: the first one is for heating and air conditioning the building and the second one is for producing domestic hot water. In general, a multi-purpose unit can be an air-water or water-water machine, a single-circuit or dual circuit, package type or split type machine, with ON/OFF compressor or inverter.
The MULTI-PURPOSE HWMC units have been designed for outdoor installation in both residential and commercial applications. The range uses R410A refrigerant, which assures high levels of performance with relatively low energy consumption. It comprises 6 models of various capacities, from 10 to 29 kW in cooling mode (9 to 32 kW in heating mode) in nominal conditions (ref. EN14511).

BEYOND CONVENTIONAL WORKING LIMITS

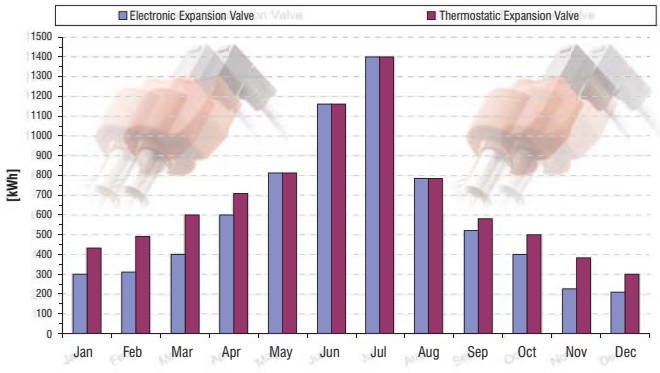
The heat exchangers with braze-welded AISI316 plates and finned block have been optimised for R410A refrigerant this permitting a better heat exchange and quiet operation of the unit. Their generous sizing guarantees the production of chilled water even with outdoor air temperatures as high as 50°C and assure a high average energy efficiency in summer and in winter mode.

EFFICIENCY IN ALL CONDITIONS

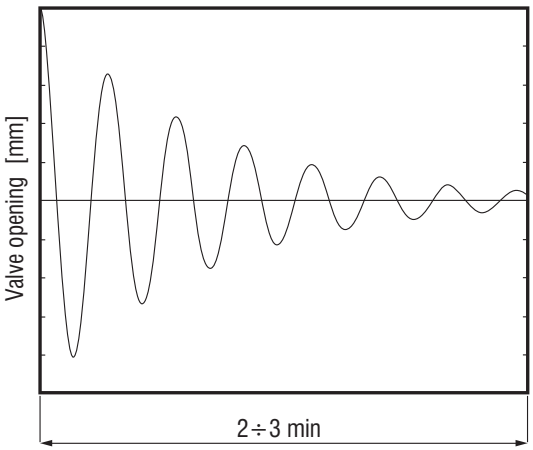
The actual thermal load of an air conditioning system is less than 60% of the rated load capacity 90% of the time; the HWMC version answers this demand by offering high efficiency during operation under partial load conditions (ESEER>4) and also guarantees the unit's operation at the worst temperature conditions.
In such conditions the microprocessor controller activates the capacity control mode, increasing the condensing surface with respect to the power delivered.
The axial-type fans with airfoil-shaped blades and 6-pole motors with electronic speed control as a standard feature, guarantee quiet operation and optimal performance of the unit in all conditions.

ELECTRONIC EXPANSION VALVES

All units, irrespective of type of construction, are equipped with electronic expansion valves to maximise efficiency under part load conditions.



Electronic expansion valves have the capacity, if correctly parameterised and controlled by the software, to optimise cooling circuit performance and decrease the system’s power consumption.
When a sudden change occurs in the thermal load, with a traditional expansion valve there is a transient time of 2 to 3 minutes before a condition of equilibrium is reached.
Proactive action of an Electronic Expansion Valve:



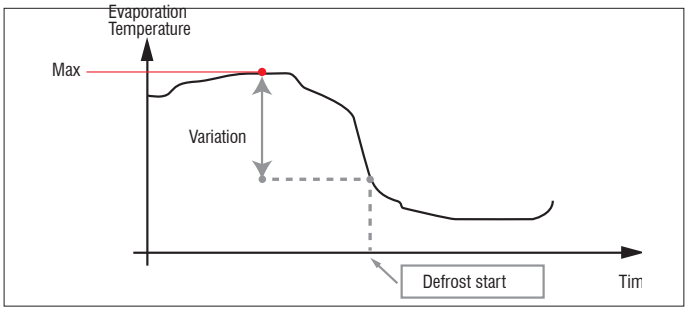
- The electronic driver pre-positions the valve at a point very near the final equilibrium point
- A status of equilibrium is quickly reached with small adjustments.
- The electronic expansion valve becomes an active, rather than passive, component within the system.
- The transient time is greatly reduced.
- Overall the system is more efficient, with higher EERs and therefore greater savings.

SELF-ADAPTIVE

The electronic control system allows the setpoint to be adjusted automatically according to the outdoor temperature in order to reduce consumption and broaden the working temperature range.
The unit can also function in systems with a low water content, even without the use of a buffer tank, thanks to the automatic adjustment of capacity from approximately 100% to 20%.

SMART DEFROST SYSTEM

The exclusive defrost system (available as standard feature with the HWMC units) can correctly identify an impairment of performance in the outdoor exchanger due to the formation of ice and minimise the process time in relation to normal operation of the unit.



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1 THE SERIES

FIELD OF APPLICATION

The multi-purpose **HWMC** units have been designed to cool and heat water for air conditioning and heating systems and for the production of DHW for residential or commercial use. The units are “real” multipurpose units, with 4 water connections, whose operating modes are described below:

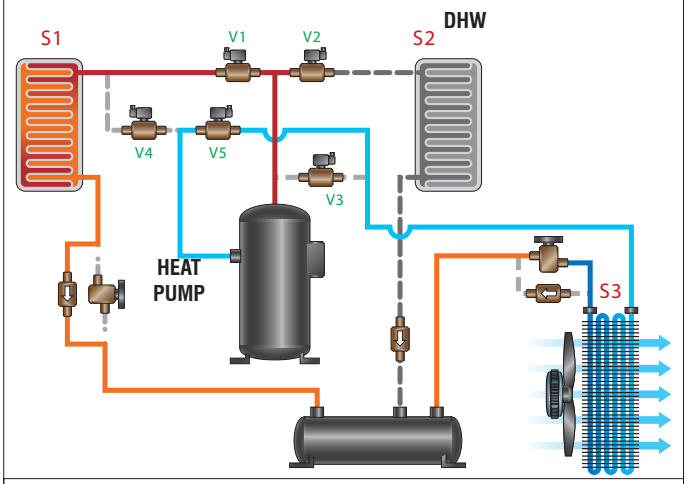
1. Cold water production in summertime mode, for the air conditioning system (air condensing system on the finned exchanger);
2. Cold water production in the summertime mode, for the air conditioning system, with TOTAL CONDENSATION HEAT RECOVERY (for the production of DHW by means of a dedicated plate exchanger);
3. Production of hot water in wintertime mode, for the heating system, functioning as a traditional heat pump (air evaporation on the heat exchanger side and water condensation on the dedicated plate heat exchanger on the system side);
4. Domestic hot water production in wintertime mode, temporarily stopping hot water production for air heating purpose (DHW priority);
5. DHW production only (in particular in mid seasons and in summertime and wintertime).

WARNING When reference is made to the production of domestic hot water, what is meant is the storage of thermal energy in a tank of “technical” water. Water for domestic use must be heated by means of a stainless steel coil contained inside the storage tank, in this way it is possible to avoid storing domestic water and it is not necessary to provide for an anti-Legionella cycle (see recommended plumbing layouts for further details).

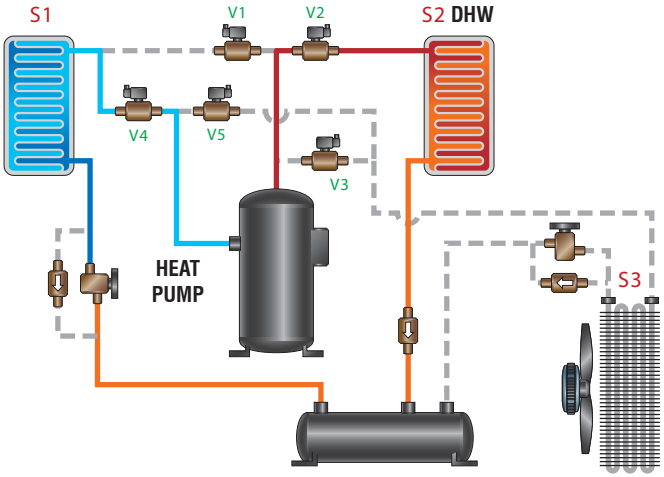
WARNING: **HWMC** units are NOT suitable for use as “rapid” heaters."

For more information on constructing a system based on the multi-purpose units of the **HWMC** series, refer to the technical document “Guidelines for constructing multi-purpose systems (code no. RG66006967).

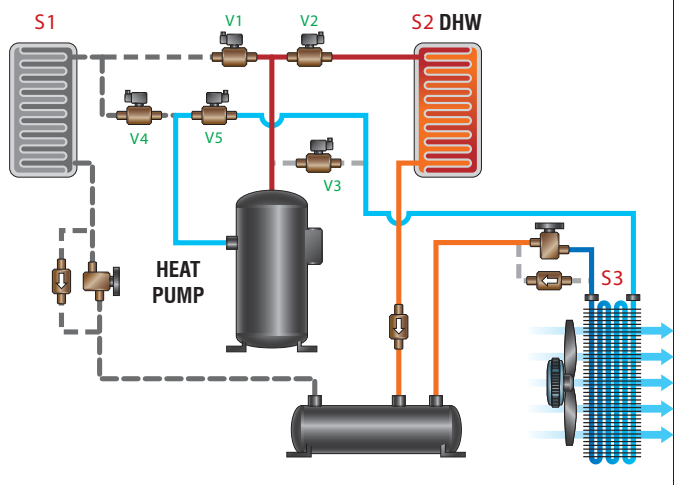
Winter configuration



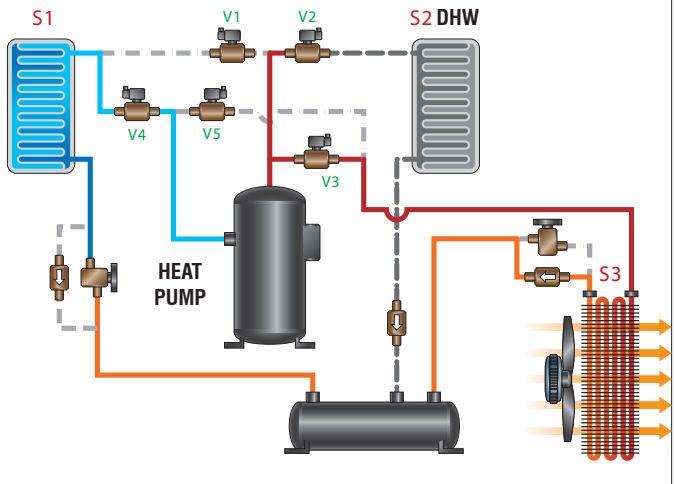
Summer configuration (total heat recovery)



DHW / Springtime (operating 365 days a year)



Summer configuration



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1 THE SERIES

MODELS AND VERSIONS

The **HWMC** series features 6 models of varying capacity, indicatively from 10 to 29 kW in cooling versions (9-32 kW in heating versions) in nominal conditions (ref. EN14511).

All models are charged with R410A refrigerant and equipped with BLDC compressors optimised for heat pump applications and domestic hot water production in all seasons.

N.B. The choice of some options may preclude the choice of others or make some other fields become mandatory. Contact Galletti S.p.A. for verification

Complete unit code	H	W	M	C	0	1	0	H	0	A	A	A	1	0	0	C	E	0	0	0	0	0	0	0

Version 0
Single compressor **0**
Tandem **T**
Model (size) 1 0
Operation H
H
Supply voltage 0
Standard 400 - 3N - 50 **0**
Single-phase **M**
400 - 3N - 50 + circuit breakers **2**
Single-phase + circuit breakers **4**
Refrigerant A
R410A high efficiency **A**
Revision A
Initial **A**
(Field 1) Expansion valve A
Electronic valve **A**
(Field 2) Pump and accessories 1
2 Modulating pumps (system+DHW side) **5**
2 EC pumps (system+DHW side) **6**
(Field 3) Inertial buffer tank 0
Absent **0**
Present, system side **S**
(Field 4) Auxiliary contacts 0
Absent **0**
User tank sensor **1**
External electric heating element control **2**
Opt 1 + Opt 2 **3**
(Field 5) Fans C
Standard with condensation control **C**
BLDC with electronic control **E**
(Field 6) Antifreeze kit E
Base (plate exchangers only) **E**
Additional protection for 1 pump **1**
Additional protection for 1 pump and tank **2**
Additional protection for 2 pumps **3**
Additional protection for 2 pumps and tank **4**
(Field 7) Sound insulation 0
Absent **0**
Compressor compartment soundproofing **1**
Compressor silencing housings **2**
Opt 1 + Opt 2 **3**
(Field 8) Cooling accessories 0
None **0**
Refrigerant pressure gauges **M**
(Field 9) Remote control 0
Absent **0**
MYCHILLER BASE remote control (option 1 - 3 field 13 disabling) **B**
MYCHILLER PLUS remote control (option 1 - 3 field 13 disabling) **P**
ADVANCED pGD1 remote control **C**
(Field 10) Special exchangers 0
Standard **0**
Copper - copper **R**
Cataphoresis **C**
Corrosion-proof **B**
Hydrophilic **GB**
(Field 11) Protective grille 0
Absent **0**
Present **G**
(Field 12) Additional options 0
Absent **0**
Exchanger heating cable **1**
(Field 13) Additional cards 0
Absent **0**
RS485 (Carel / Modbus) **1**
Clock card **2**
LON card **3**

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2 CONSTRUCTIVE FEATURES

Painted galvanised sheet steel structure (RAL9002) for an attractive look and effective resistance to corrosive agents.
Fastening devices are made of non-oxidizable materials, or carbon steel that has undergone surface-passivating treatments.
The compressor compartment is completely sealed and may be accessed on 3 sides thanks to easy-to-remove panels that greatly simplify maintenance and/or inspection. The accessibility to the compressor compartment is possible without removing any connection to the water circuit.
Sound insulation, available on request, can further reduce the noise emissions of the unit.

CUSTOMISED HYDRONIC KITS

- High head pump made entirely of stainless steel, already configured for use with mixtures of water and ethylene glycol up to 35% and provided with internal thermal protection.
  It is housed in the compressor compartment and is easy to reach thanks to the removable perimeter panels.
  The units can be equipped with two circulating pumps, one for the system side and the other one for the DHW side, both controlled by the on-board microprocessor. As option, the units can be equipped with an inertial buffer tank, on the system side, particularly useful during defrosting, especially when they are coupled with low thermal inertia distribution units.
- Expansion tank.
- Safety valve.
- Filling cock (included).
- Automatic vent valve.
- Water differential pressure switch and outlet water temperature probe with anti-freeze thermostat function.
- Mechanical Y filter supplied as a standard feature on all models to protect the evaporator (included).

As option, electronic pumps with permanent magnet motors are available to further increase the levels of performance and enable an optimal modulation on the whole working range and an accurate control of the outlet temperature.

COOLING CIRCUIT

-Inverter technology scroll-type compressor optimised for heat pump installations for R410A refrigerant, housed in a compartment that can be sound insulated.
- Heat exchanger with stainless steel braze-welded plates.
- Finned block condenser with 8.0 mm copper piping and aluminium fins, characterised by ample heat exchange surfaces.
- Dehydrating filter.
- Flow indicator with humidity indicator.
- Electronic thermostatic valves with advanced driver and integrated MOP function

Solenoid valves for the control of the cooling cycles in the various modes

- One-way valves.
- Liquid receiver.
- High and low pressure switches.
- Schrader valves for checks and/or maintenance.
- Refrigerant pressure gauges (optional).

FAN DRIVE ASSEMBLY

Electric fan with 6-pole external rotor motor directly keyed to the axial fan, with internal thermal protection on the windings, complete with safety grille and dedicated supporting structure.
The fan is housed in a special compartment having a profile designed to optimise ventilation.
The use of wide surface finned block heat exchangers reduces pressure drops on the air side, thus significantly improving the noise levels of the units.
The condensation control system continuously and automatically regulates the fan speed, further limiting the noise emissions of the unit during night-time operation and under partial load conditions.
The pressure control is also active during DHW production, as evaporation control, in order to guarantee optimal operation in all seasons.
As option, EC electronic fans with permanent magnet motors are available to further increase the levels of performance and enable an optimal modulation on the whole working range.

FINNED BLOCK HEAT EXCHANGER

Made of 8.0 mm diameter copper pipes and aluminium fins, sized to achieve maximum efficiency with R410 refrigerant.
The special engineering of the heat exchangers allows defrost cycles to be carried out at maximum speed in the models with heat pump operation, which brings clear benefits in terms of the integrated efficiency of the whole cycle.

ELECTRONIC MICROPROCESSOR CONTROL

The electronic control enables the complete control of the HWMC unit. It can be easily accessed through a polycarbonate flap with IP65 protection rating.



The microprocessor control is the heart of the unit and the multi-purpose system. It must control a unit with four connections and, therefore, two completely independent water circuits: on the one hand we have the production of hot/chilled water for the heating/cooling requirements, and on the other hand we have the production of DHW.
Regardless of the unit configuration, the control manages the logic that is most suitable for integration with the system (for example, the circulation pumps on the system side and/or the DHW side may be installed inside or outside the unit, but they are always managed by the control logic by means of contacts on the unit's electrical board).
The portion connected to the heating unit may or may not have an internal and/or external buffer tank, while inside the unit there will always be a buffer tank for storing the energy necessary for producing DHW. For managing priorities in DHW production, the unit is equipped with a temperature sensor to be inserted in the buffer tank's trap. This sensor will activate the pump on the DHW buffer tank side and DHW production each time the buffer tank temperature drops below a programmable threshold value. As an alternative to a temperature sensor, it is possible to use (connected to the electrical board's terminal board) a clean contact from an external thermostat.
In theory, the self-adaptive logic enables the unit to operate even in systems where the water content is low, without the use of an inertial buffer tank. Particular care has to be taken in the calculation of water temperatures on the system side during defrosting.
By reading the outdoor air temperature, it can automatically change the setpoint to adapt it to the outdoor load conditions or keep the unit running even in the harshest winter conditions.
The controller can be configured using different serial cards and enables an immediate connection to the supervisor networks.

Main functions:

- Continuous regulation of cooling/heating capacity from 100% to 20% according to the system demand.
- Control over the temperature of the water entering the exchanger on the system side.
- Control over the temperature of the water entering the exchanger on the DHW side.
- Control of DHW production as a priority.
- Control of the pump activation on the DHW side (only if necessary, based on the buffer tank water temperature)
- Defrosting management
- Control of fan speed
- Complete alarm management
- Dynamic control of the setpoint depending on the outdoor air temperature
- Connection to an RS485 serial line for supervisory / teleassistance operation
- Option of connecting a remote terminal that duplicates the control functions

Check of the unit devices:

- Compressor
- Fans
- Solenoid valves on the cooling circuit
- Water circulation pump/s
- Antifreeze heating elements
- Alarm signalling relay

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2 CONSTRUCTIVE FEATURES

ELECTRIC CONTROL BOARD
The electric control board is constructed and wired in accordance with EEC Directive 73/23, Directive 89/336 on electromagnetic compatibility and related standards. Made of steel sheet, it is also protected by the enclosing panels of the machine.

OPTIONS
- Circuit breakers
- Water pump options (1 or 2, on/off or modulating or phase cut pumps or EC pumps)
- Integrated buffer tank, system side.
- DC brushless fans
- Antifreeze heating elements on the water circuit
- Low noise version (sound insulation of the CP compartment and/or CP silencing housings)
- Refrigerant pressure gauges
- Remote microprocessor controls
- Special exchangers (hydrophilic treatment, copper-copper, cataphoresis, anti-corrosion)
- Heat exchanger protective grilles
- Power factor correction capacitors
- Soft starter
  RS485 serial cards, Clock, LON

ACCESSORIES AVAILABLE
Base vibration dampers

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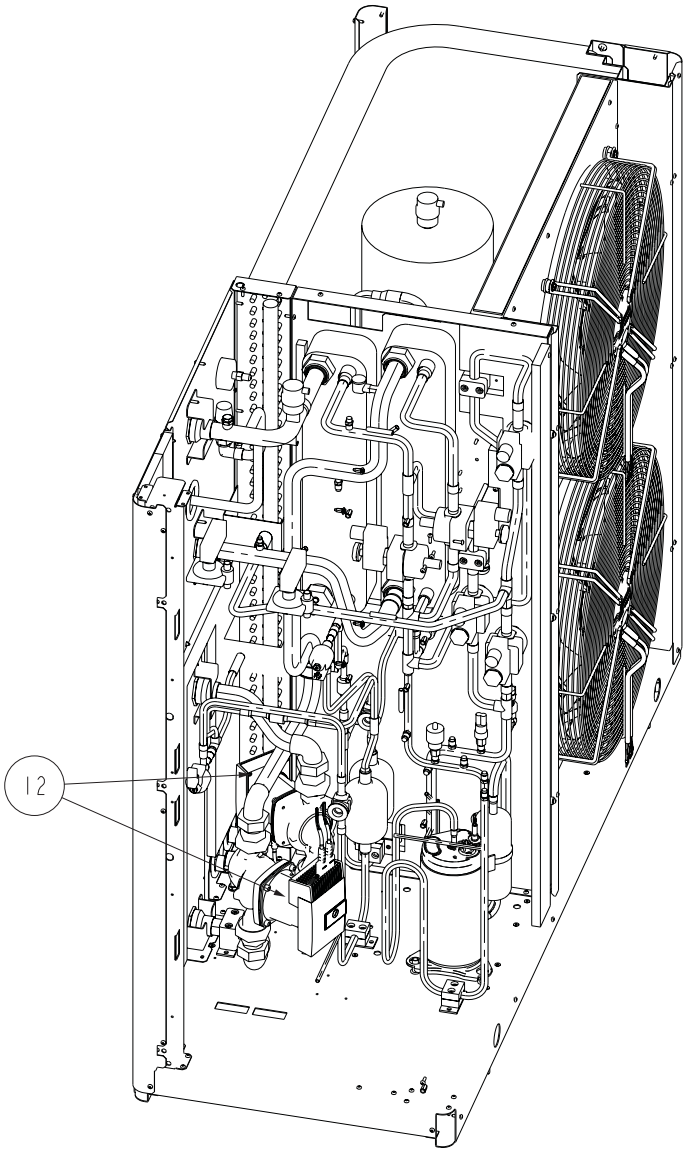
3 LAYOUT OF COMPONENTS

HWMC 10 EC PUMPS



	Description
12	Circulation pump

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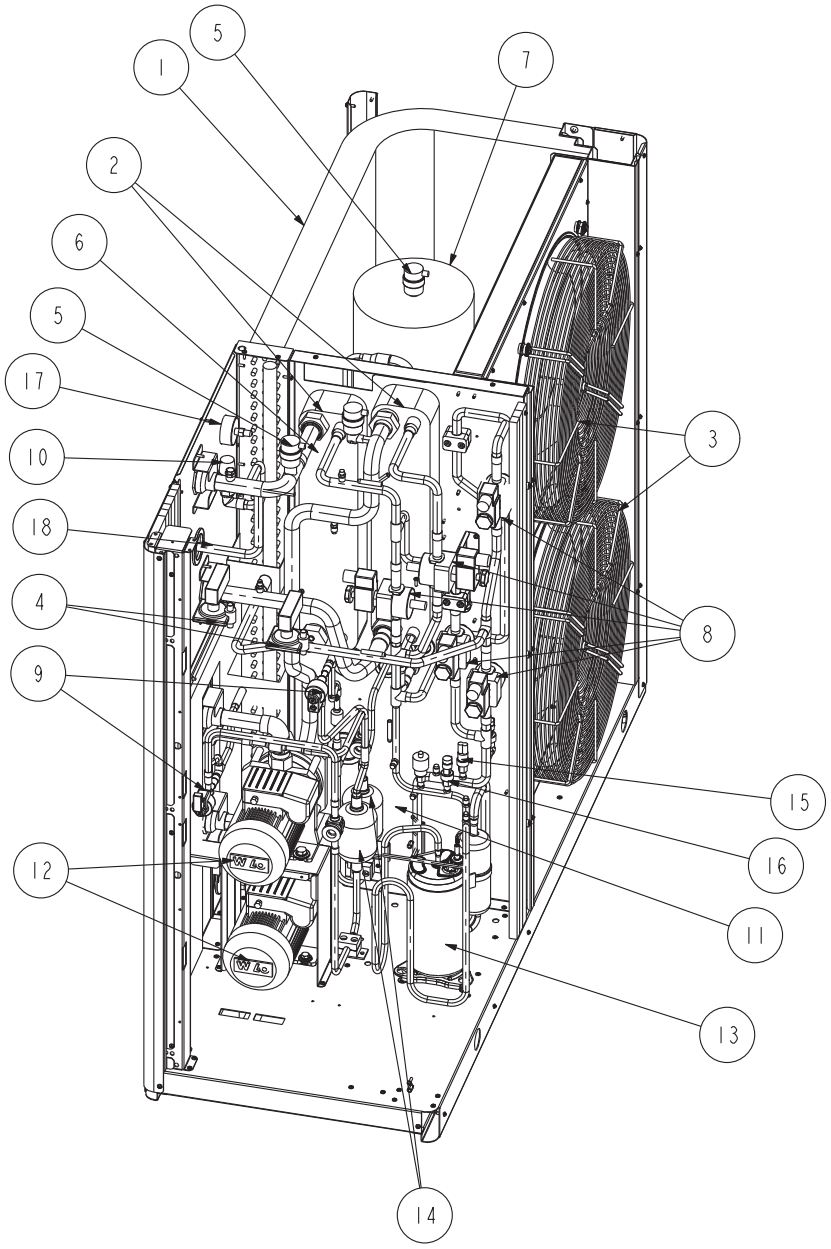
3 LAYOUT OF COMPONENTS

HWMC 10



	Description
1	R410A - air exchanger
2	R410A - water exchanger
3	Fan
4	Water differential pressure switch (no. 1 fan compartment)
5	Automatic air vent valve
6	Expansion tank (fan compartment)
7	Buffer tank
8	Refrigerant solenoid valve
9	Electronic thermostatic valve
10	Water safety valve
11	Liquid receiver (fan compartment)
12	Circulation pump
13	Compressor
14	Refrigerant filter
15	Low pressure switch
16	High pressure switch
17	Water pressure gauge
18	Water filling point

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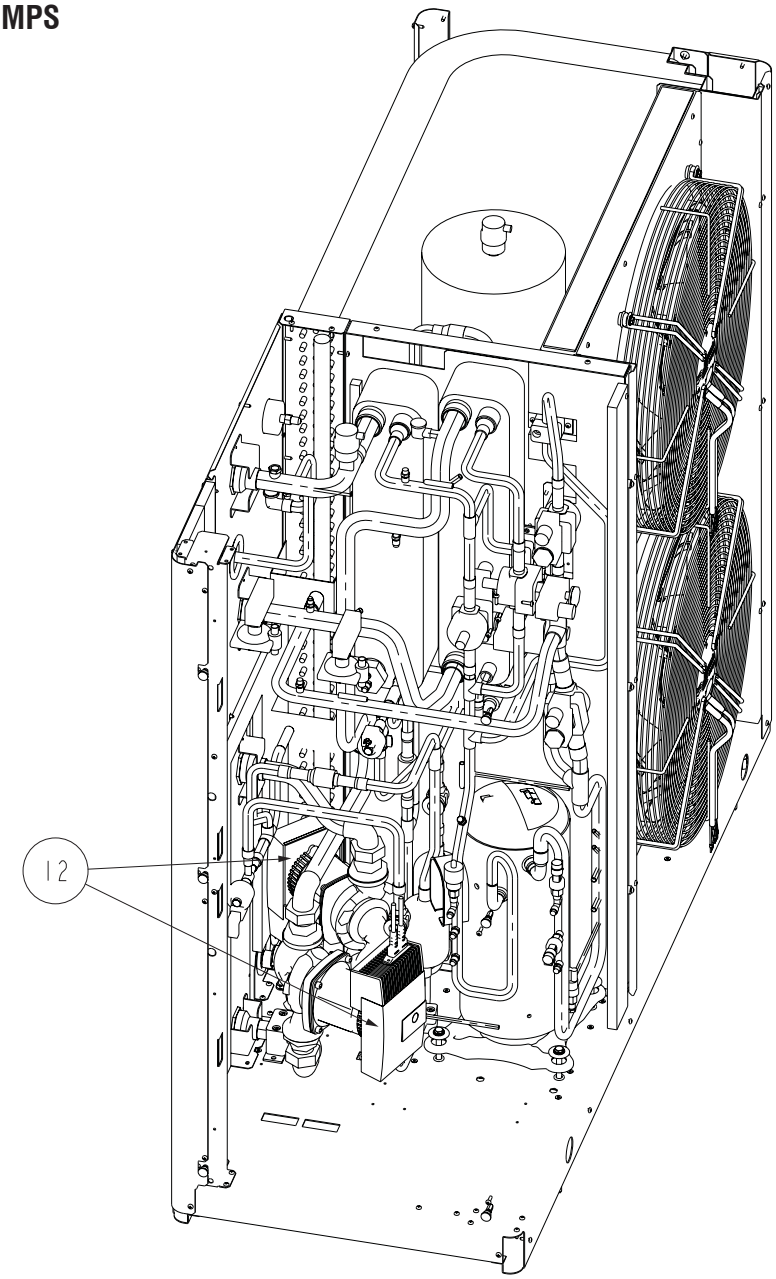
3 LAYOUT OF COMPONENTS

HWMC 13 - 18 EC PUMPS



	Description
12	Circulation pump

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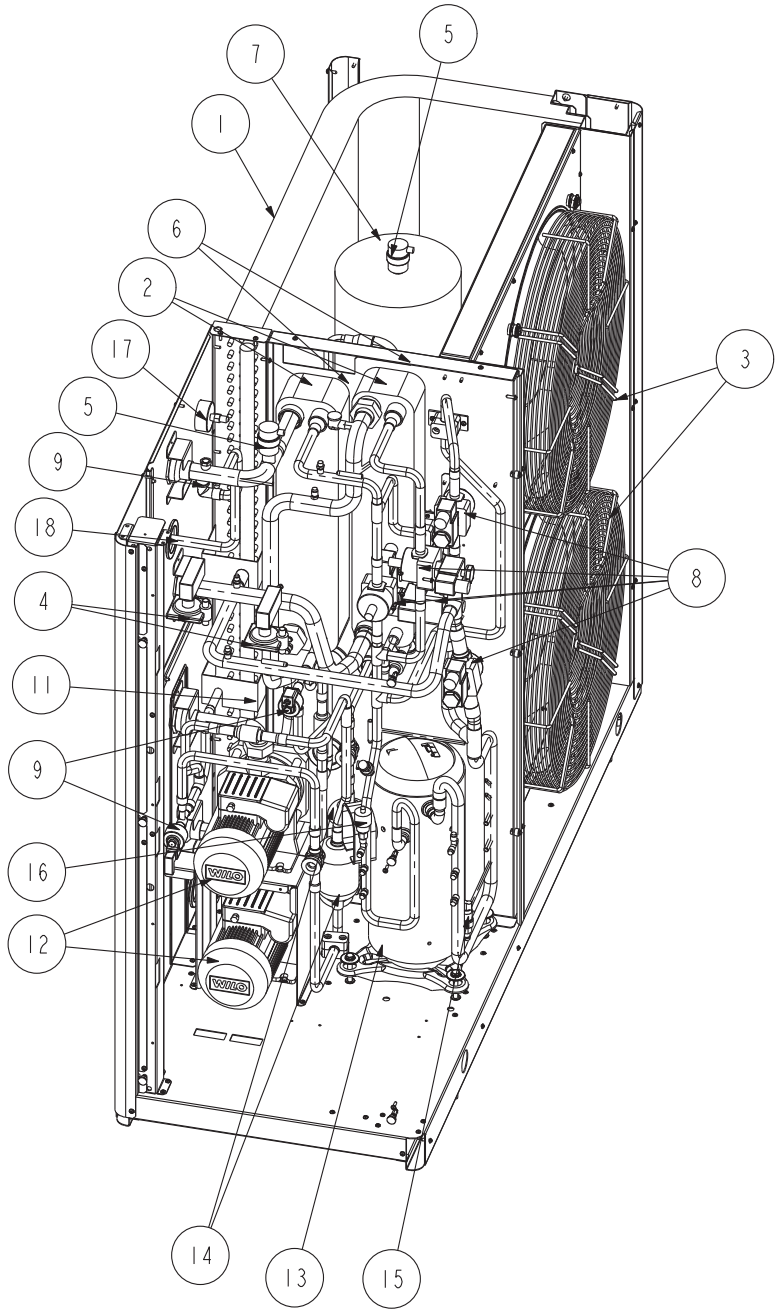
3 LAYOUT OF COMPONENTS

HWMC 13 - 18



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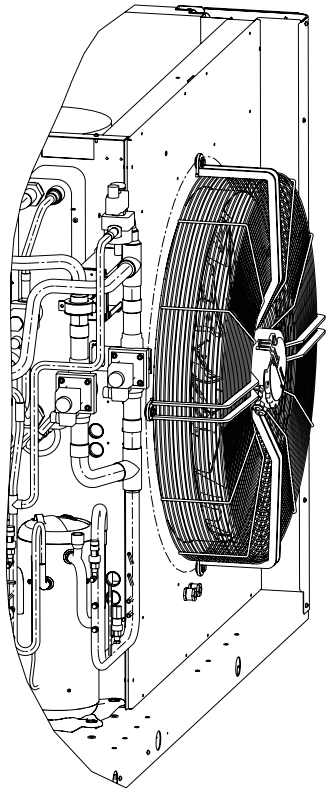
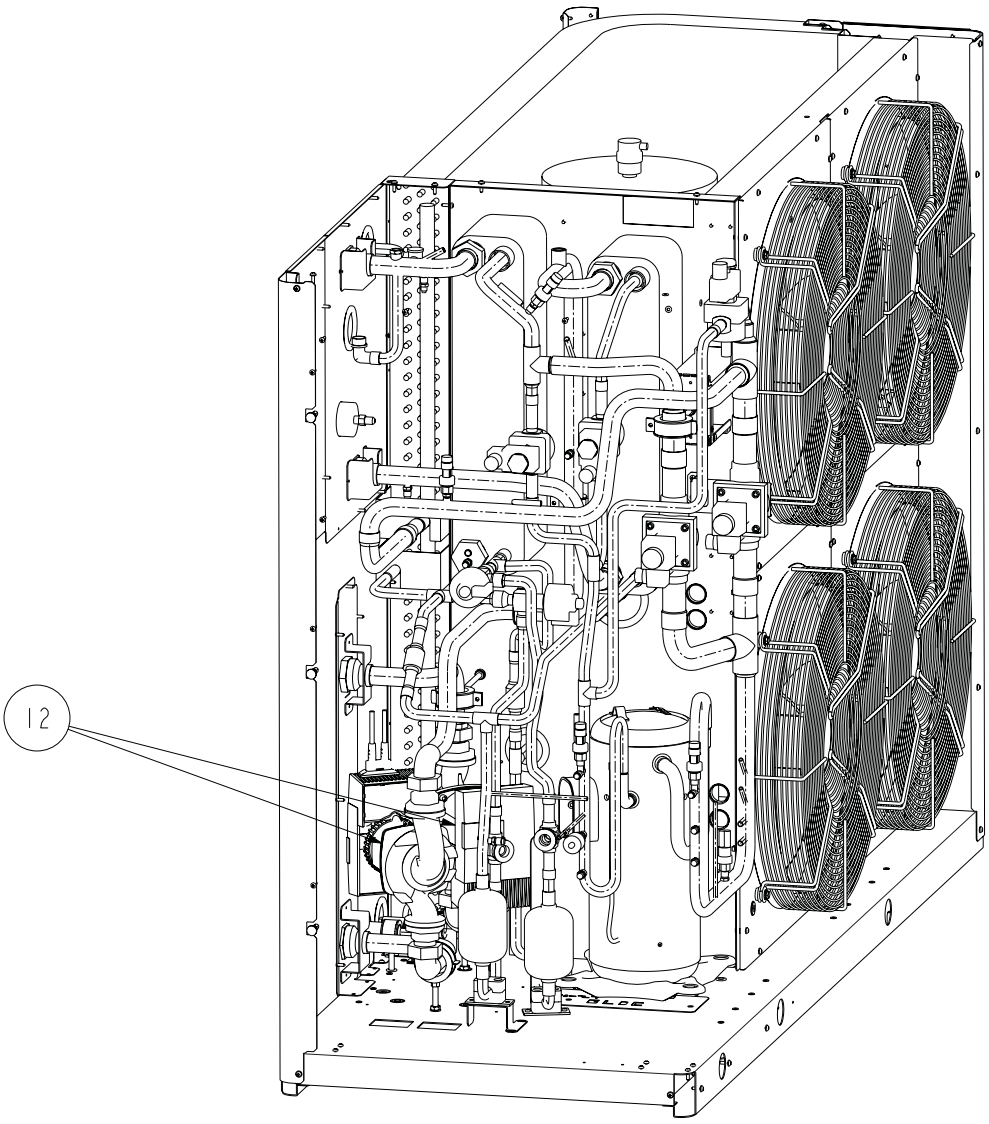
3 LAYOUT OF COMPONENTS

HWMC 23 - 29 FANS



HWMC 23 - 29 EC PUMPS



	Description
12	Circulation pump

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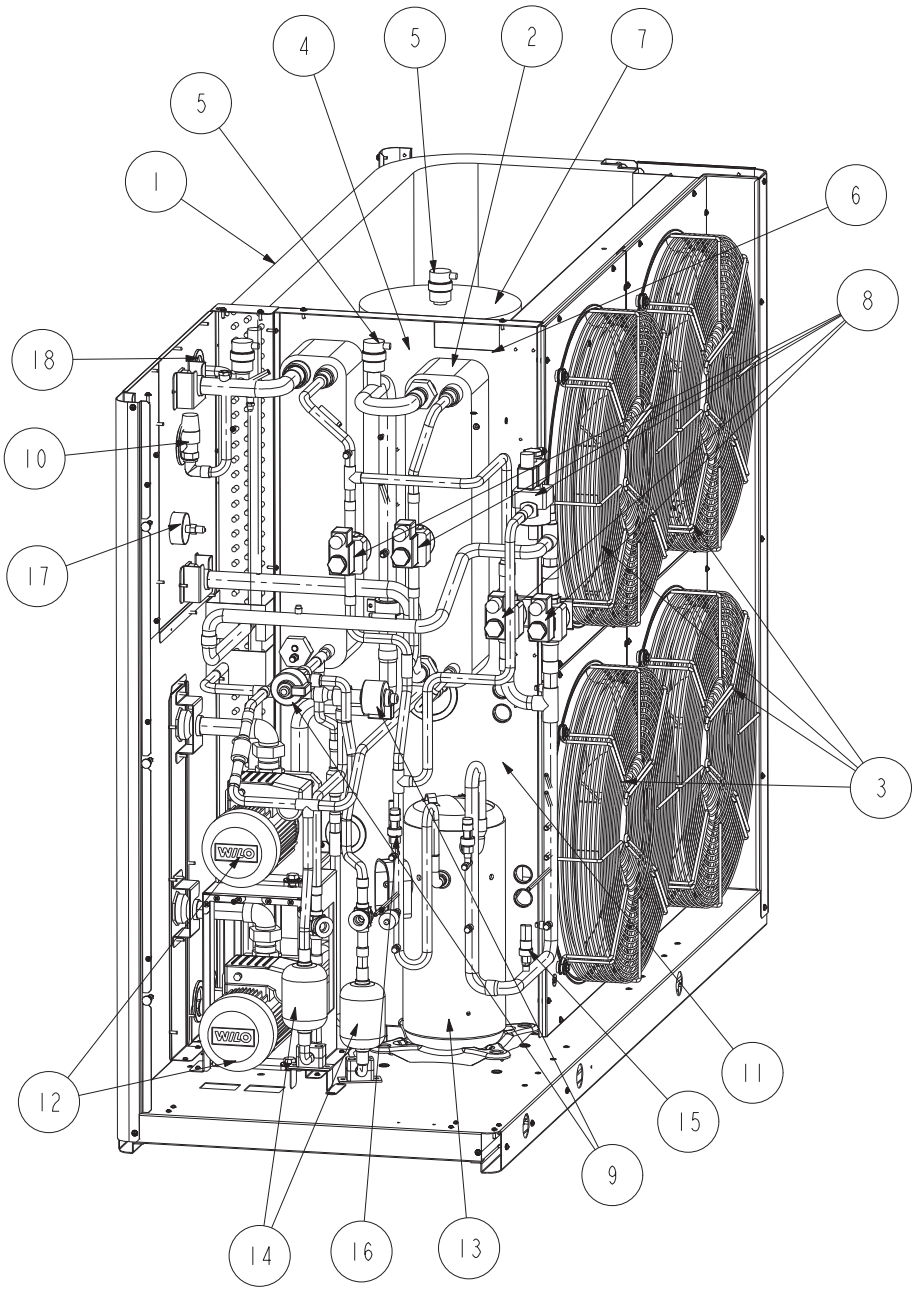
3 LAYOUT OF COMPONENTS

HWMC 23 - 29



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18	Water filling point

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4 TECHNICAL FEATURES

4.1 RATED TECHNICAL DATA - HEAT PUMPS

HWMC		010M	013	018	023	029
Power supply	V-ph-Hz	230-1-50	400-3-50	400-3-50	400-3-50	400-3-50
Cooling mode						
Cooling capacity [1]	kW	10.60	13.80	18.50	23.40	29.60
Power absorbed [1]	kW	3.34	4.37	7.52	7.40	11.50
EER		3.18	3.14	2.46	2.93	2.45
Cooling mode +DHW						
Cooling capacity [1]	kW	10.10	13.50	18.90	23.10	30.40
Power input [1]	kW	3.31	4.21	6.98	7.53	11.00
Heating capacity DHW	kW	13.00	17.20	25.00	29.70	40.00
Total COP		6.99	7.29	6.29	7.02	6.43
Heating mode (system / DHW)						
Heating capacity [2]	kW	11.40	14.90	21.50	25.60	33.70
Power absorbed [2]	kW	3.44	4.34	7.51	8.05	12.00
COP		3.30	3.21	2.86	3.18	2.82
Water flow - chiller mode	l/h	1.820	2.362	3.174	4.013	5.080
Water flow - heat pump mode	l/h	1.973	2.582	3.734	4.447	5.856
DHW water flow (total heat recovery)	l/h	2.263	2.984	4.351	5.170	6.952
Pump head, system side (chiller)	kPa	127	157	116	146	120
Expansion tank	dm^3	5	5	5	5	5
Pump head, DHW side	kPa	97	128	45	107	57
DHW expansion tank	dm^3	1	1	1	1	1
No. of scroll compressors / circuits		1 / 1	1 / 1	1 / 1	1 / 1	1 / 1
Diameter of water connections	inches	1”1/4	1”1/4	1”1/4	1”1/4	1”1/4
Buffer tank	dm^3	30	30	30	50	50
Height	mm	1250	1250	1250	1300	1300
Length	mm	1220	1220	1220	1565	1565
Depth	mm	560	560	560	600	600
Sound power level	dB(A)	70	71	71	74	74
Refrigerant charge R410A	(kg)	6.4	8.3	8.3	11.5	11.5
Transport weight*	(kg)	220	220	220	300	300
Operating weight*	(kg)	240	240	240	347	347

***** Weights refer to model with pump and tank
1 Water temperature 12°C - 7°C; outdoor air temperature 35°C
2 Water temperature 40°C - 45°C, outdoor air temperature 7°C dry bulb, outdoor air temperature 6°C wet bulb
Performances measured according to standard EN 14511

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5 PERFORMANCES

To calculate the nominal performance data of HiWarm units, read the output thermal capacity and input electrical power for specific operating conditions (including the inverter) from the ordinates in the diagrams below. The unit's efficiency is measured by the ratio between these two values. For nominal operating conditions included between the curves, linearly interpolate to obtain the new values; for nominal operating conditions outside the curves, contact Galletti S.p.A.

5.1 HWMC HEATING CAPACITIES OR DHW PRODUCTION

Tbs_1 Air inlet temperature (dry bulb)
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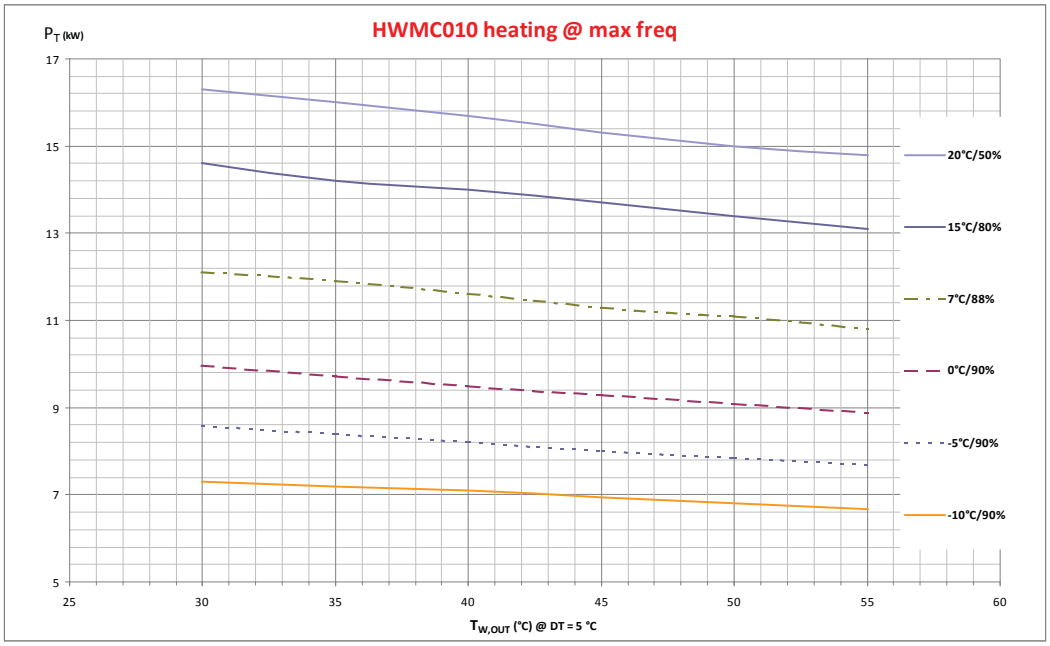

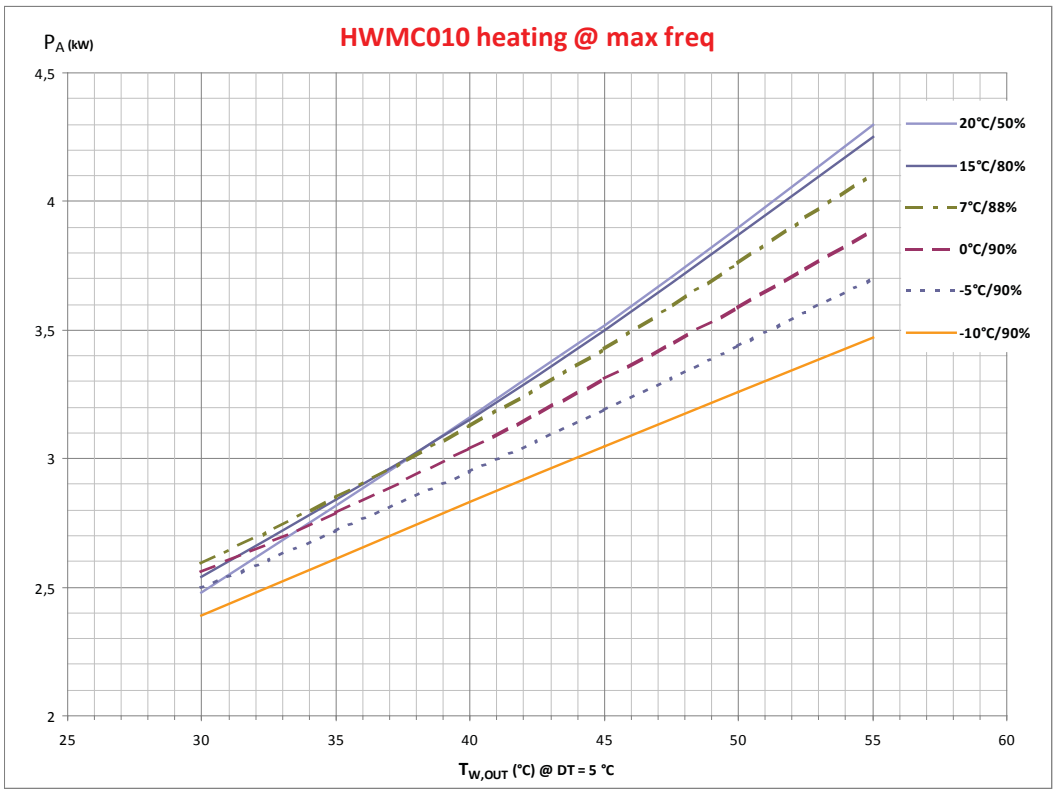

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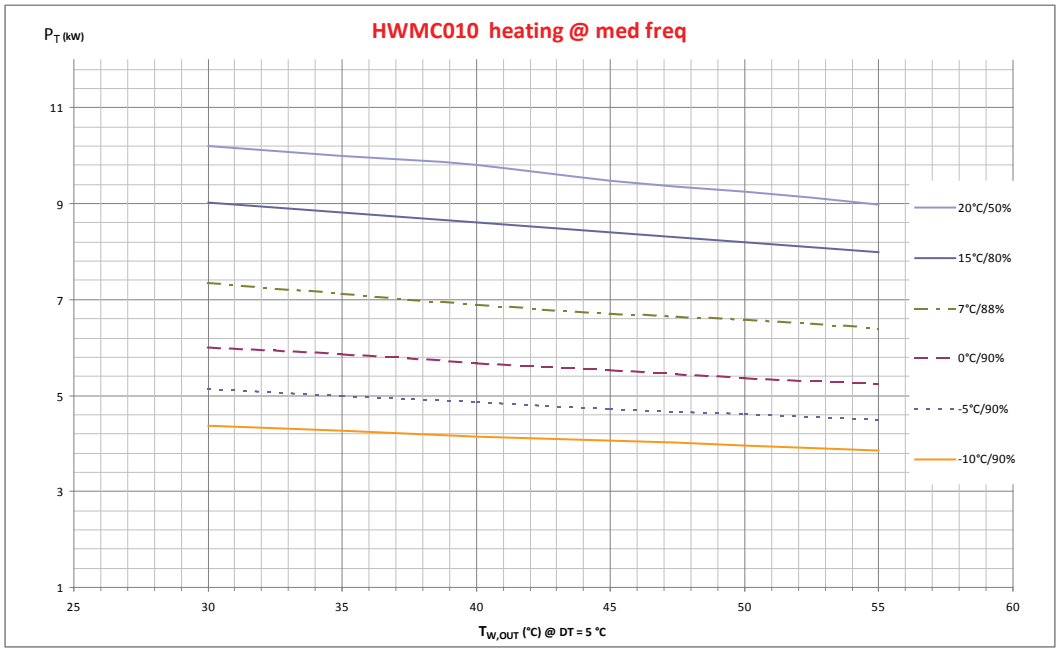

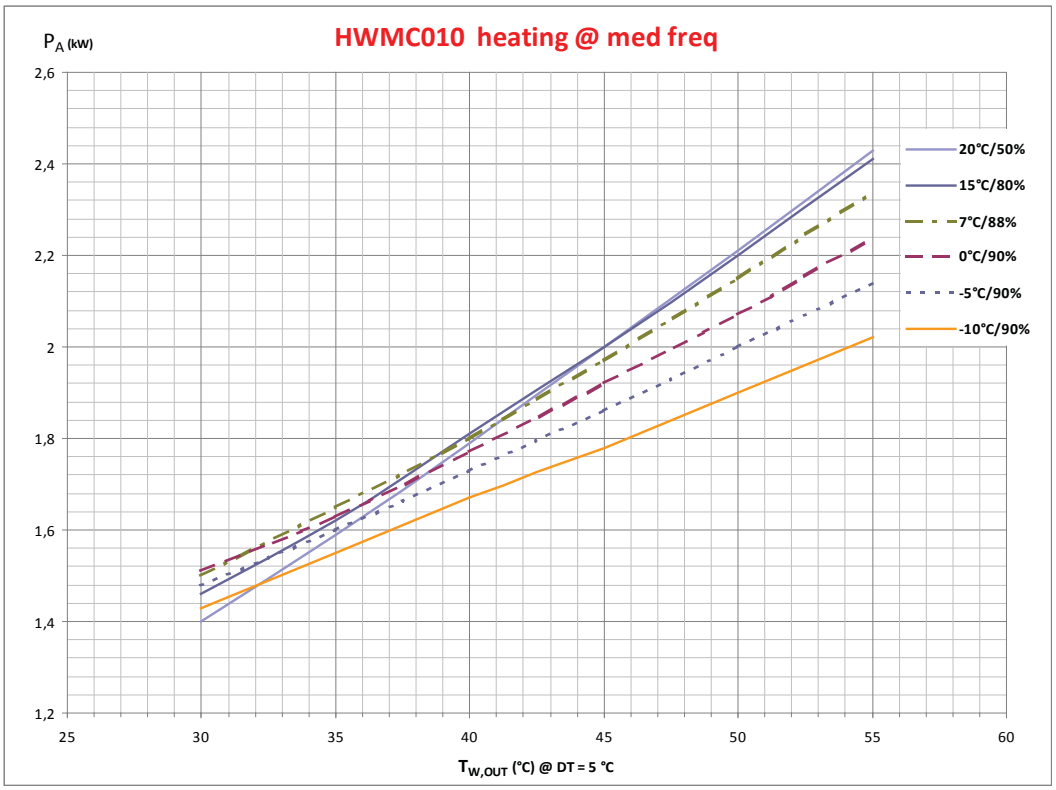

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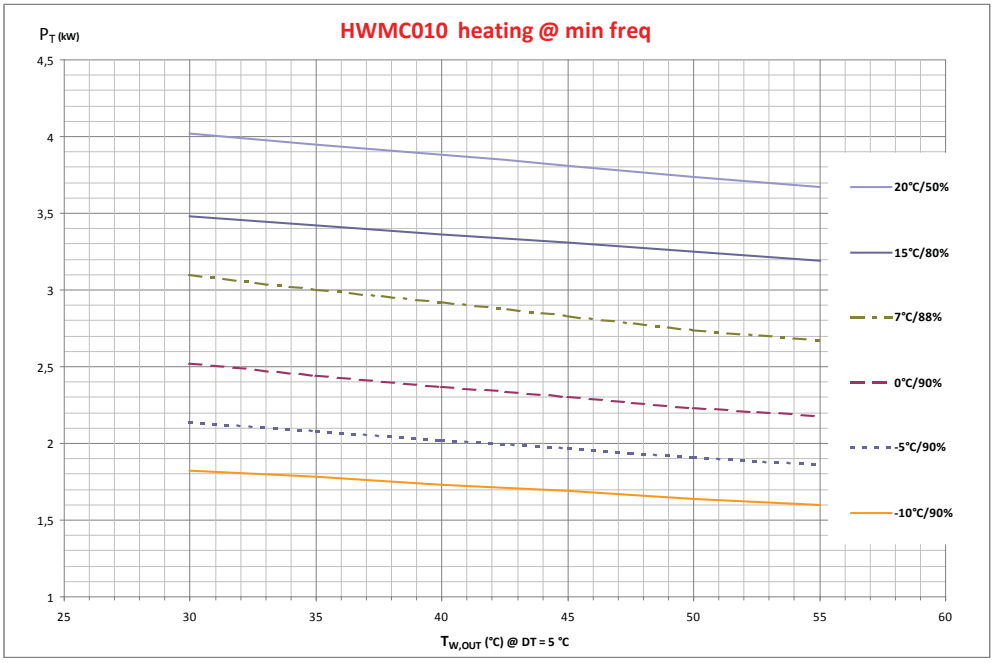

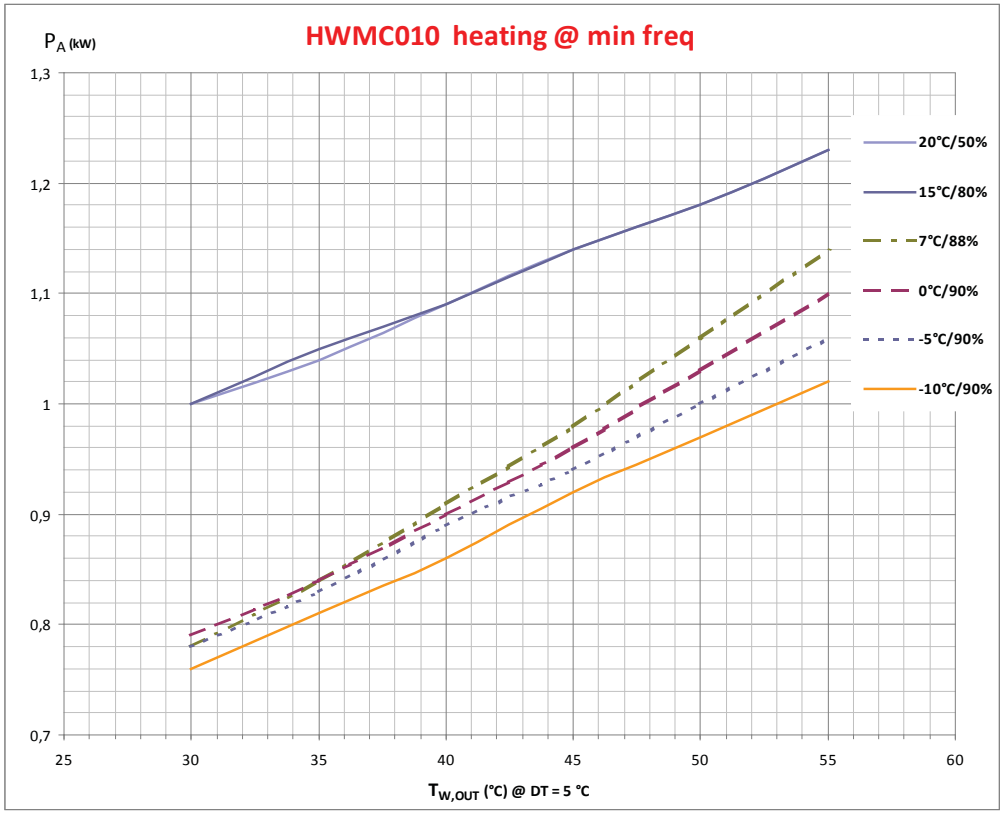

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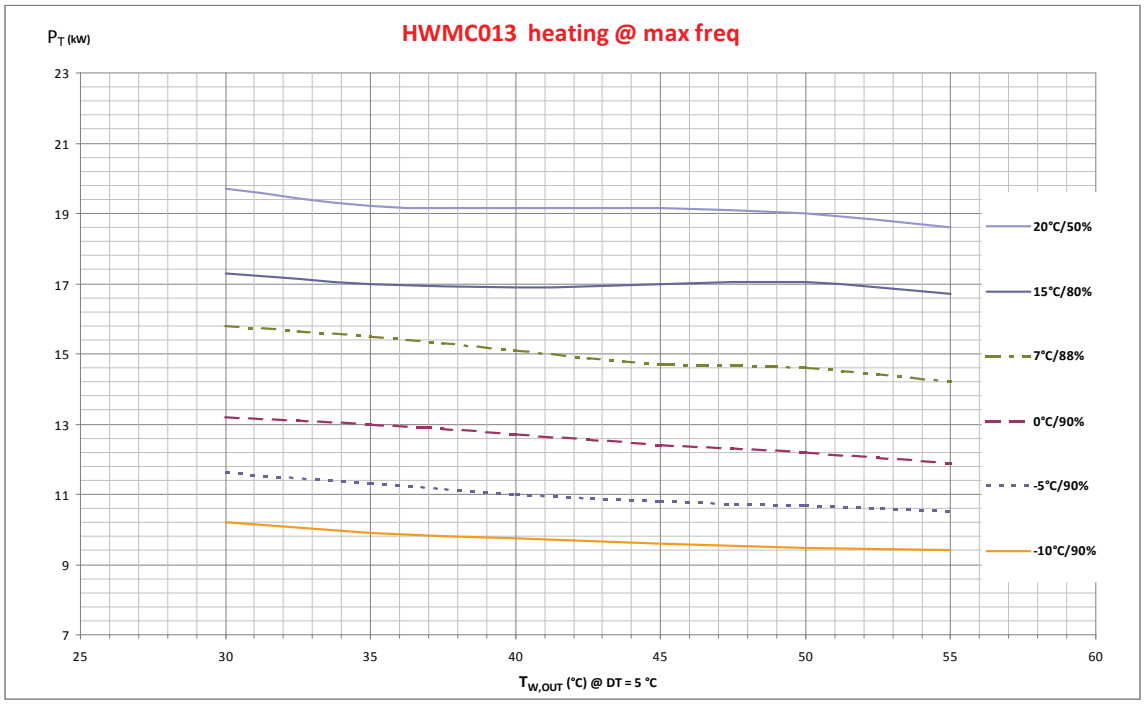

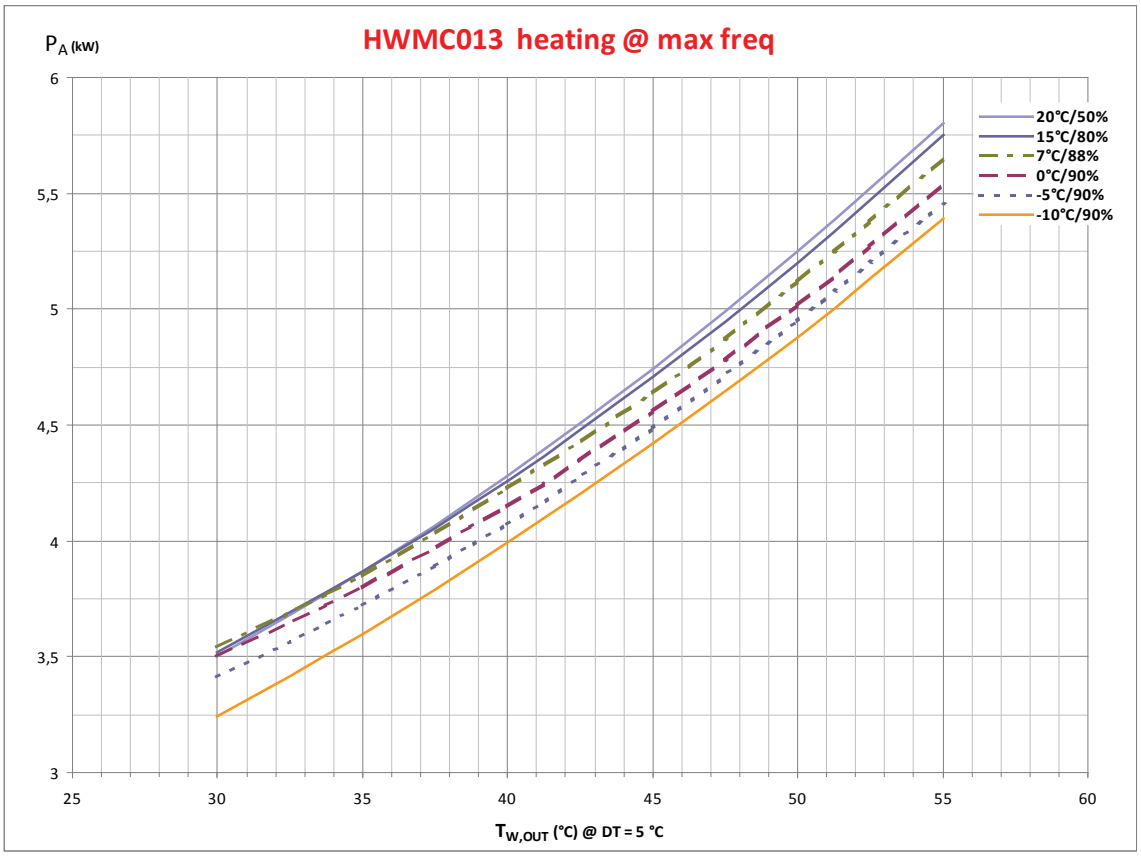

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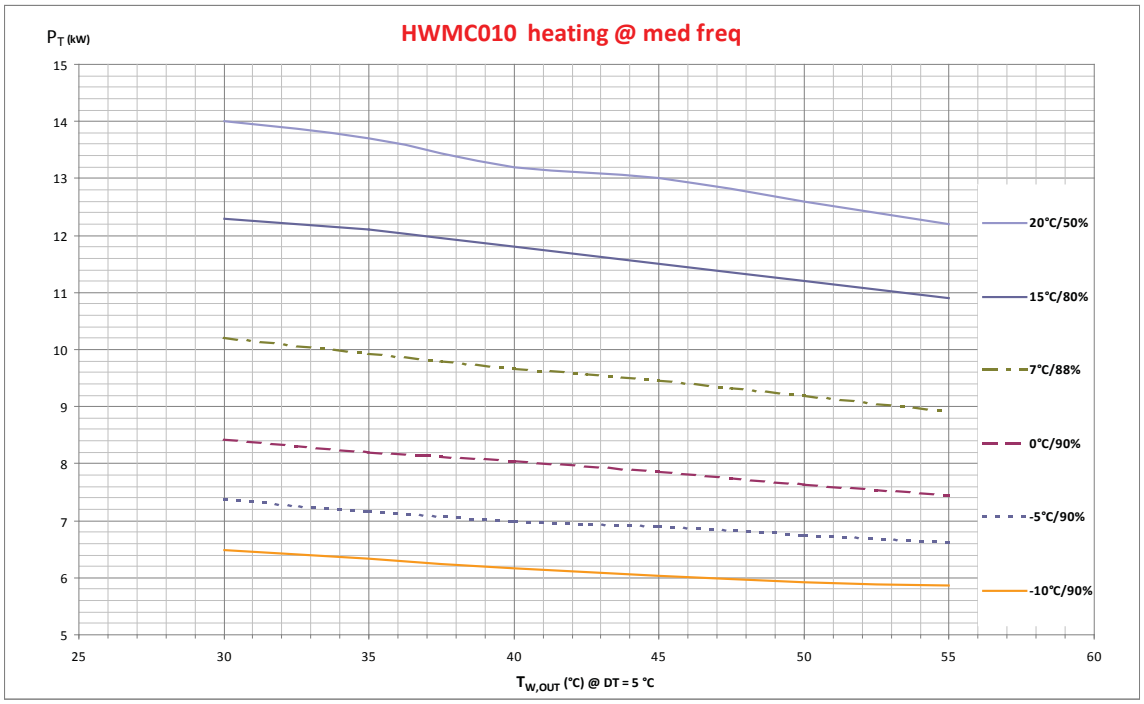

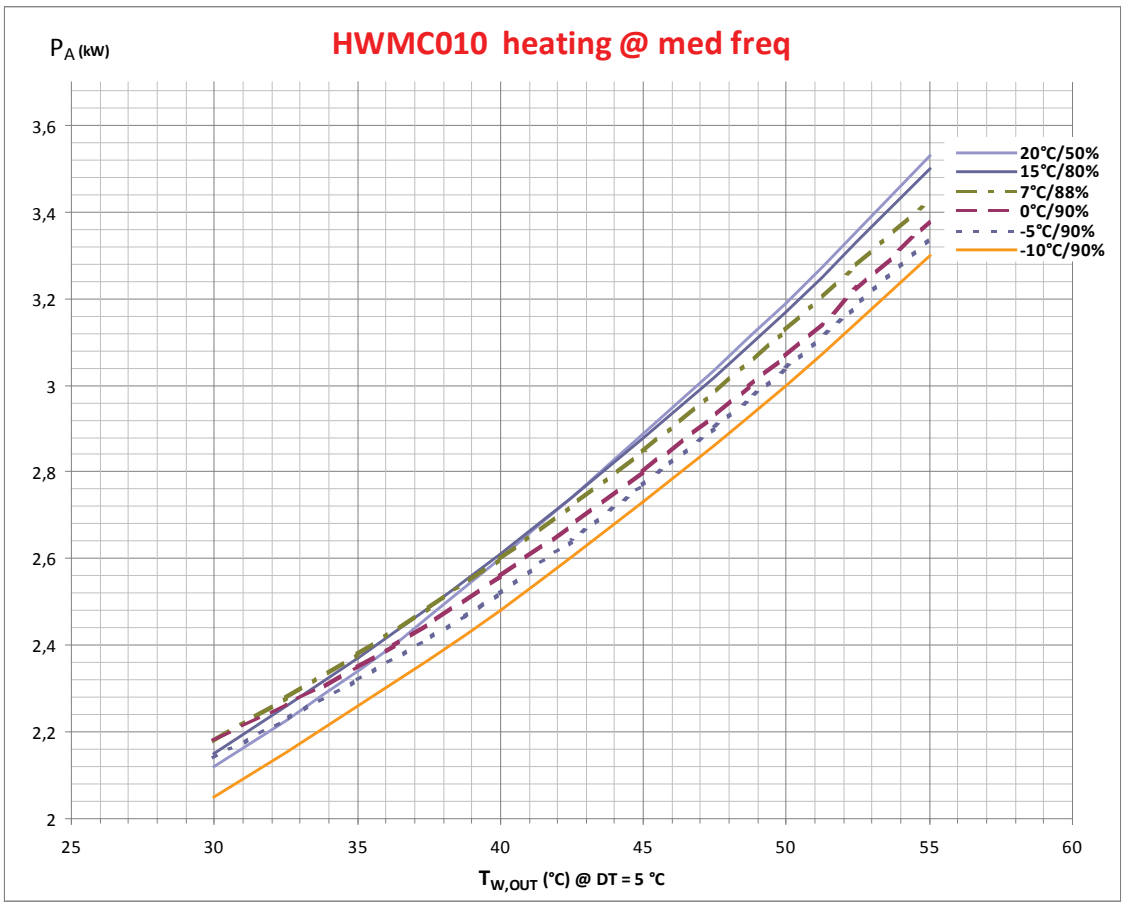

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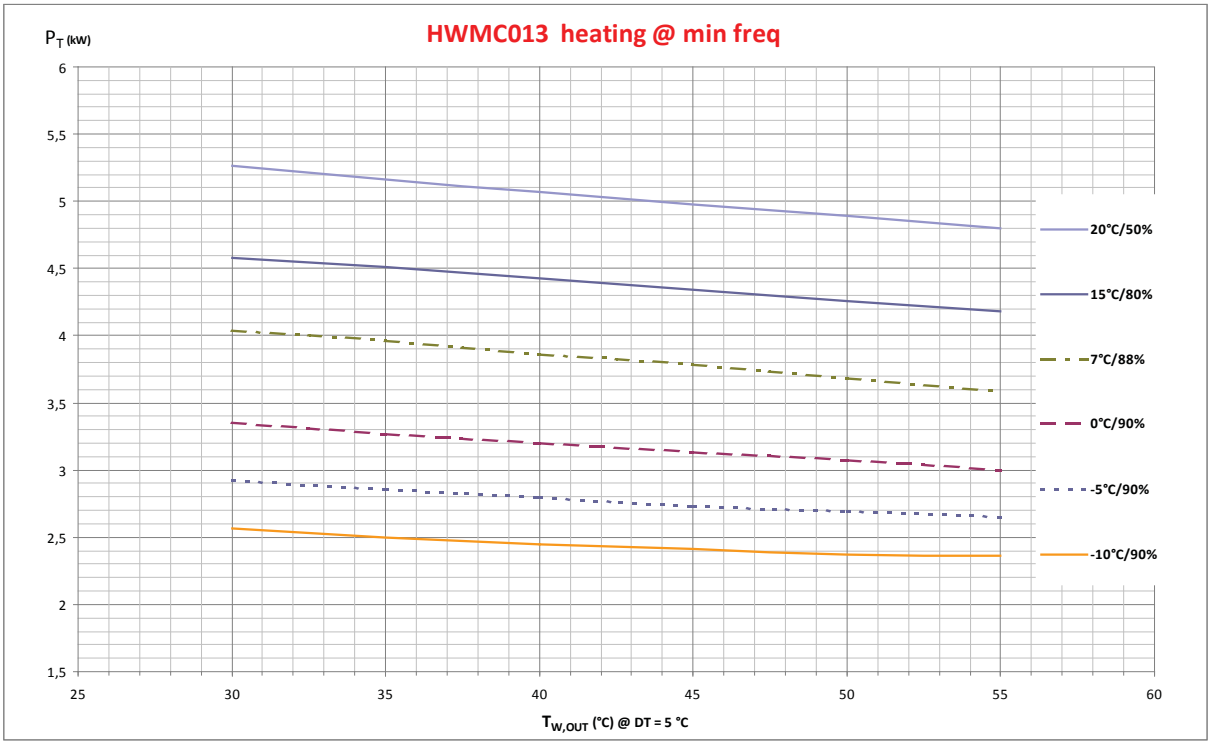

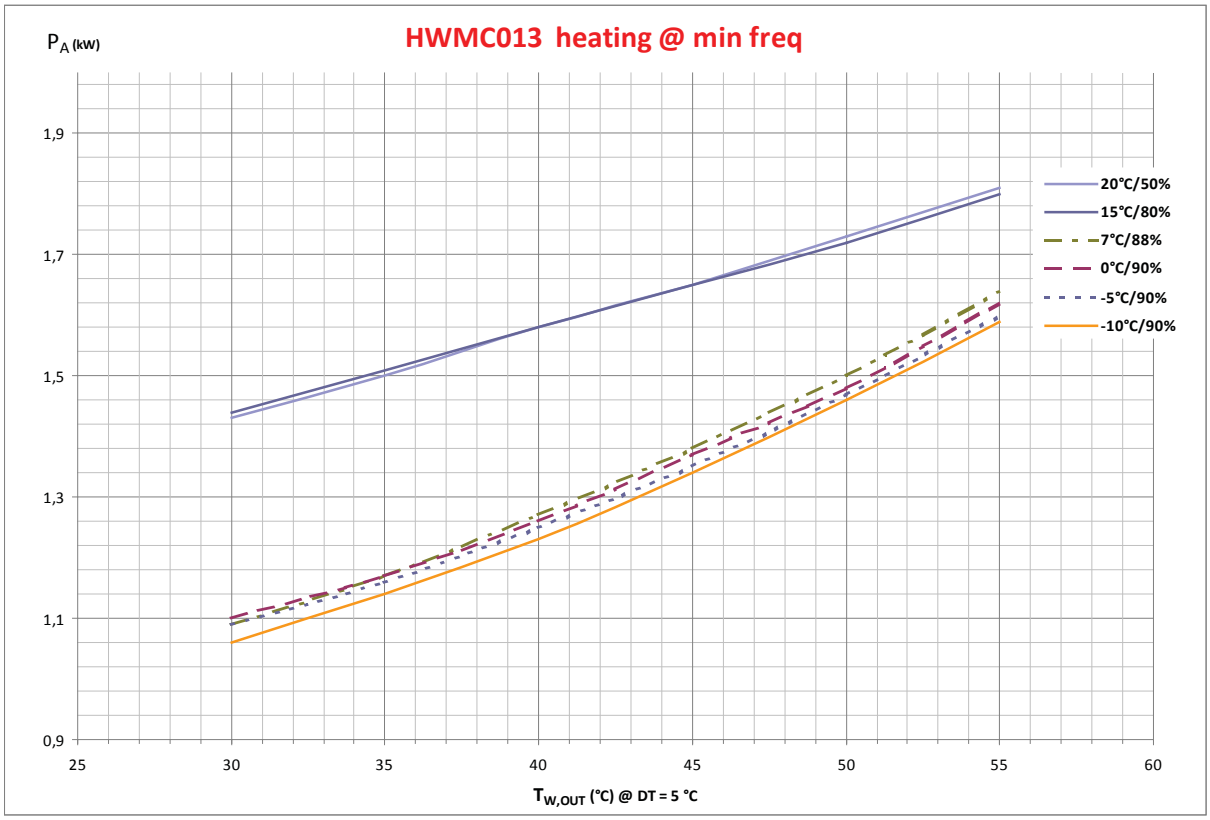

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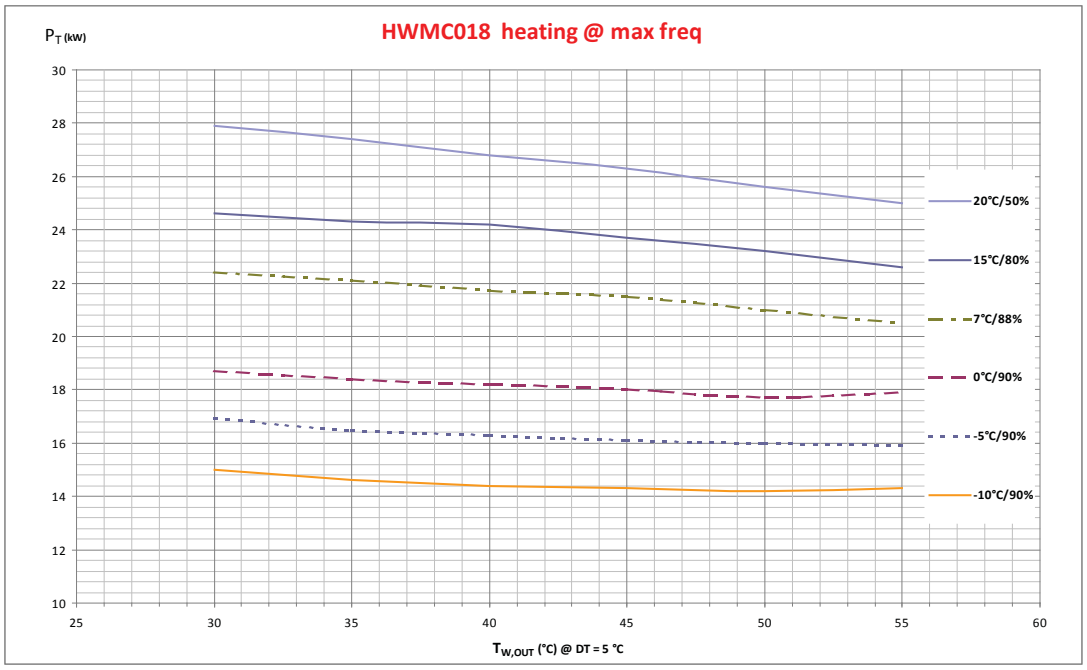

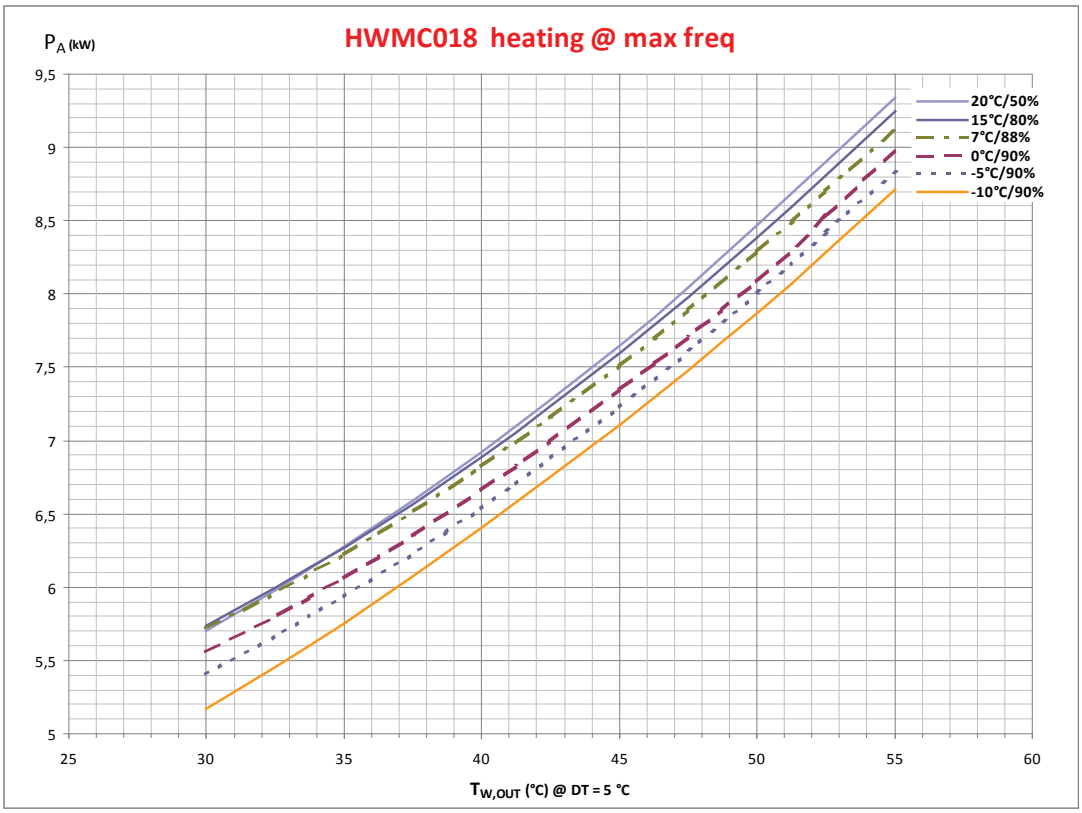

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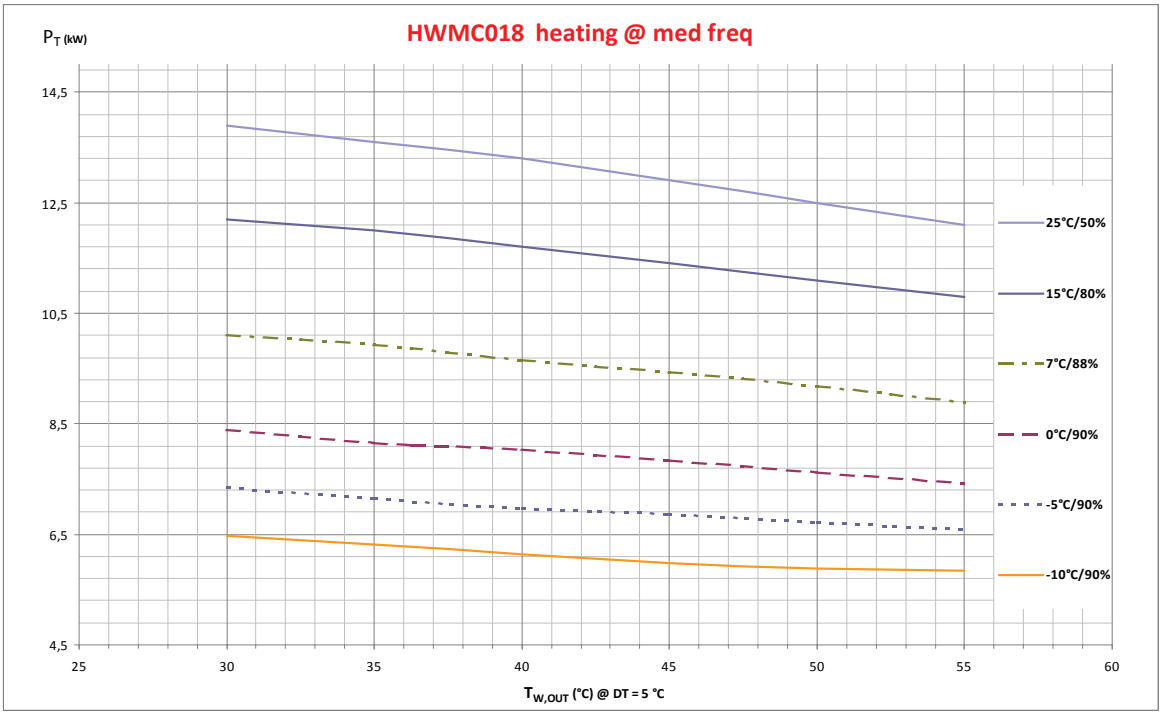

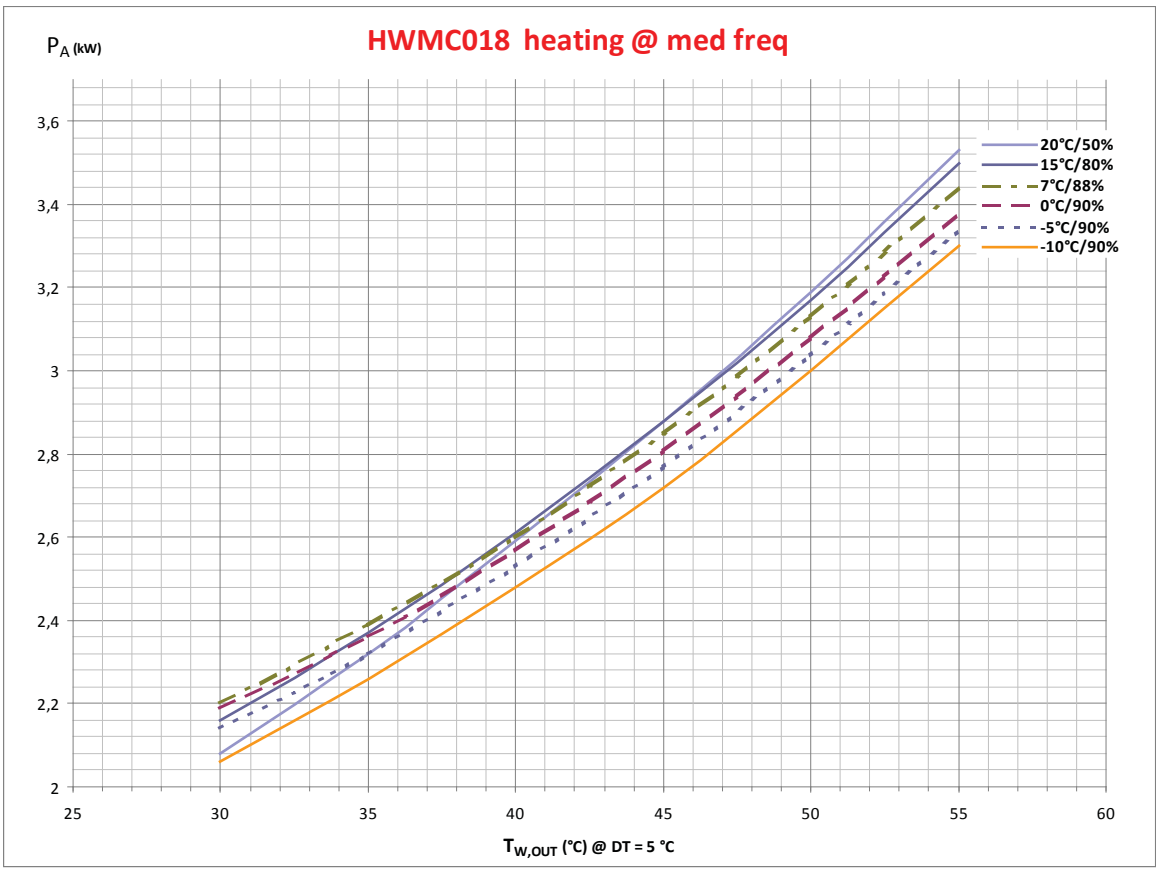

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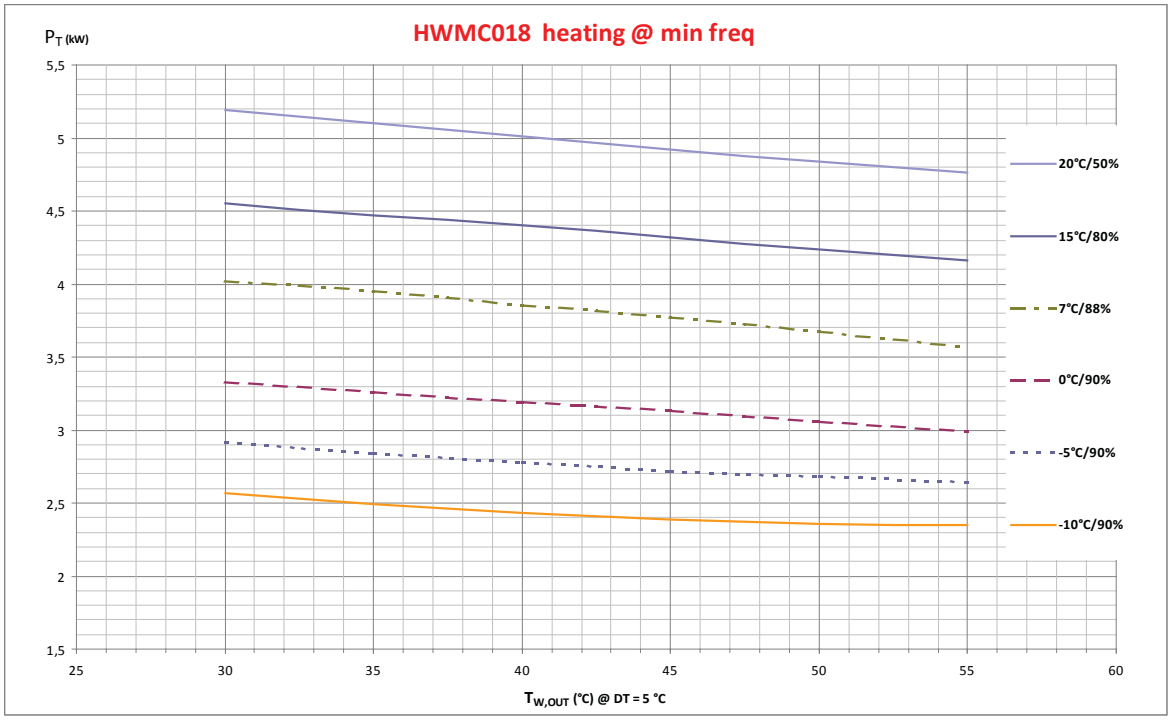

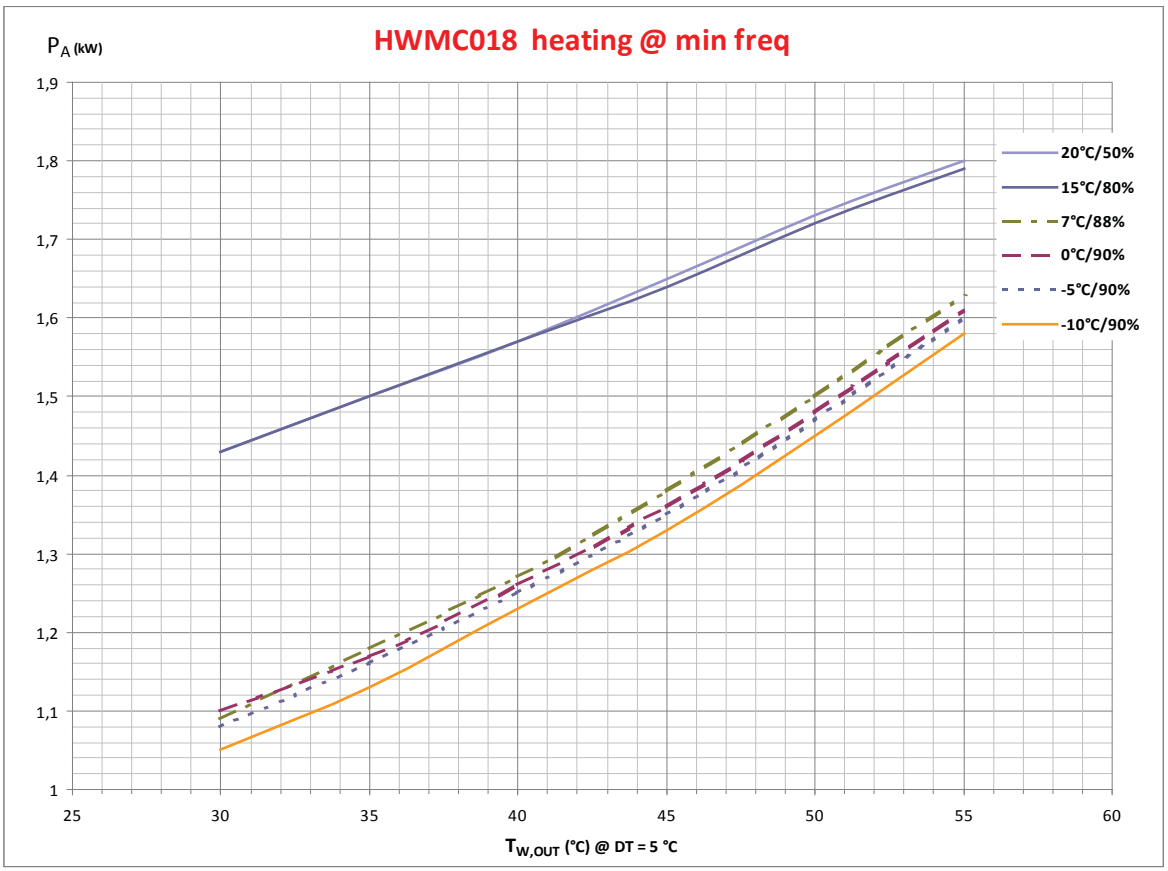

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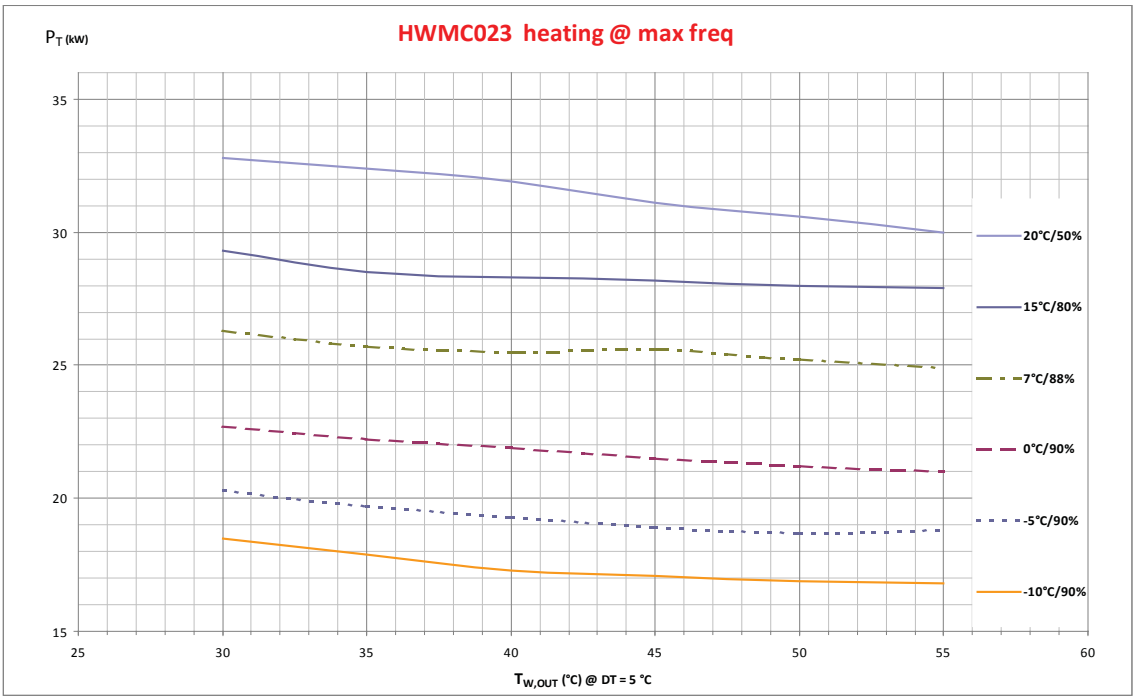

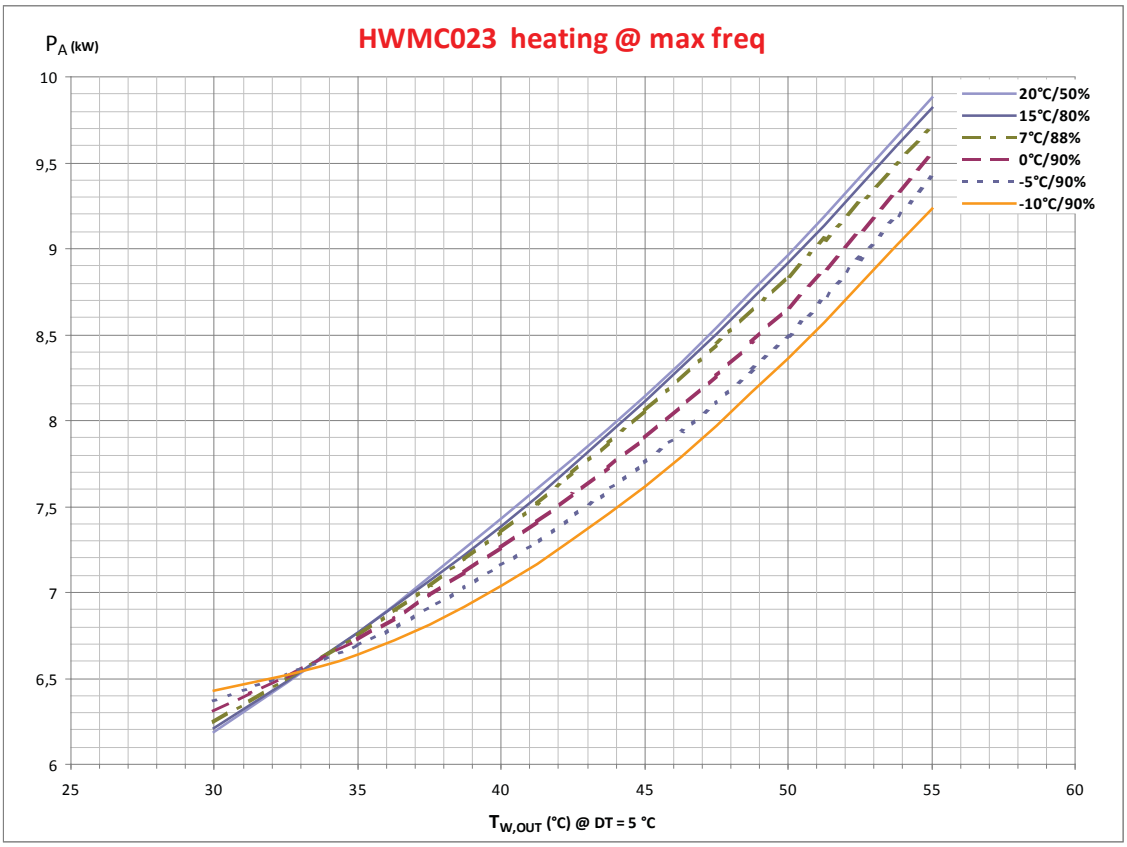

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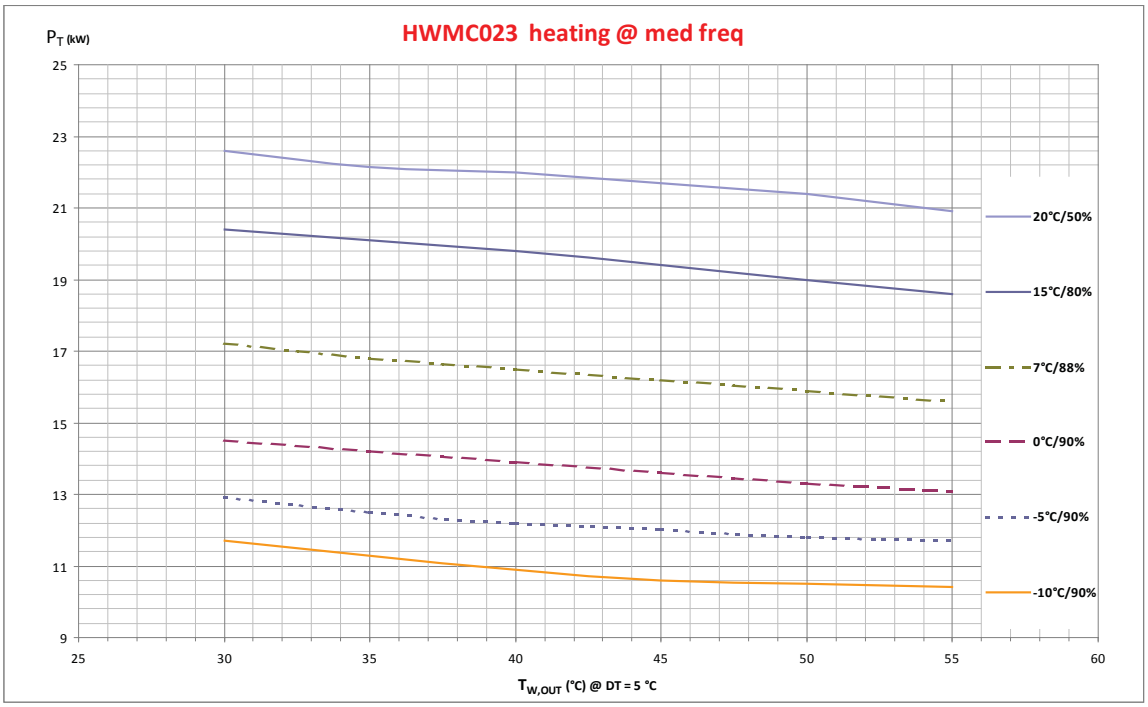

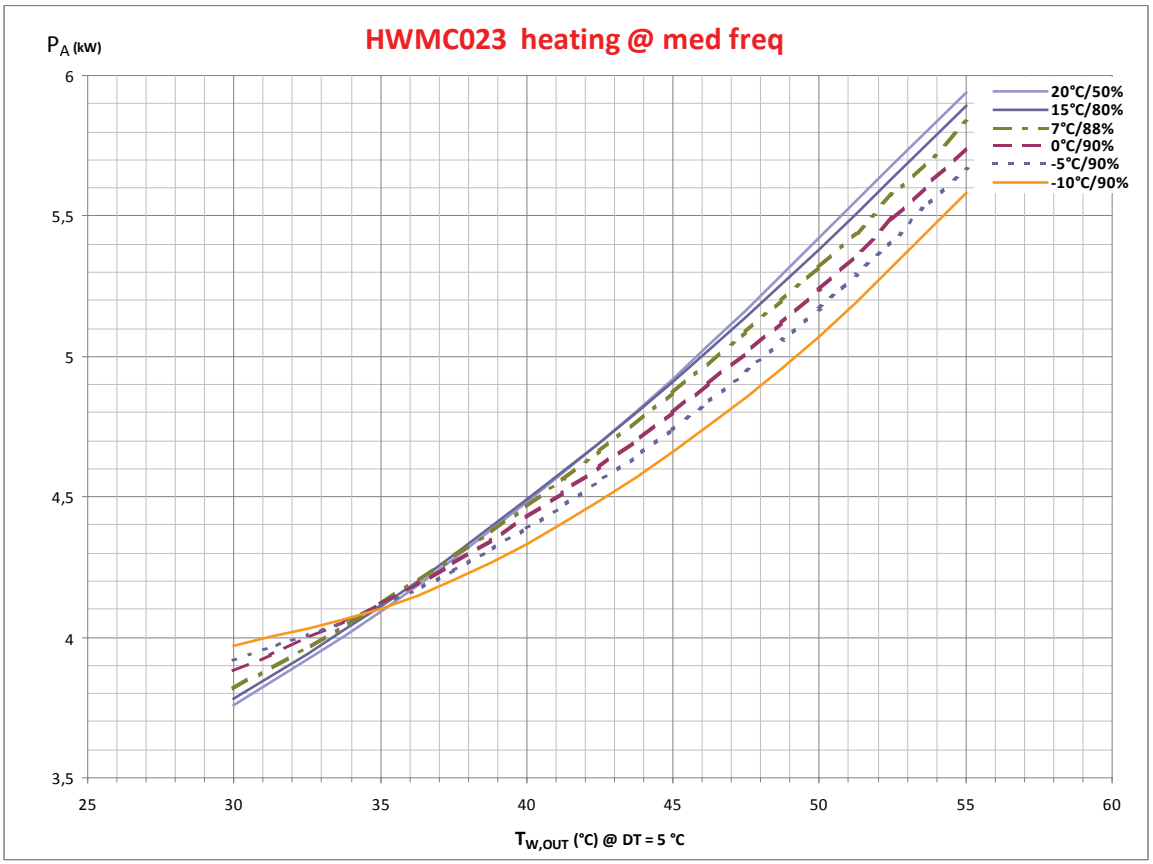

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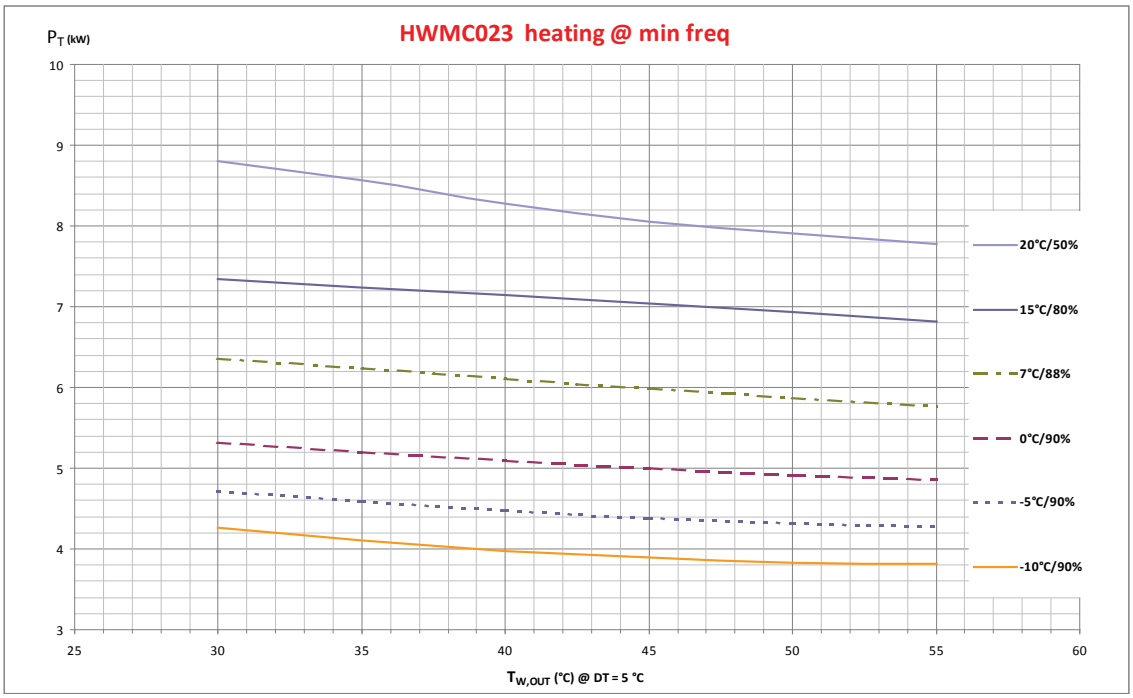

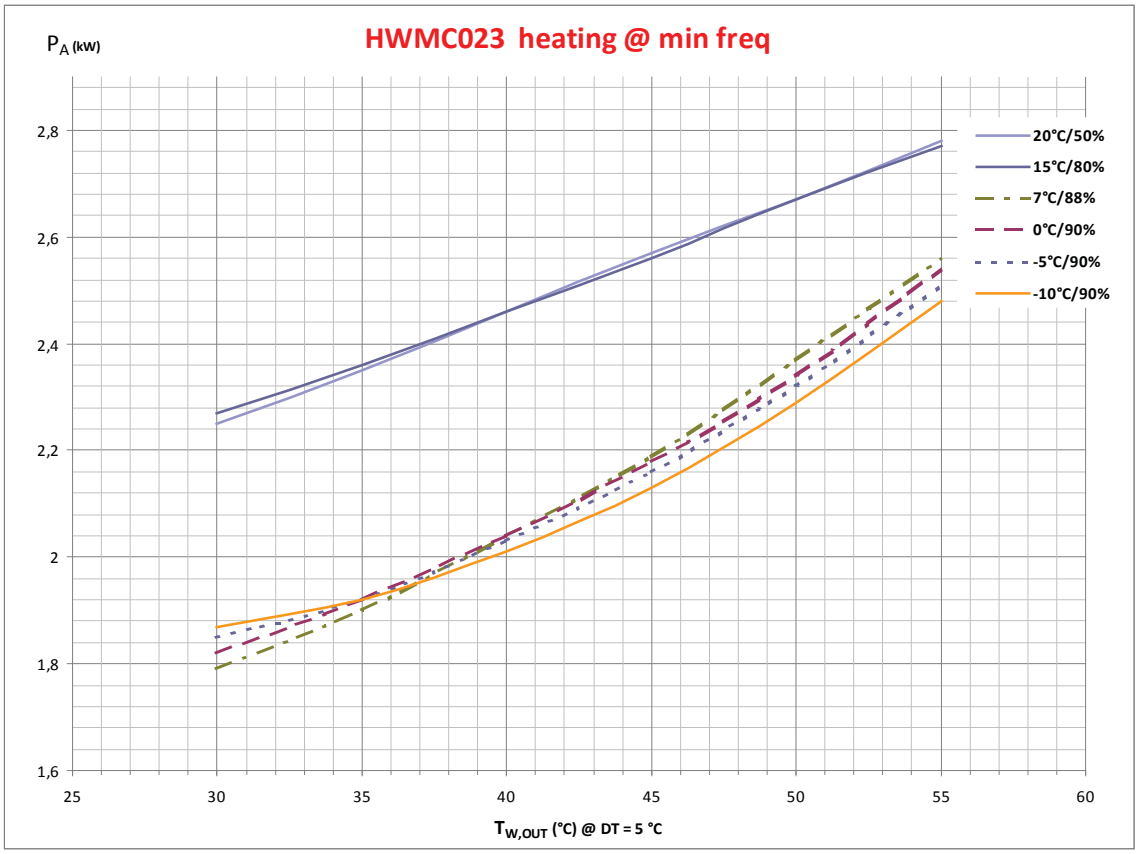

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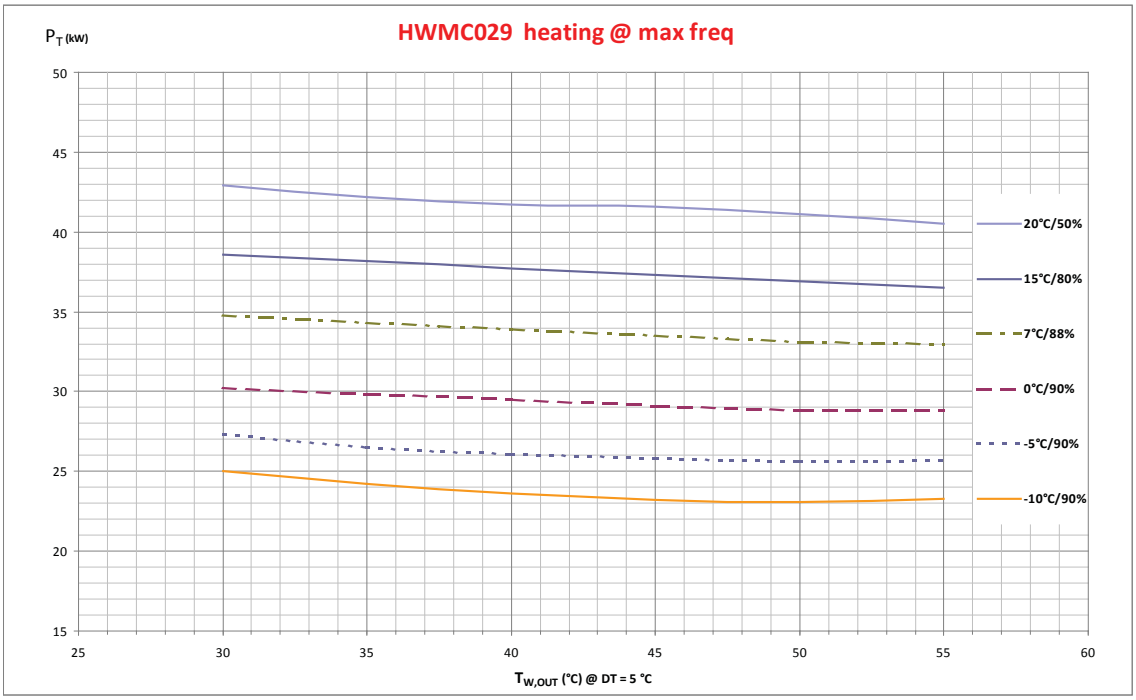

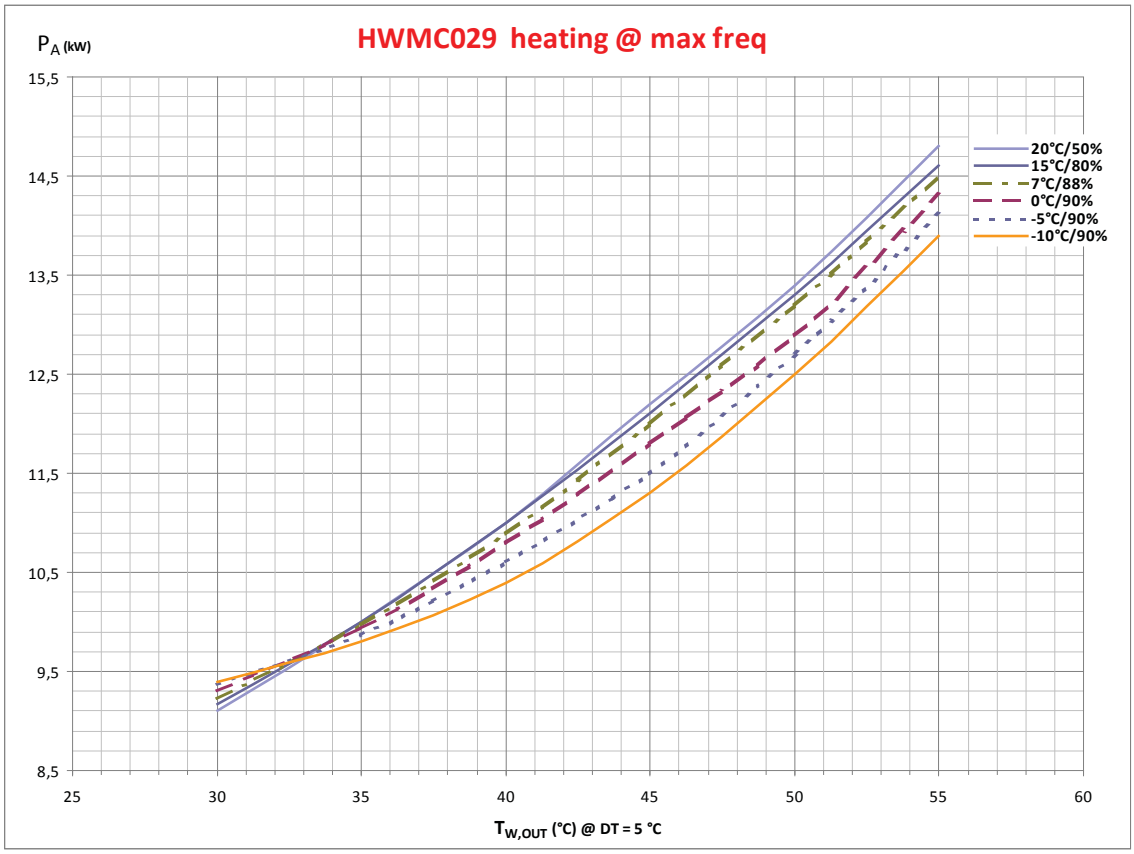

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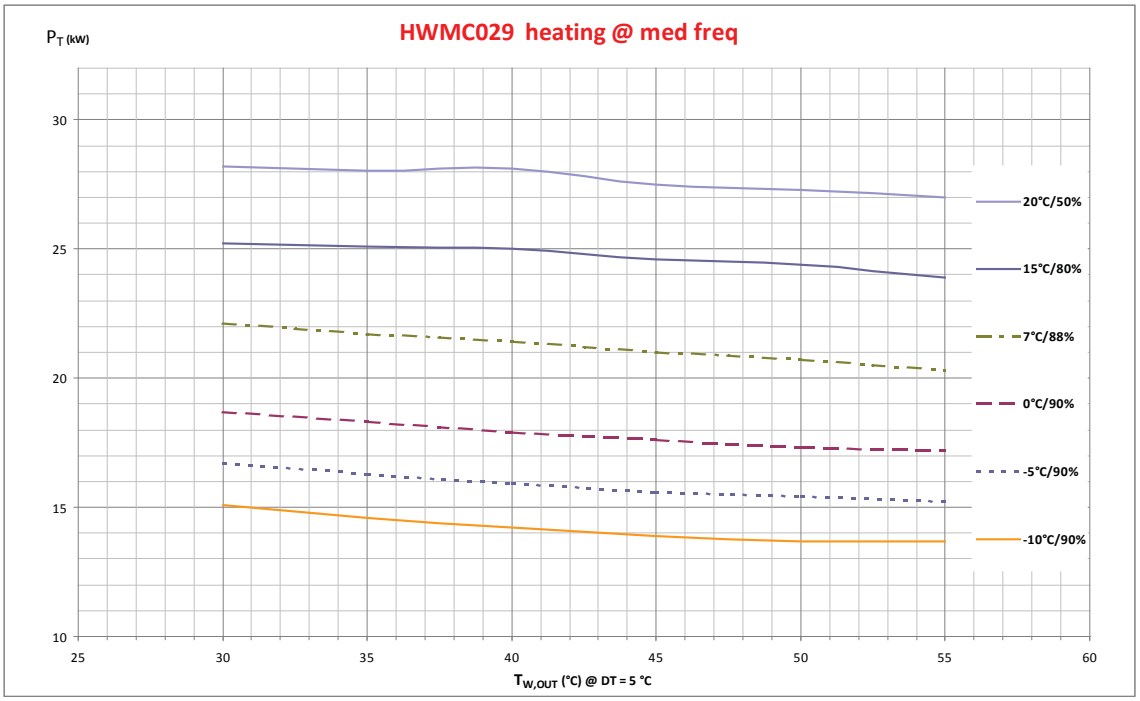

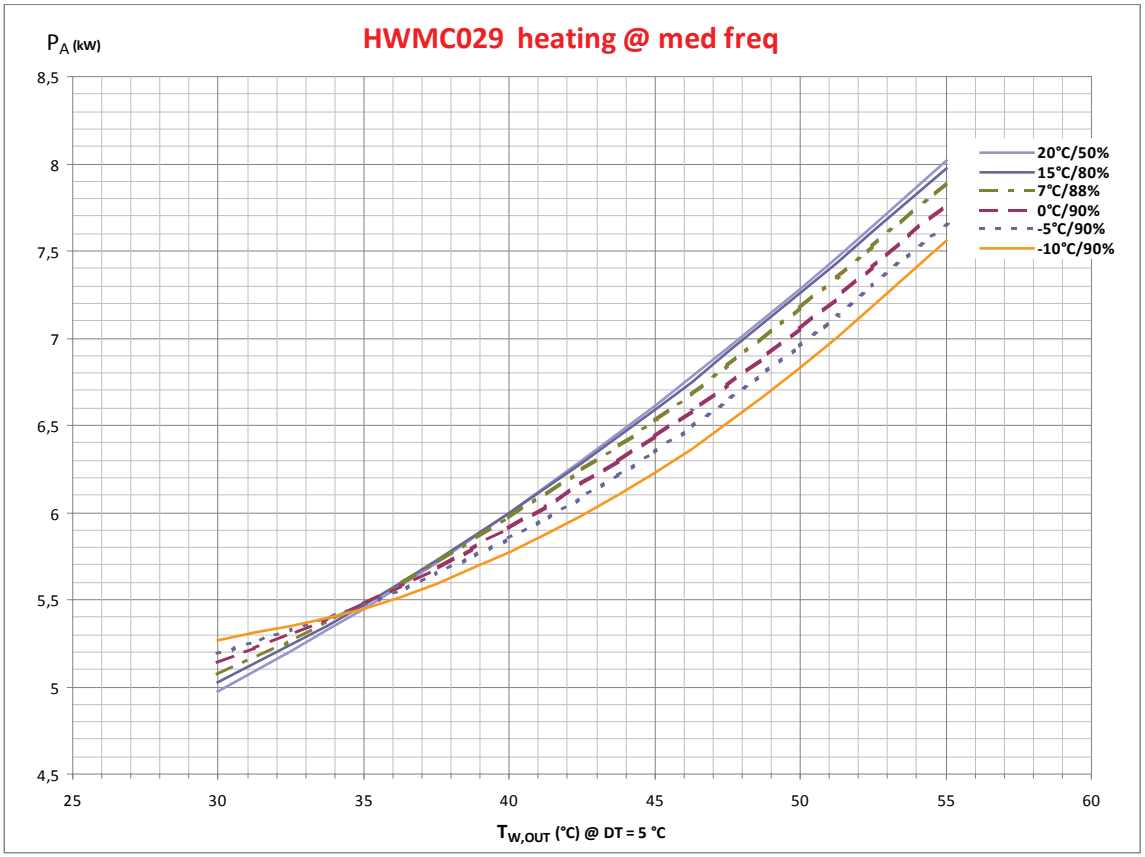

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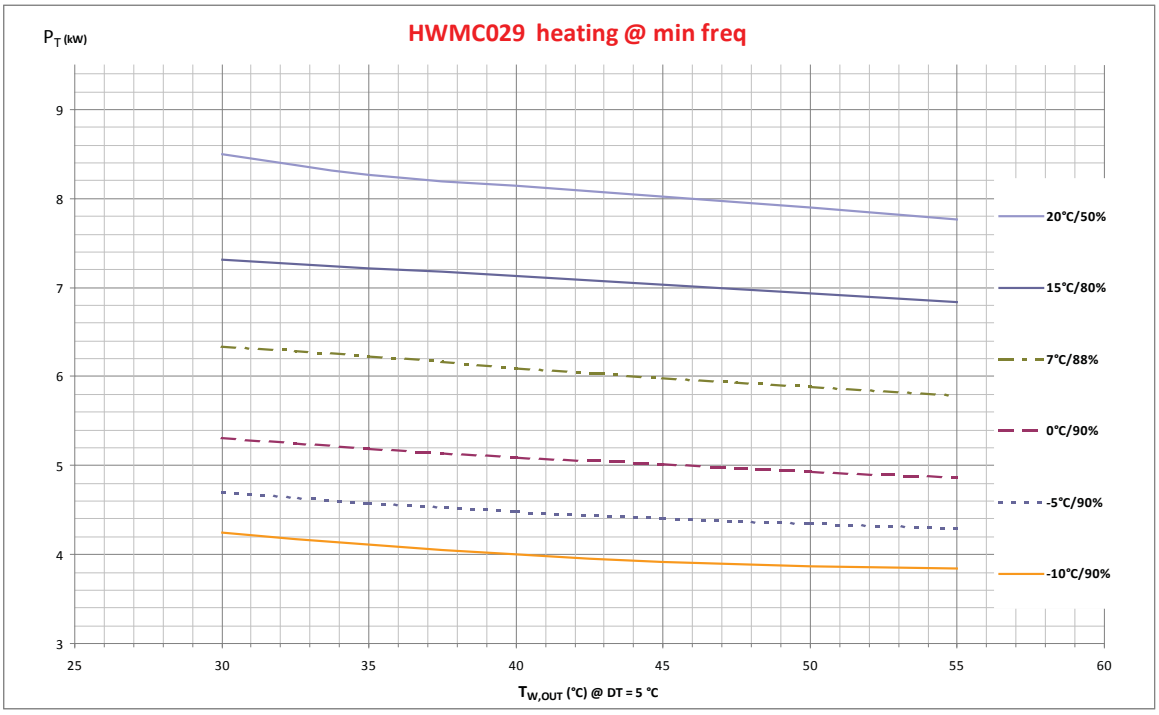

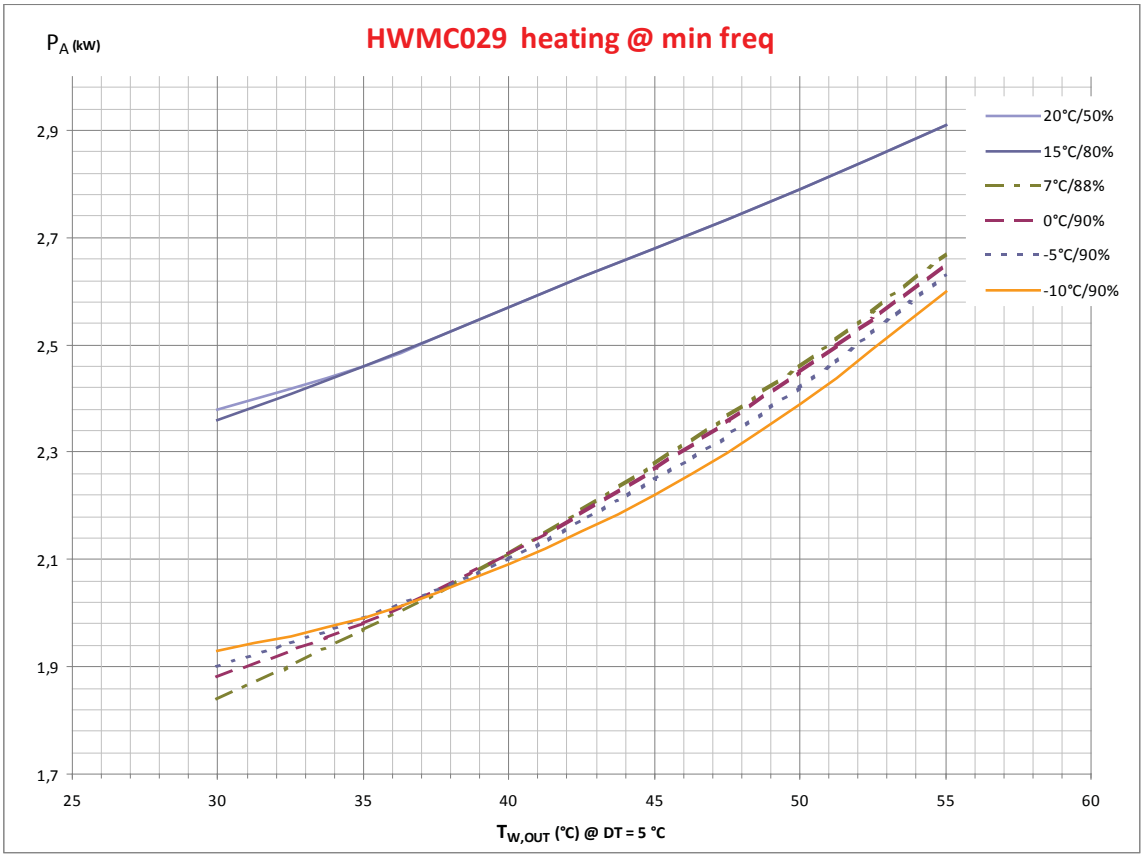

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5 PERFORMANCES

5.2 COOLING CAPACITIES HWMC

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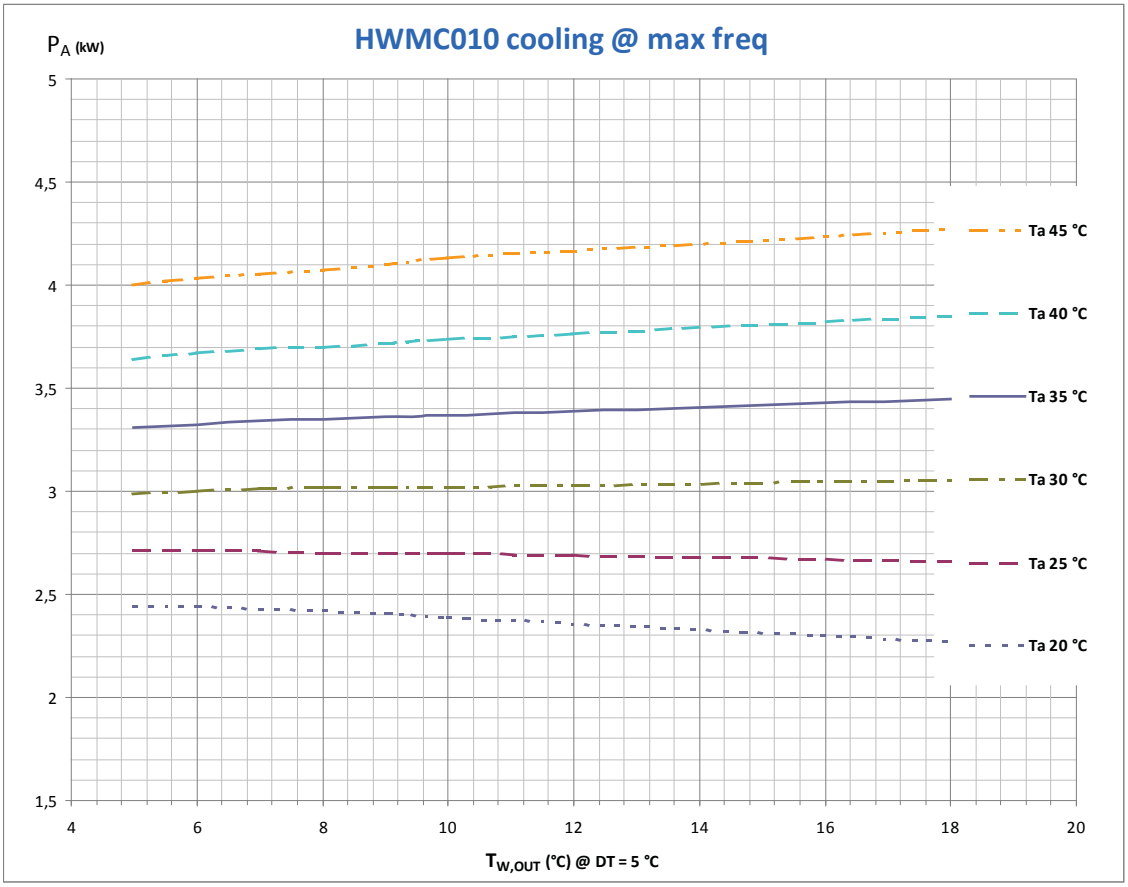

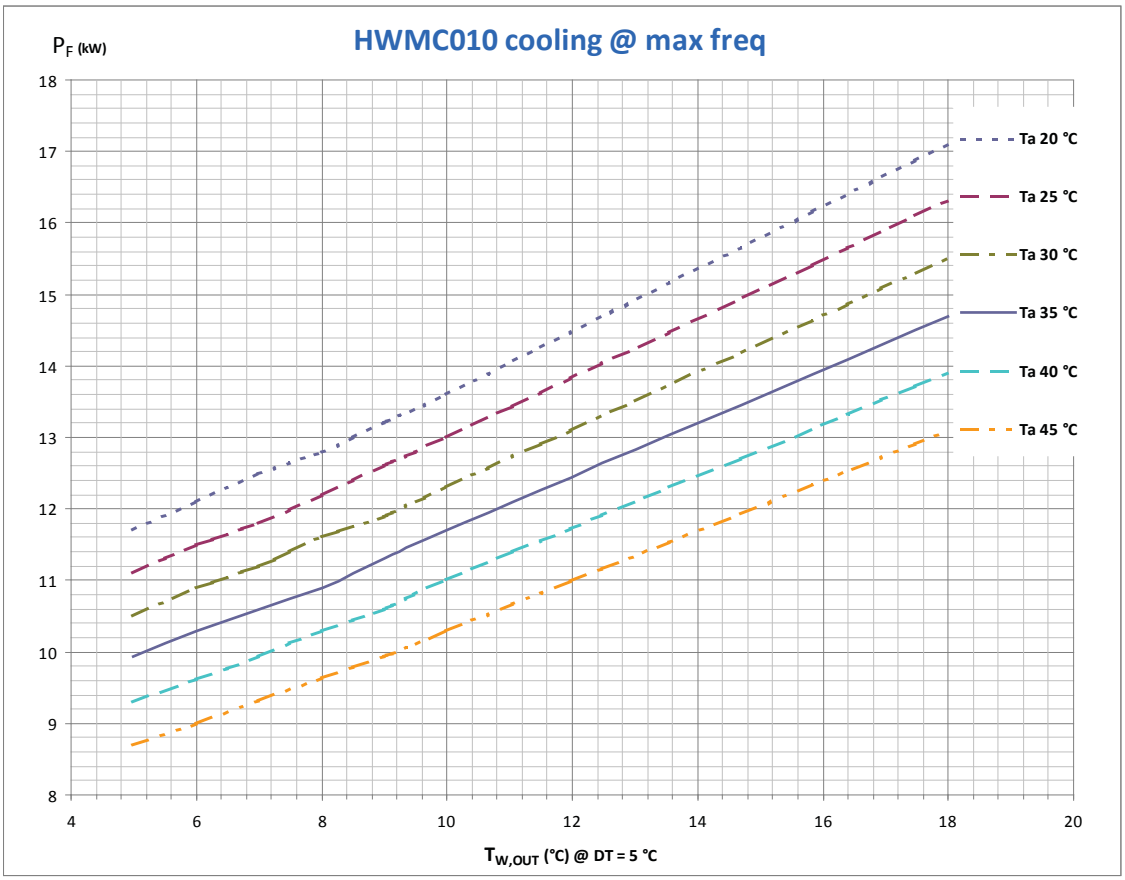

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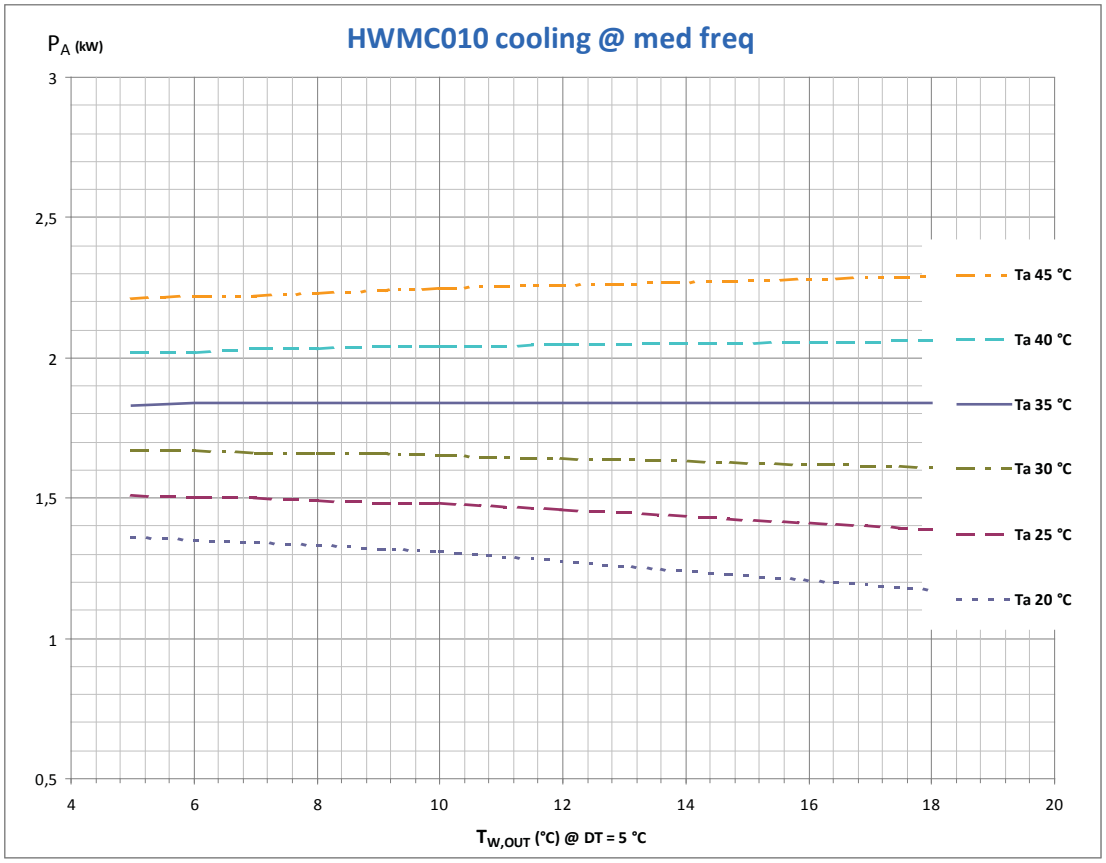

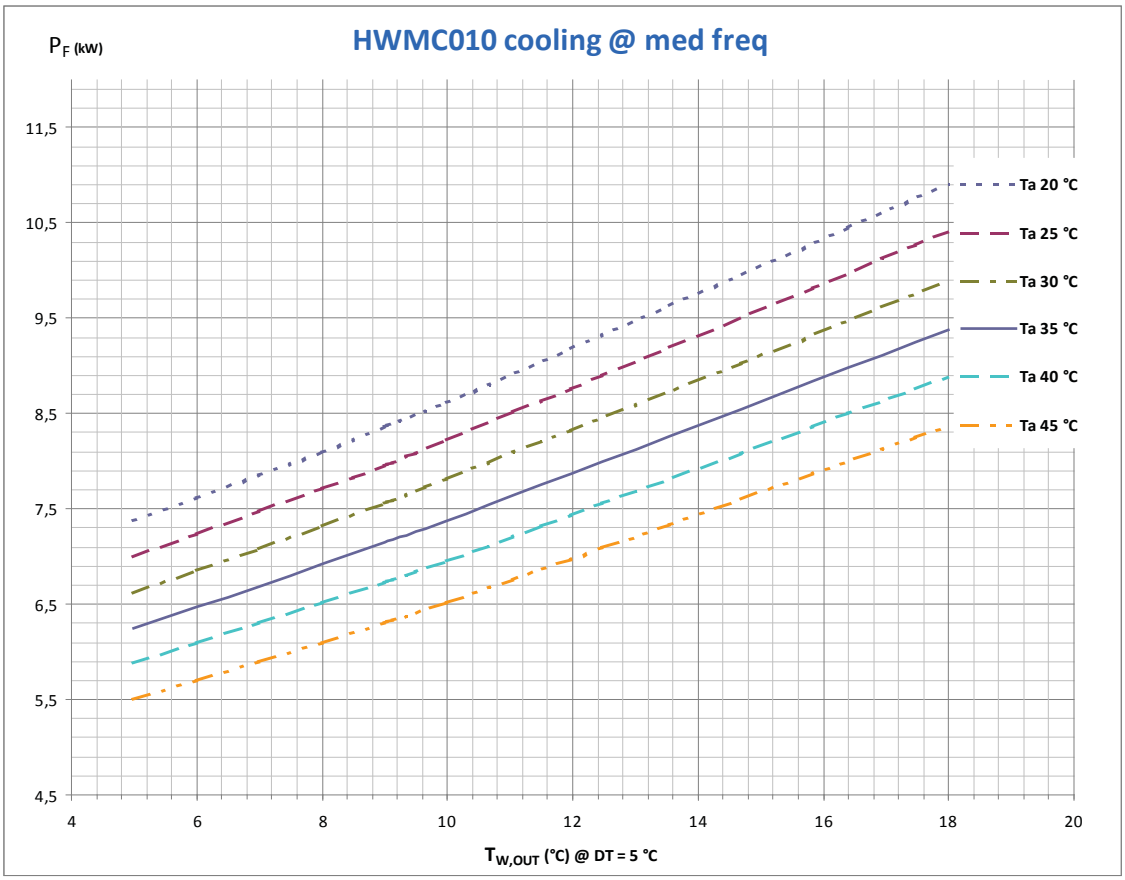

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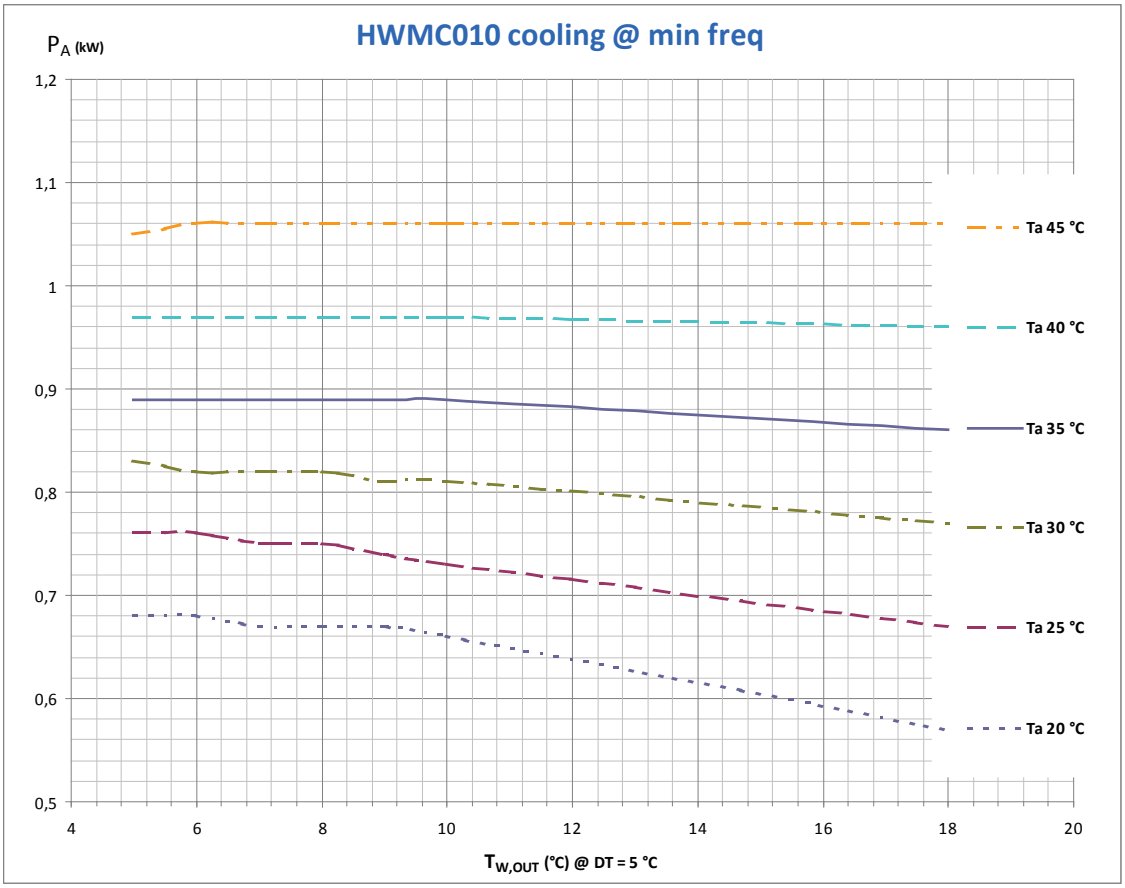

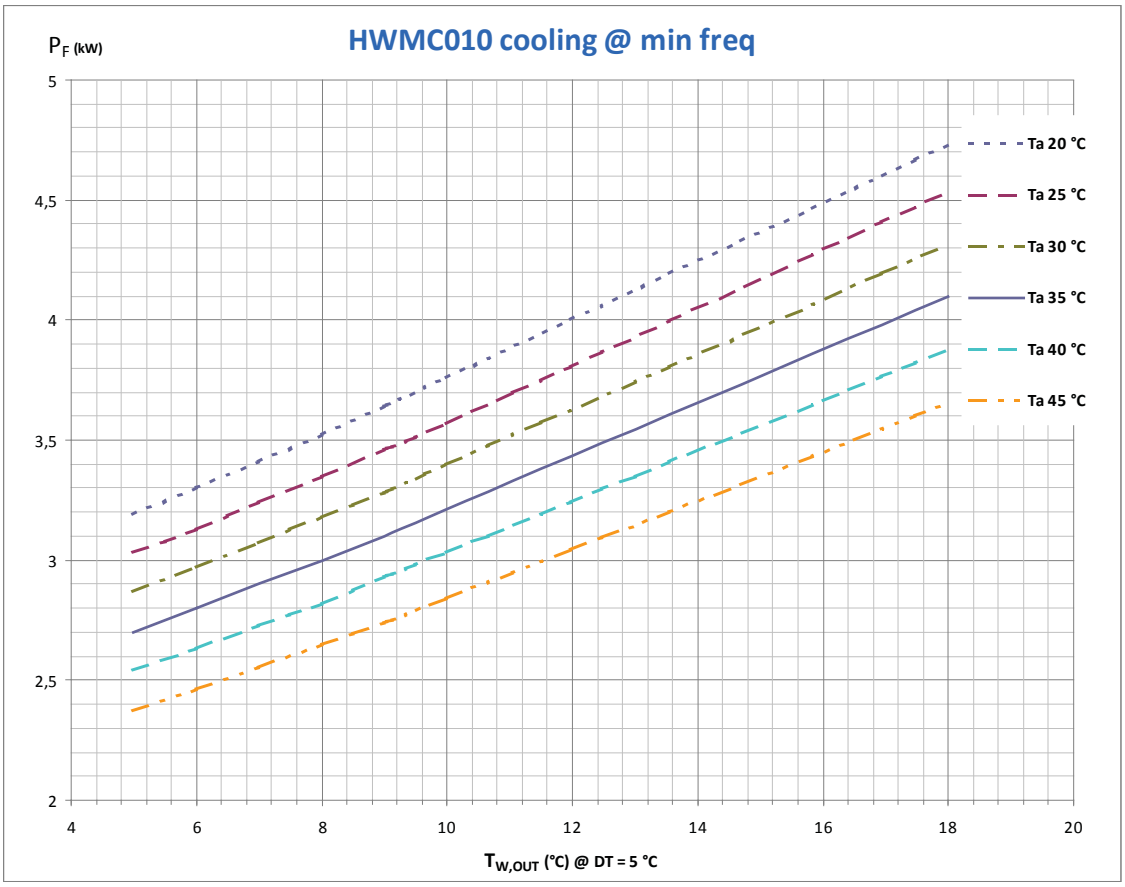

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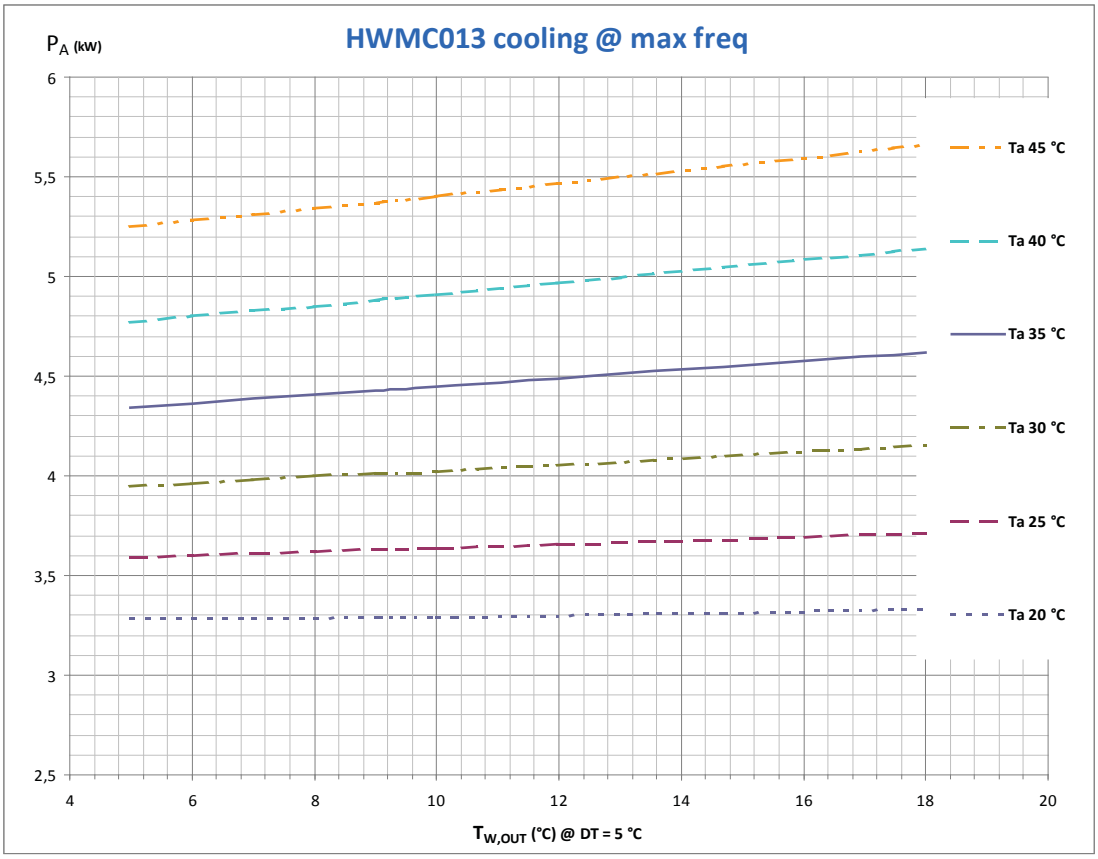

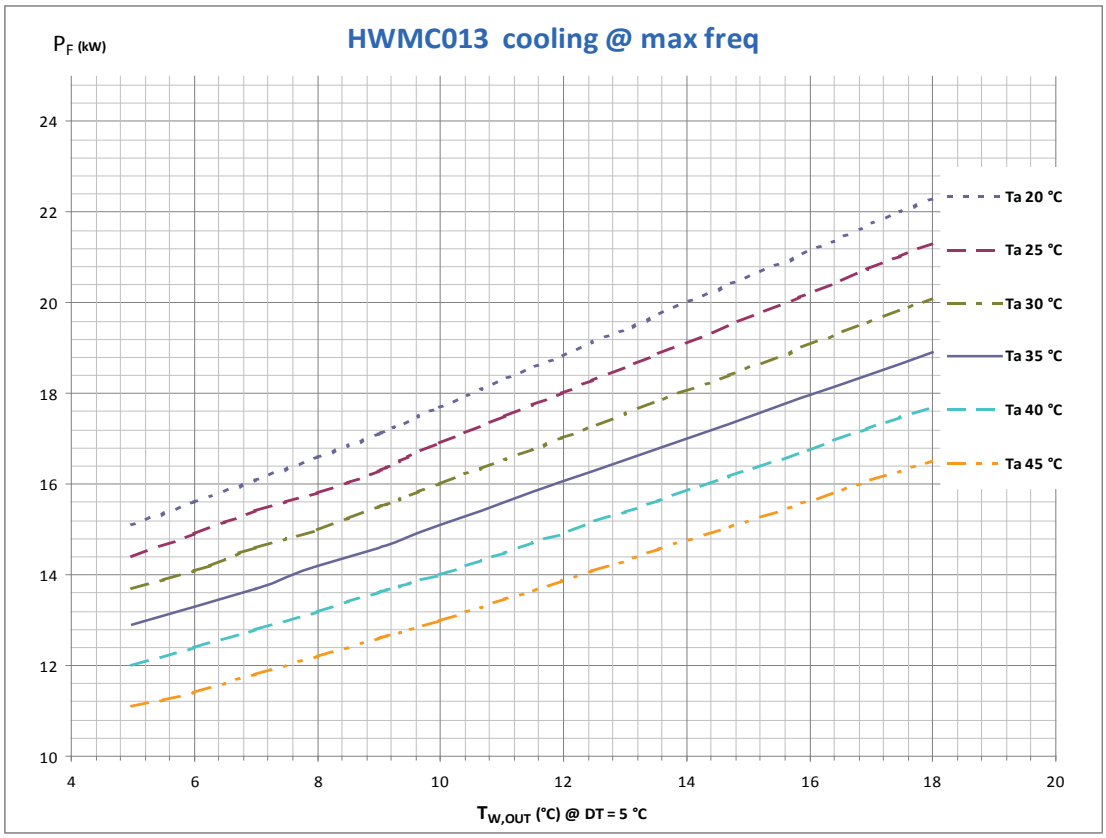

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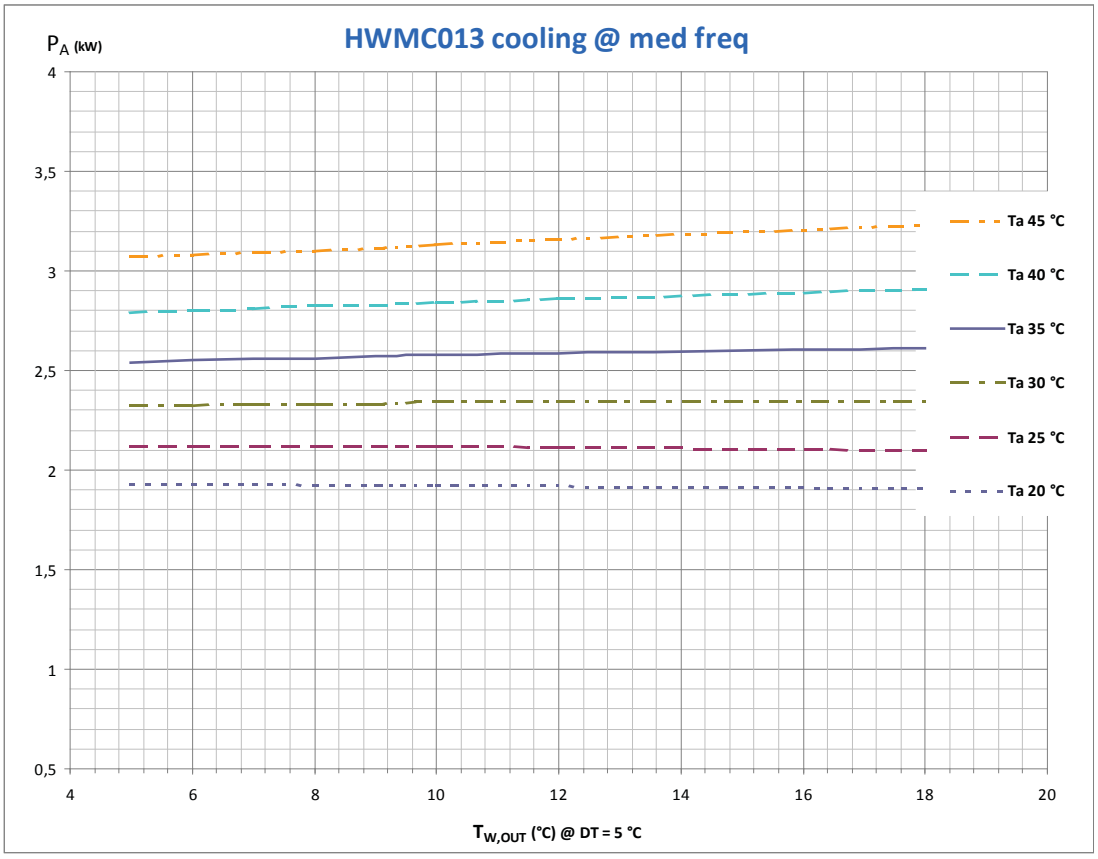

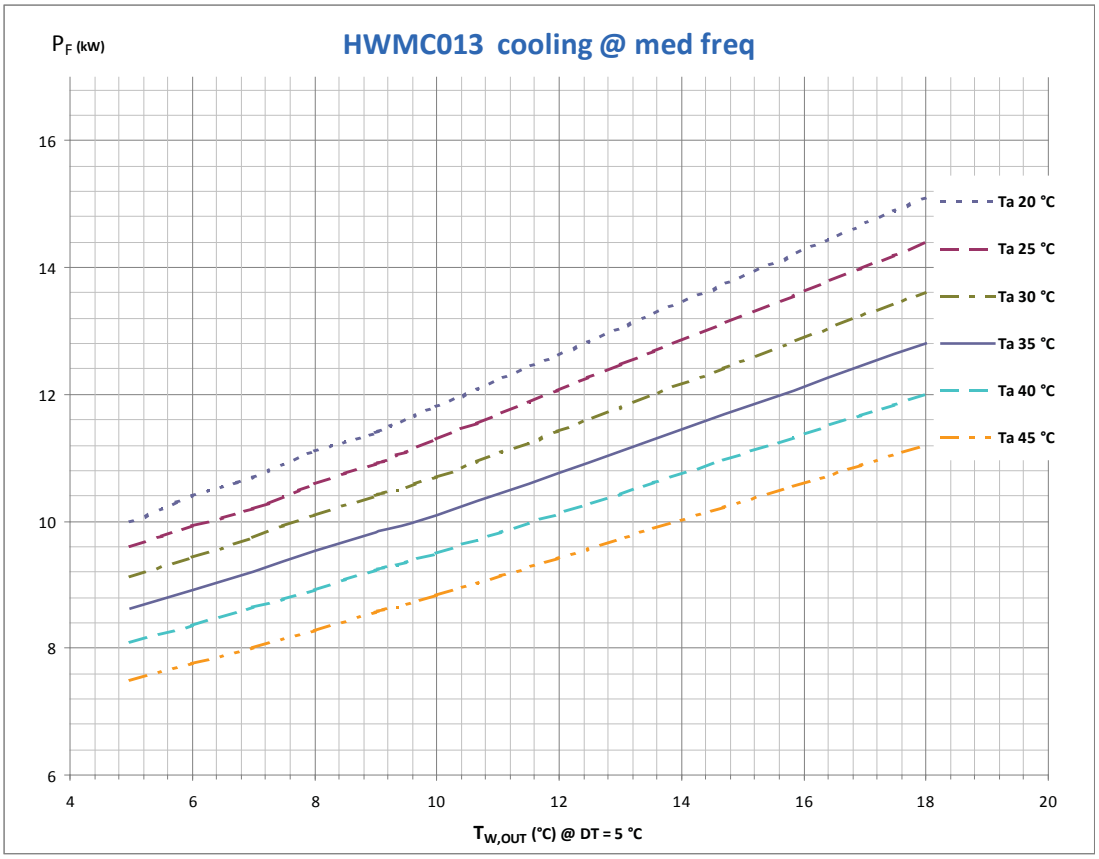

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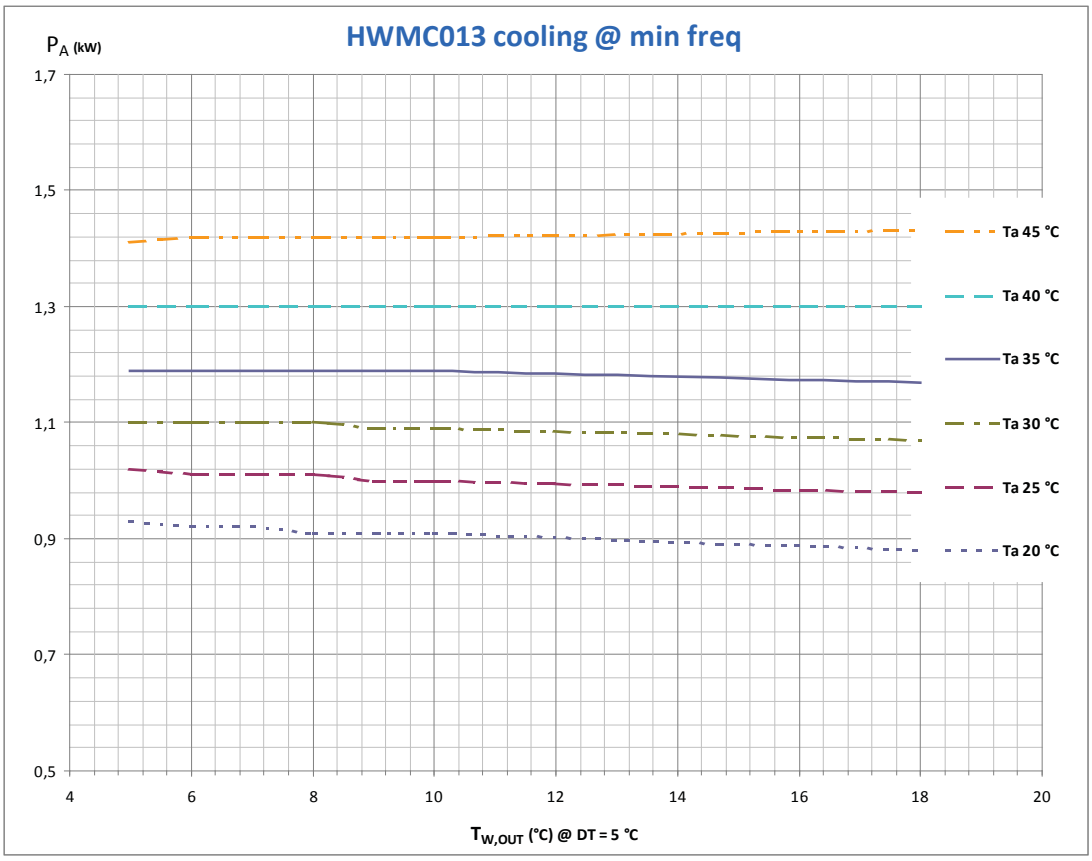

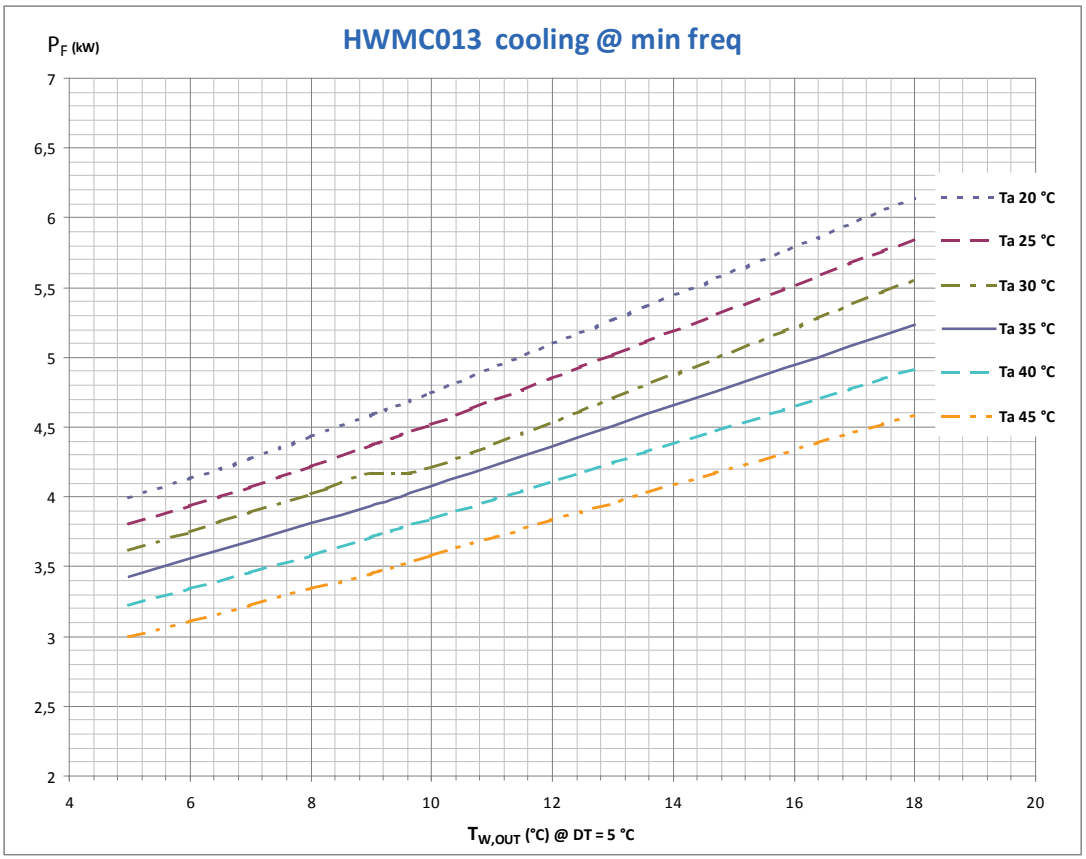

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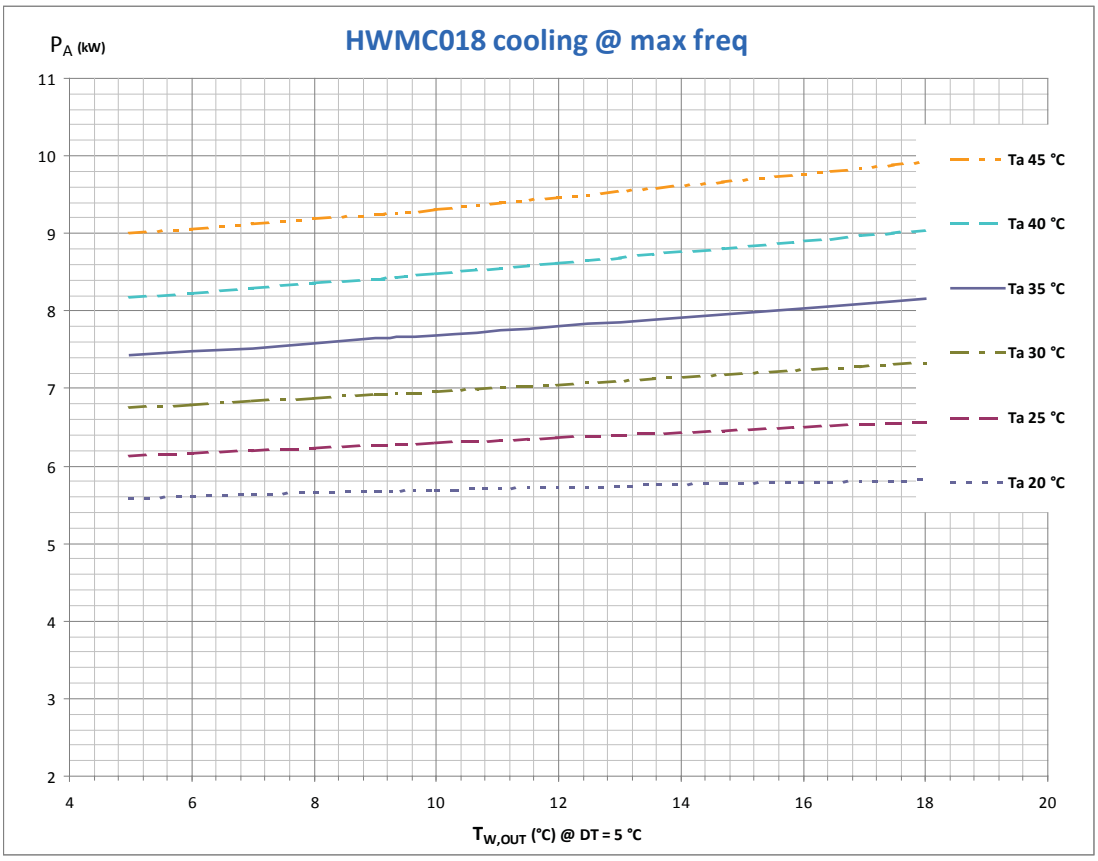

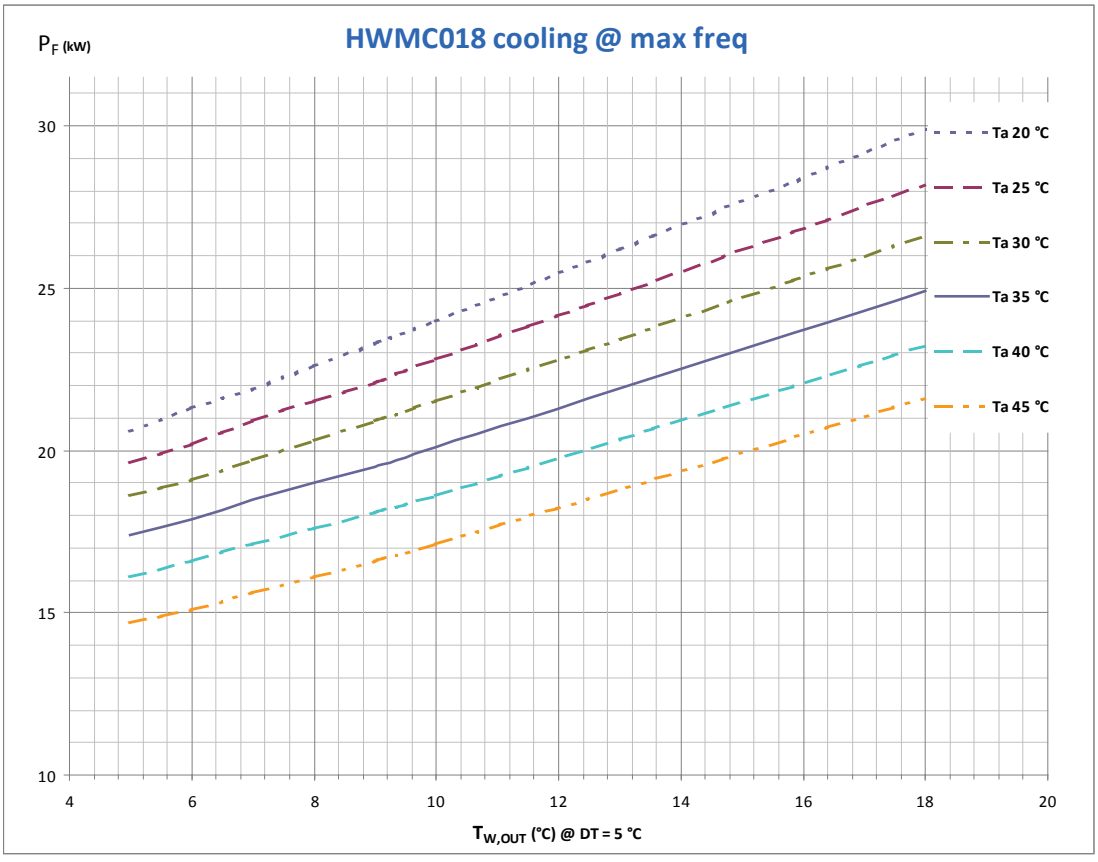

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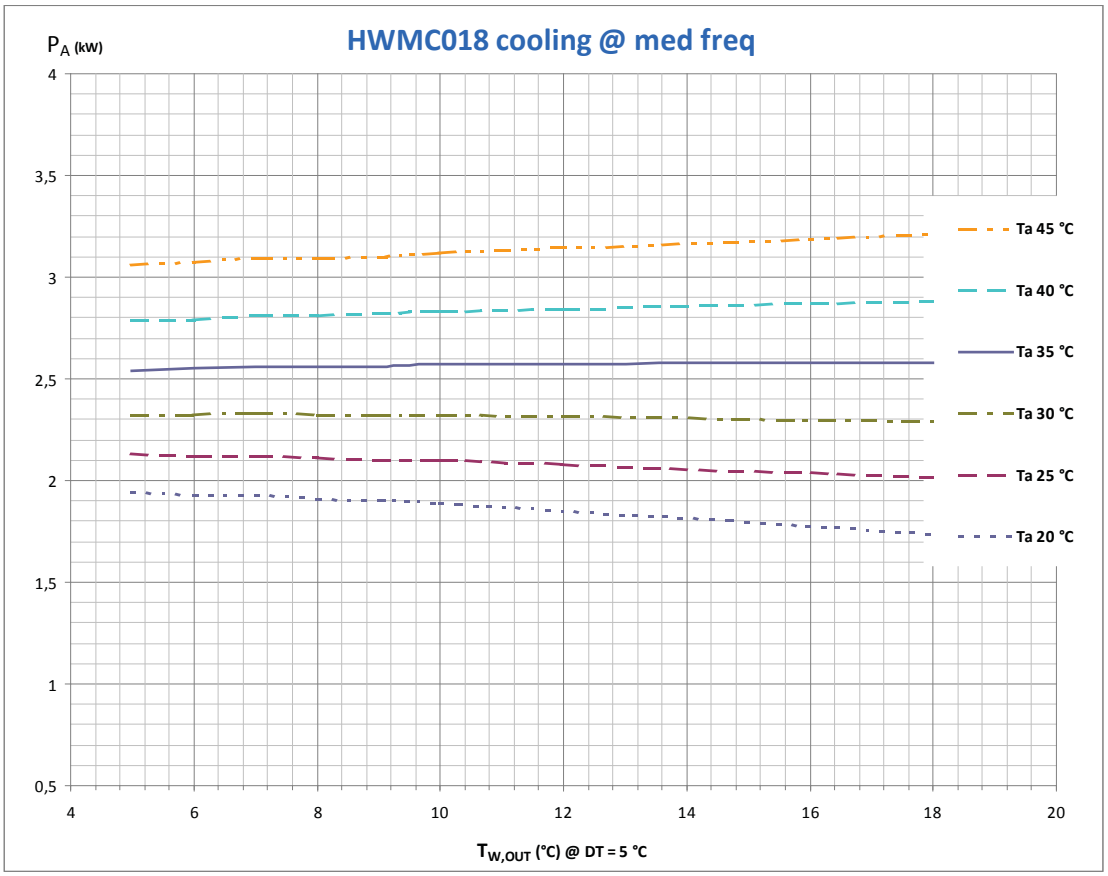

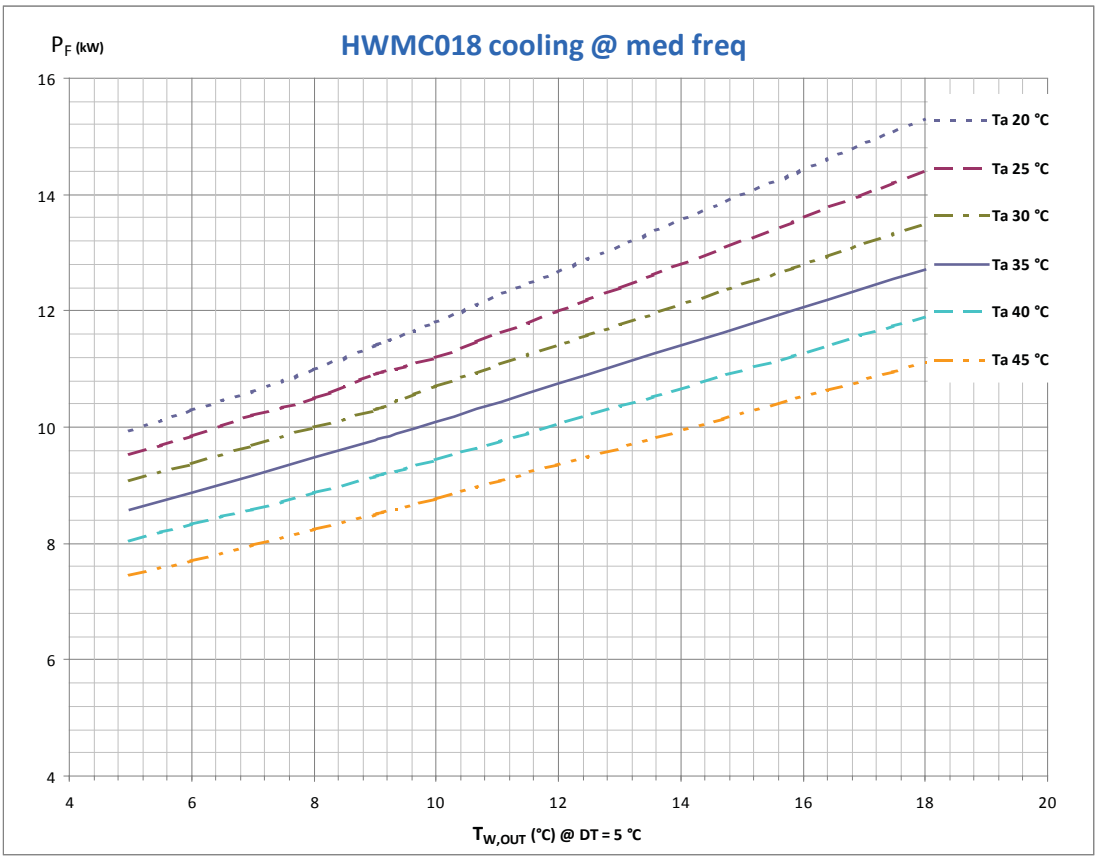

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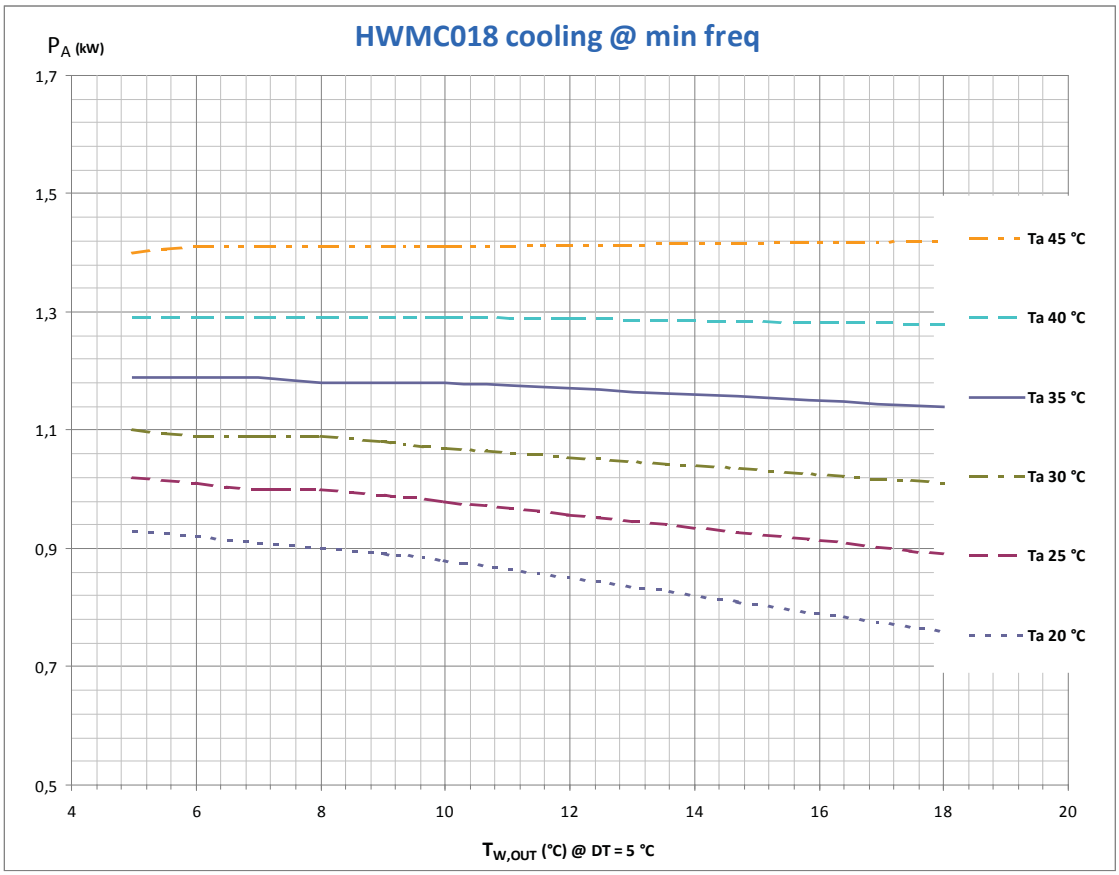

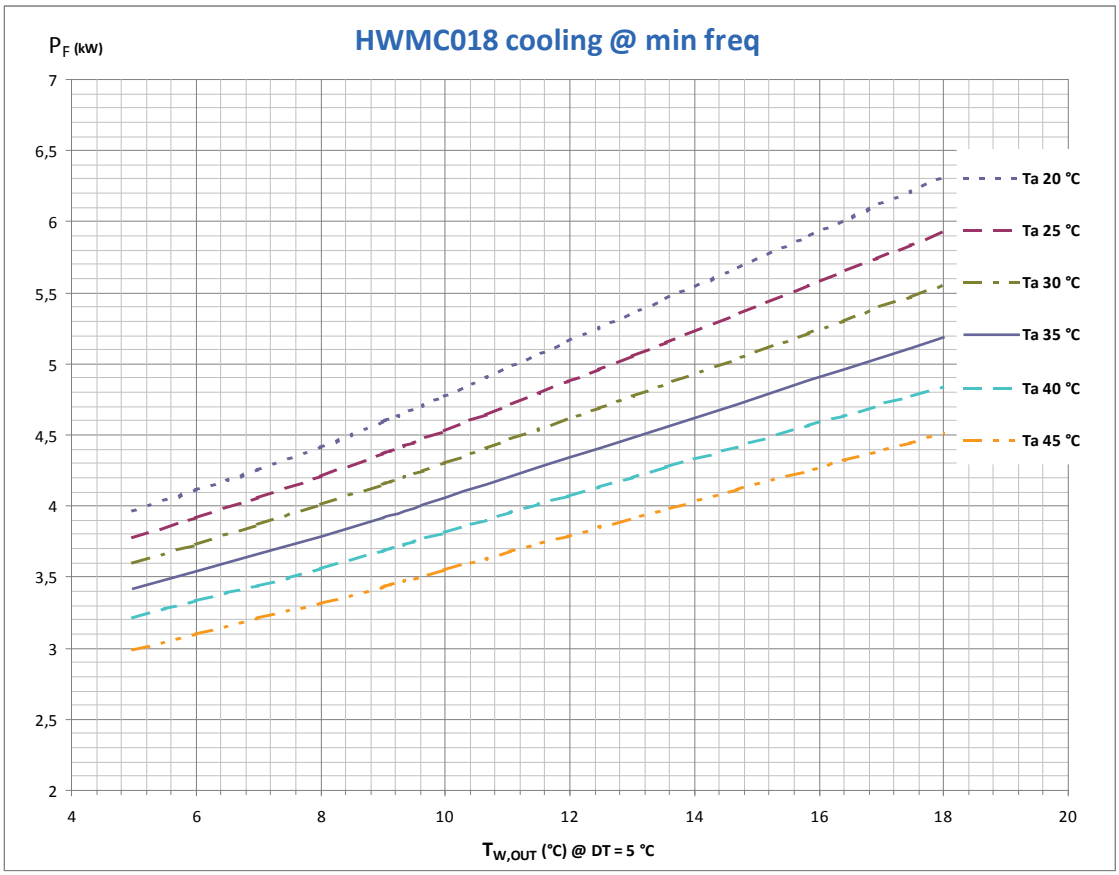

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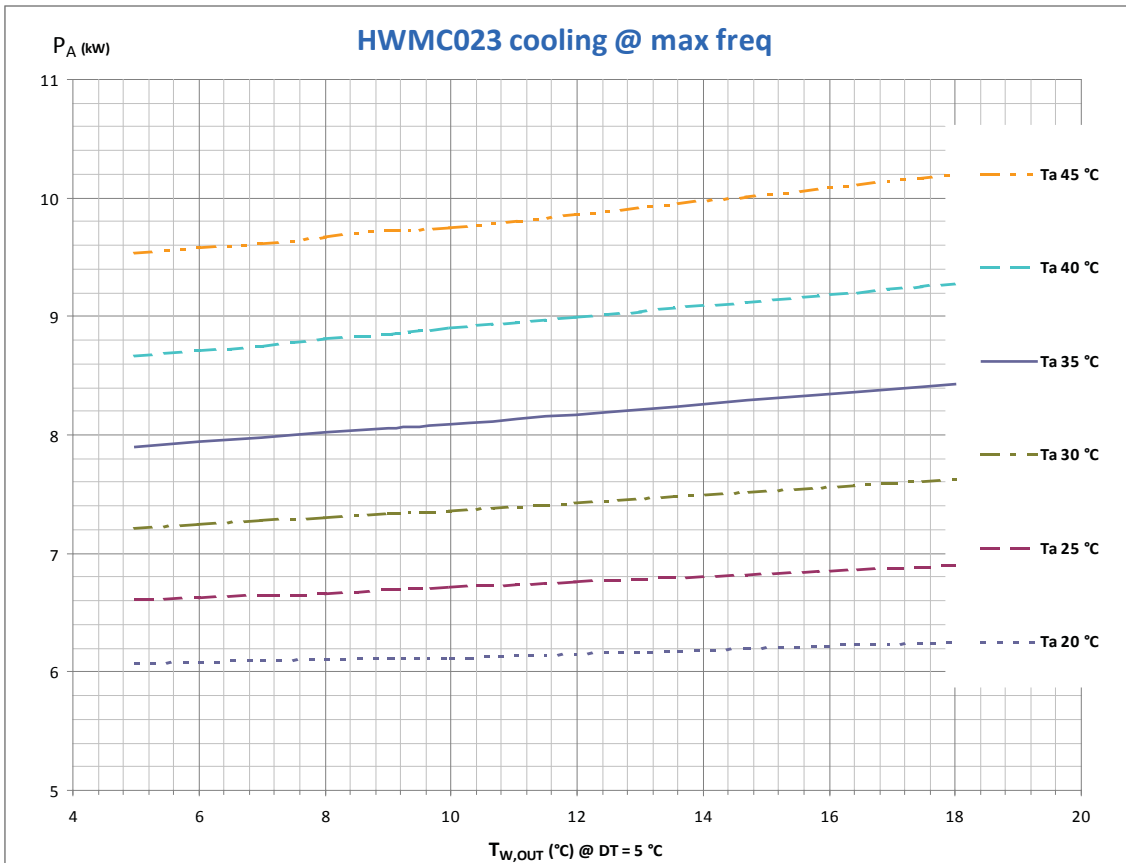

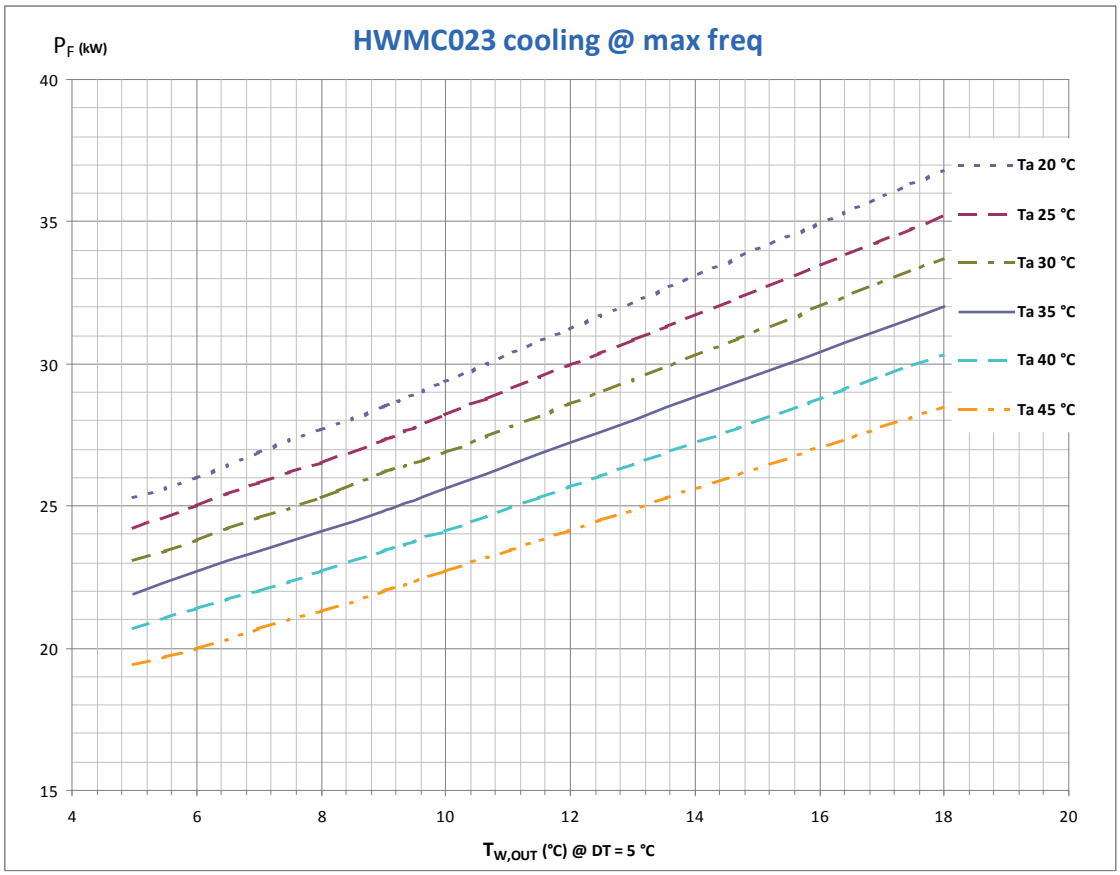

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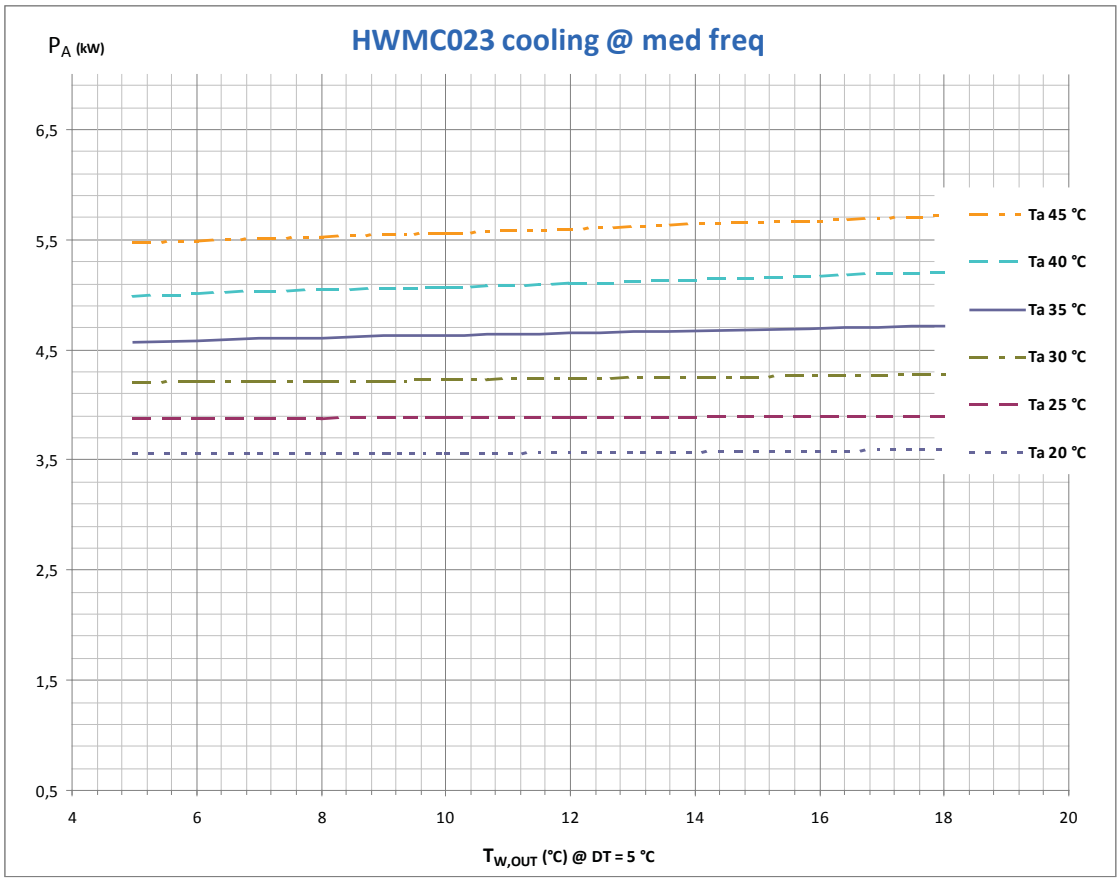

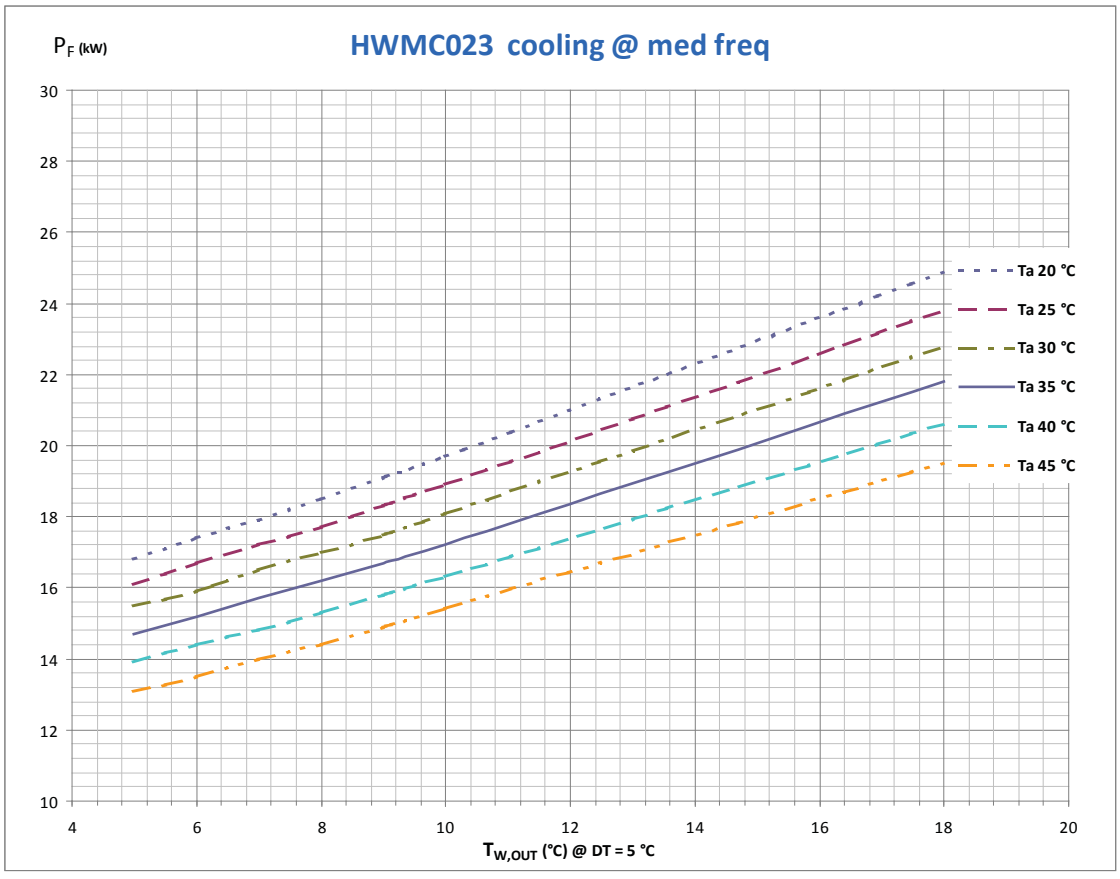

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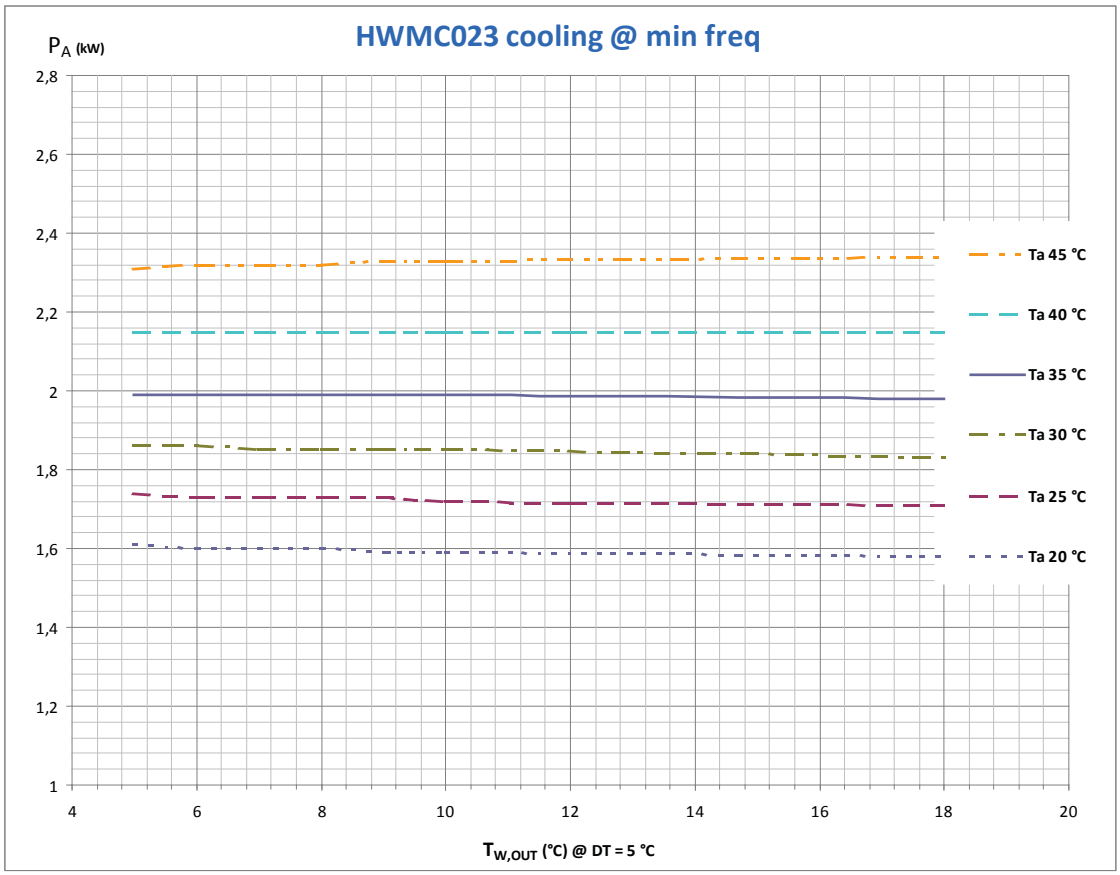

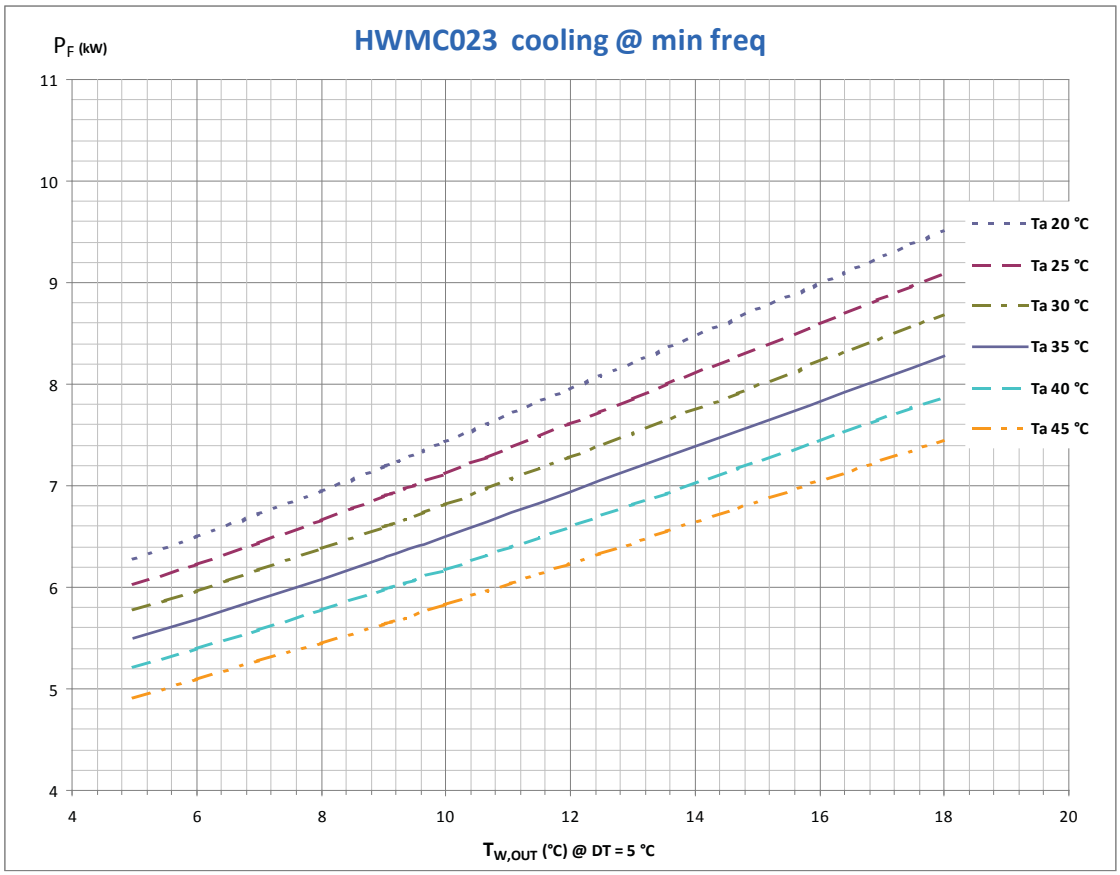

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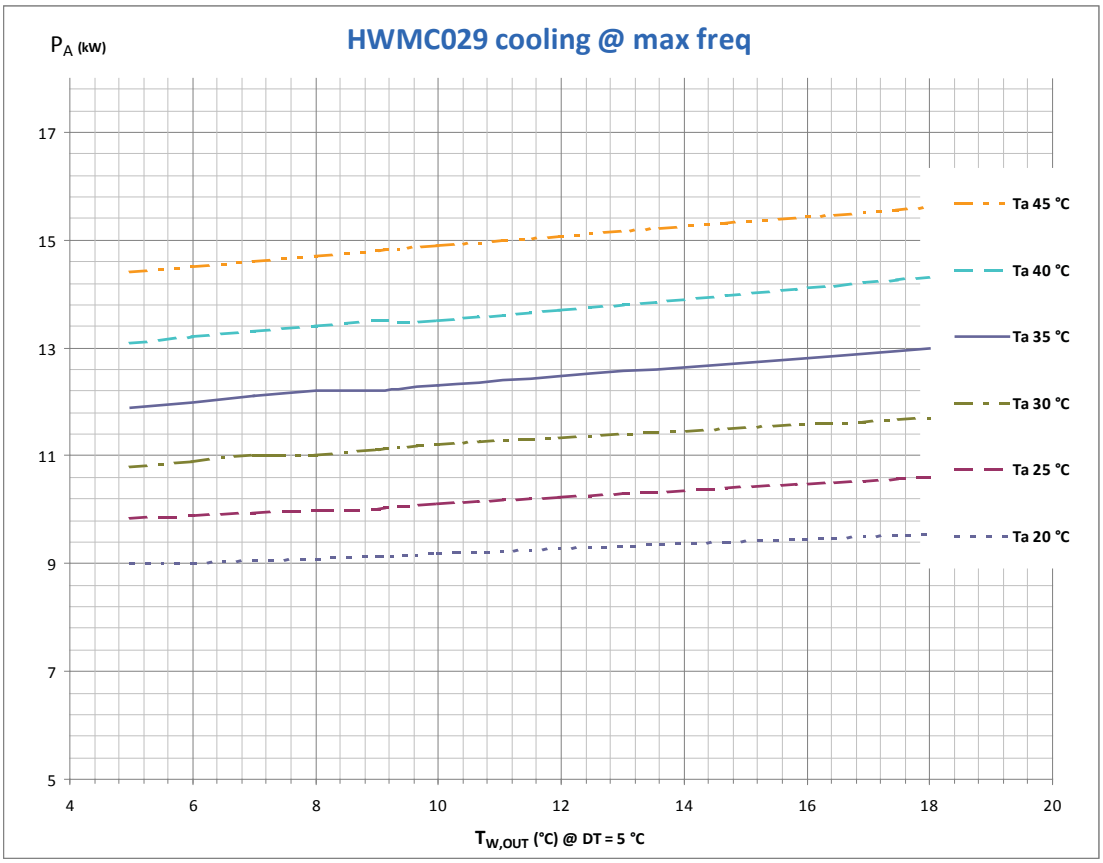

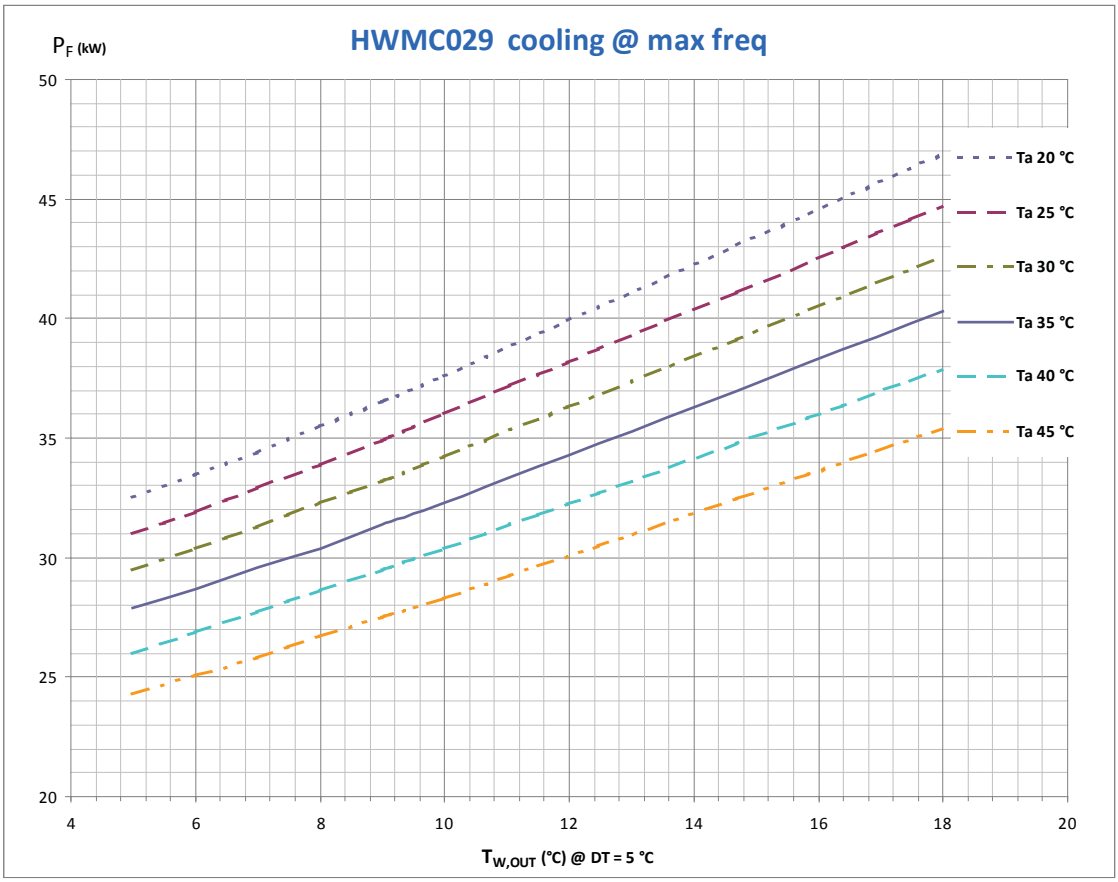

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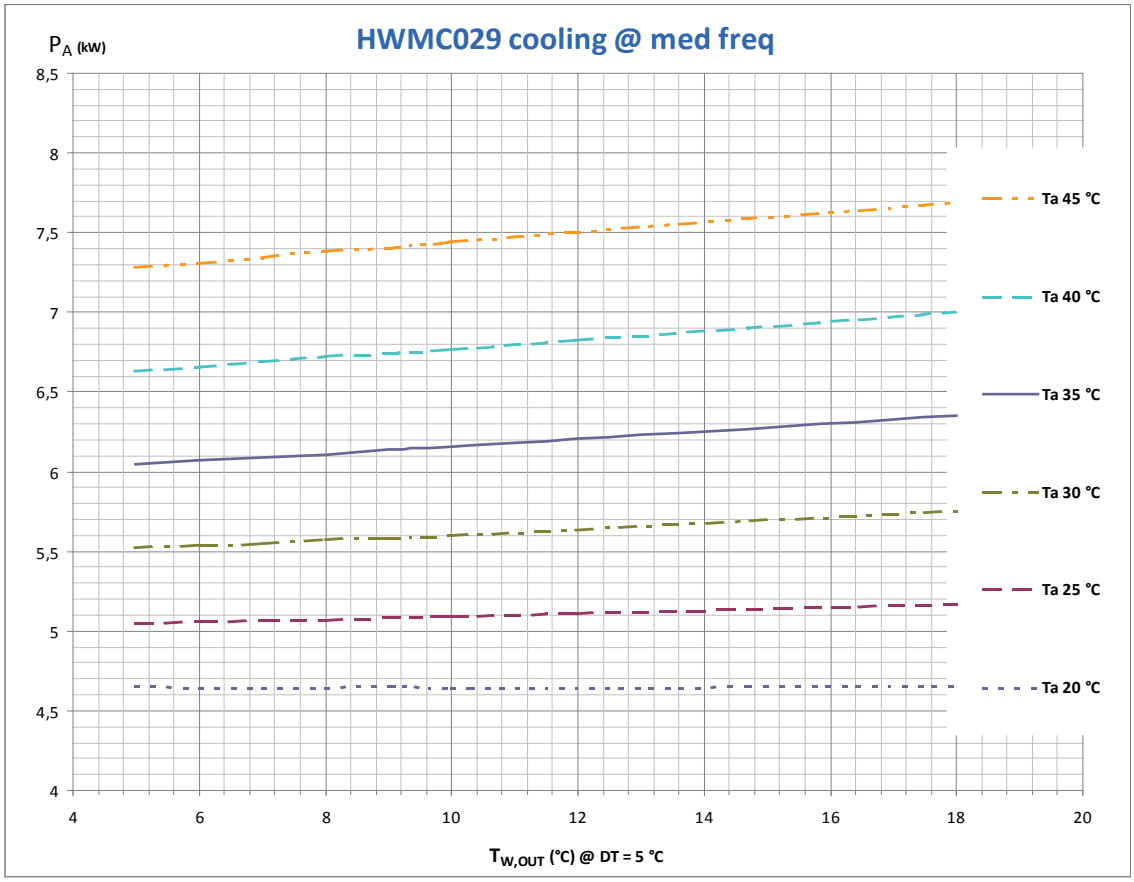

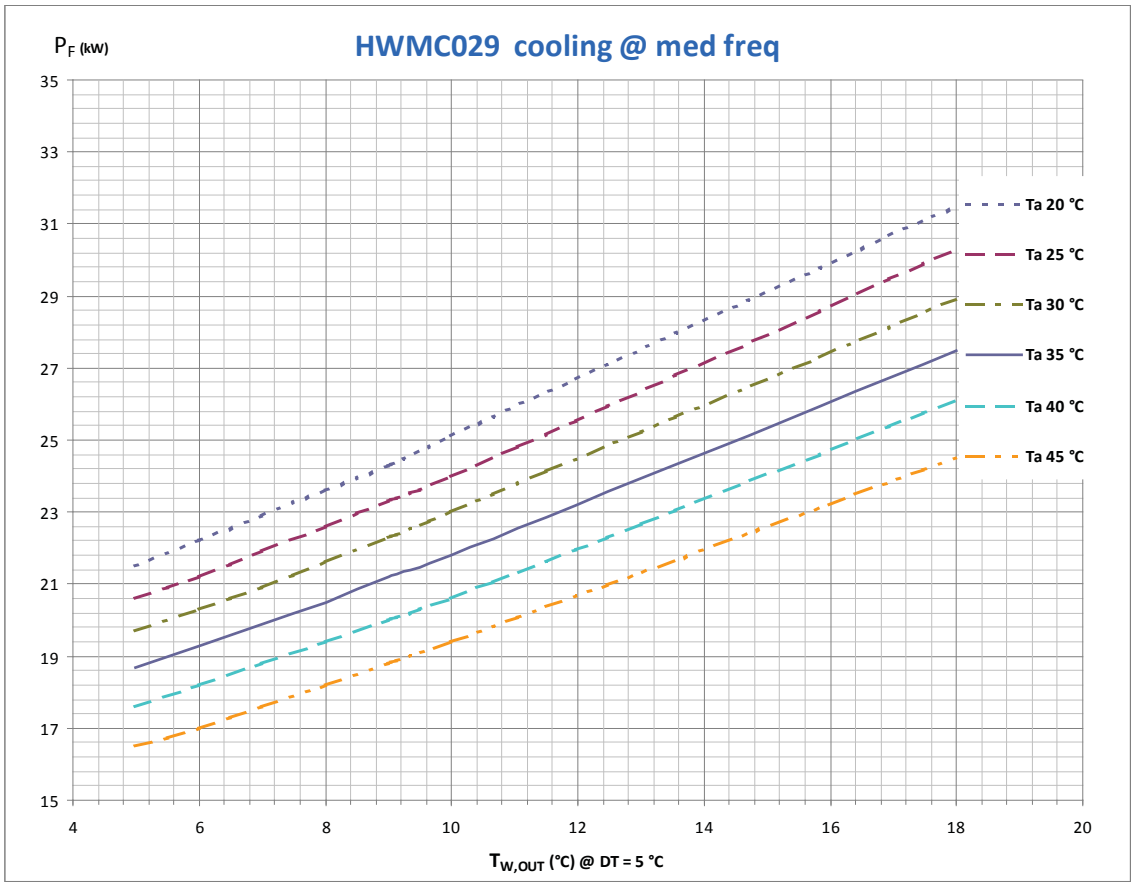

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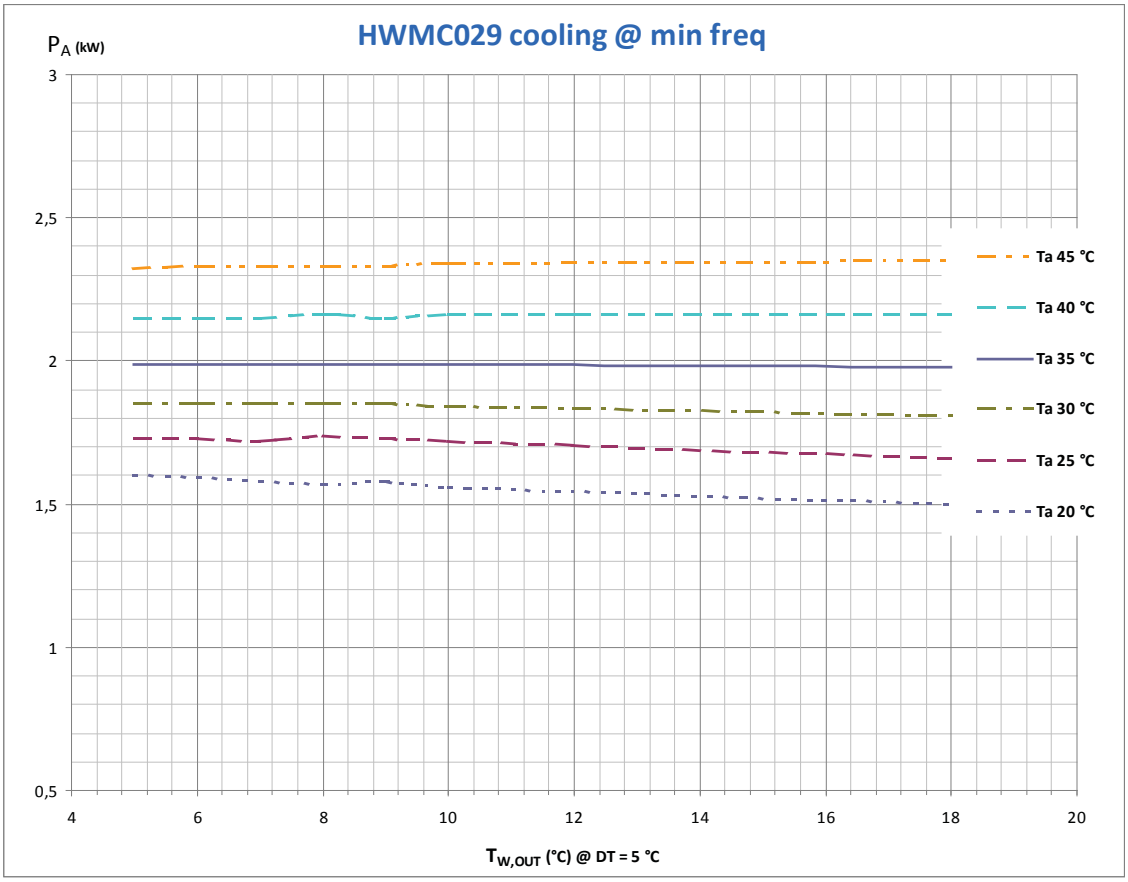

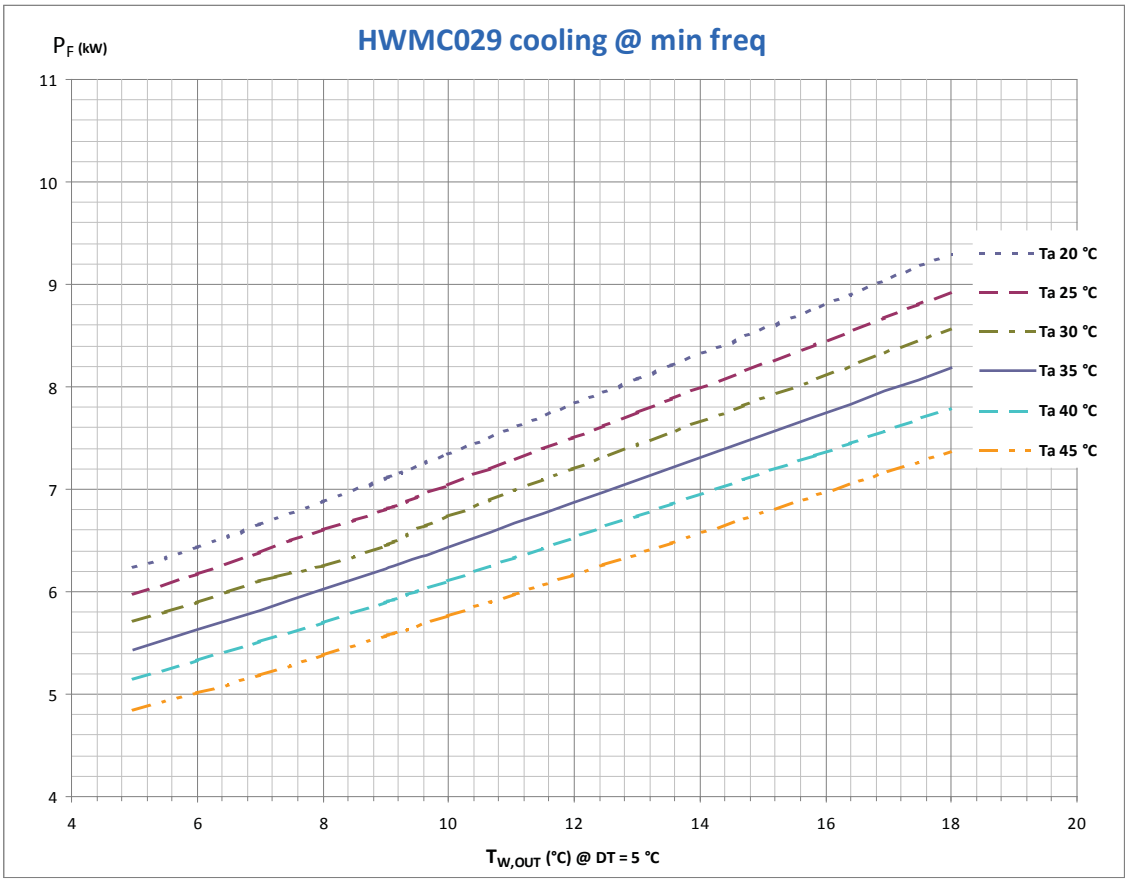

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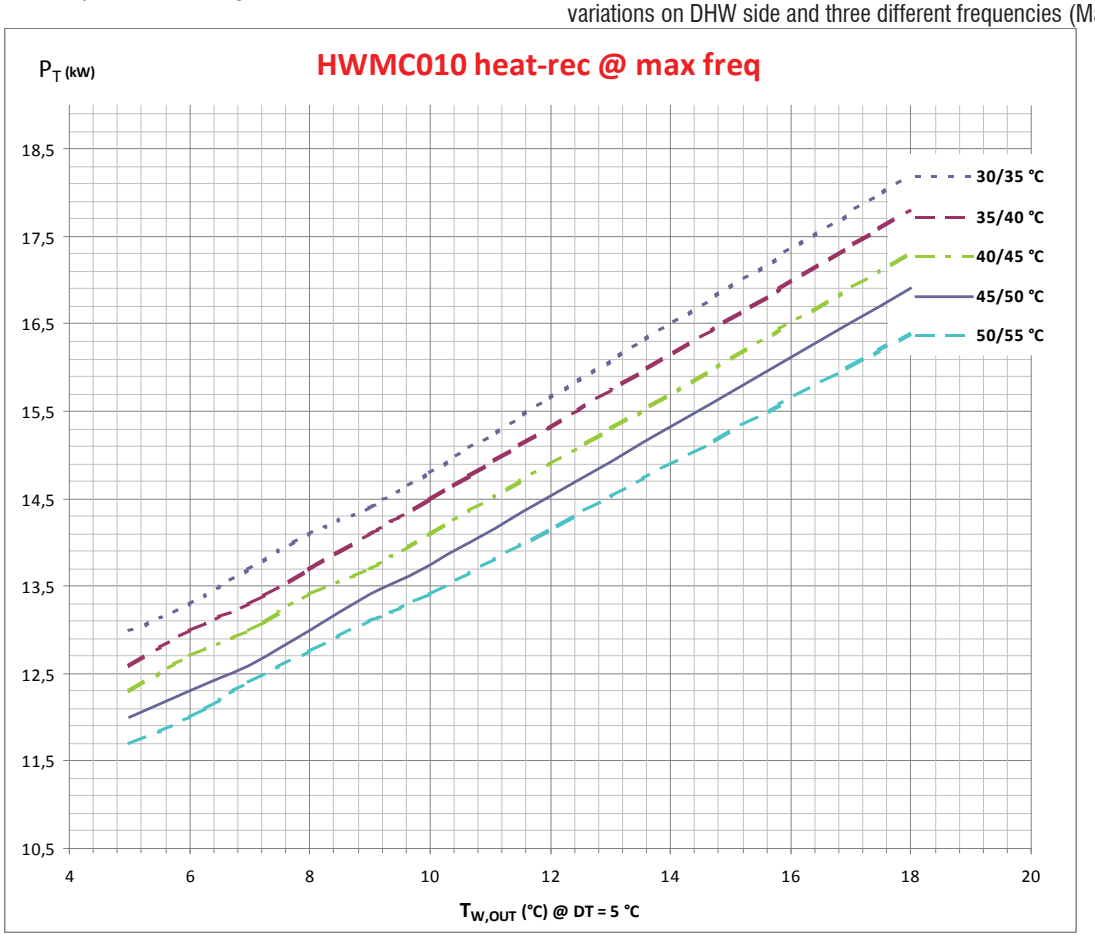

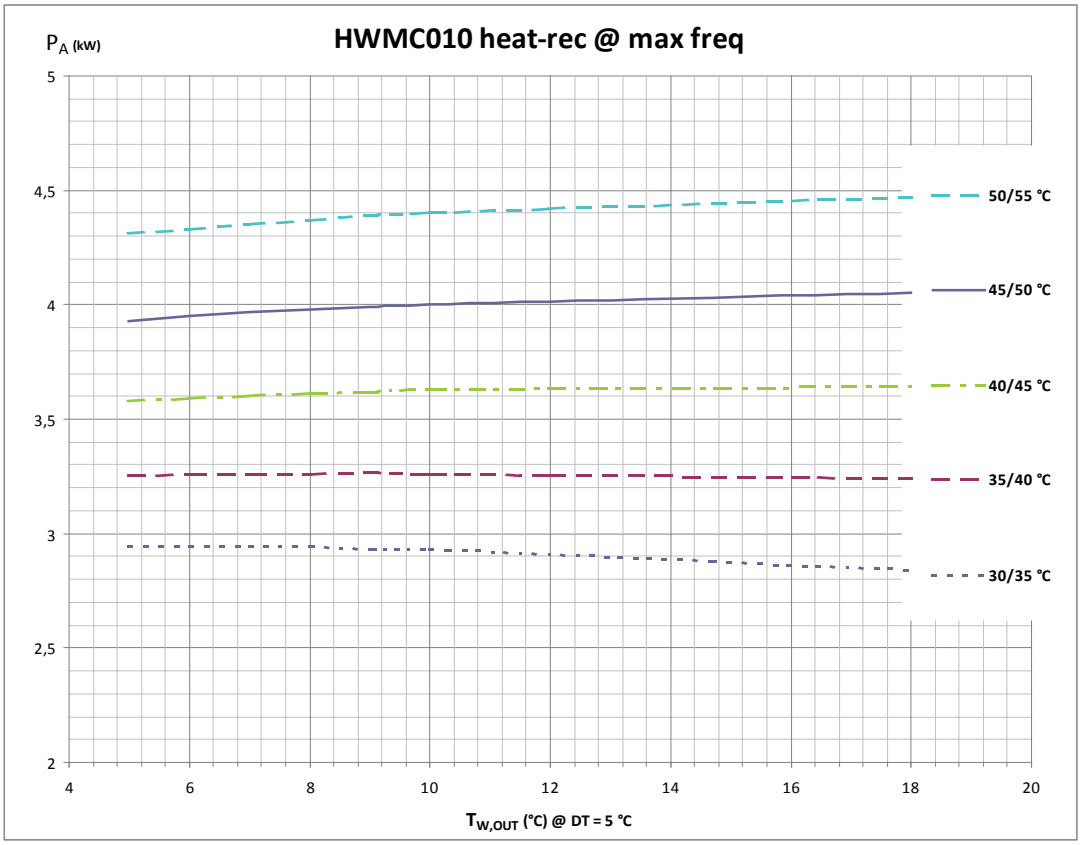

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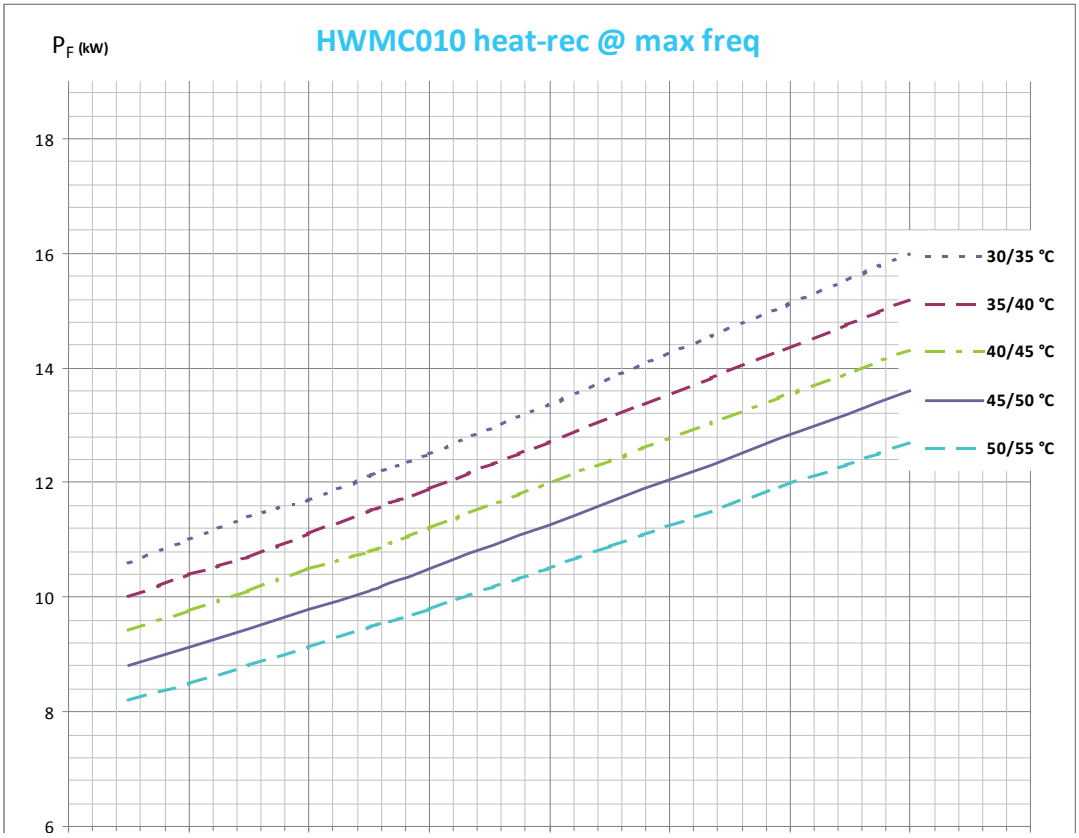

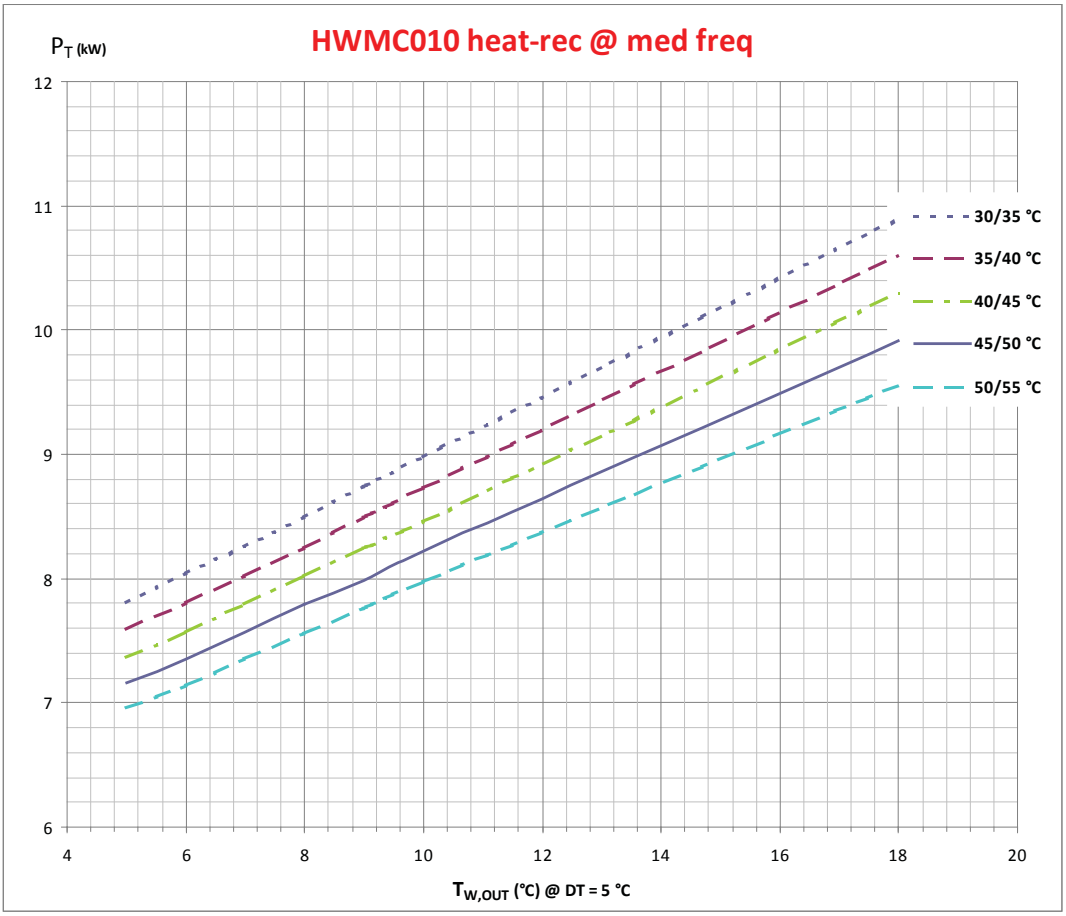

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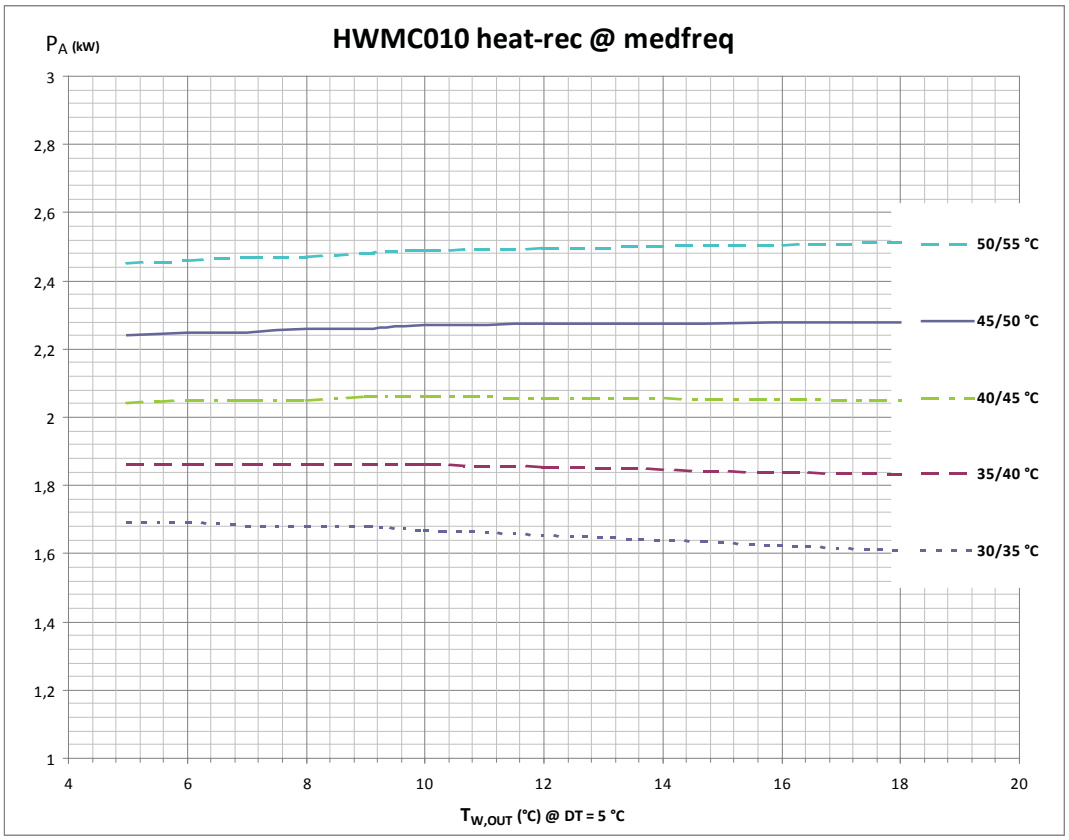

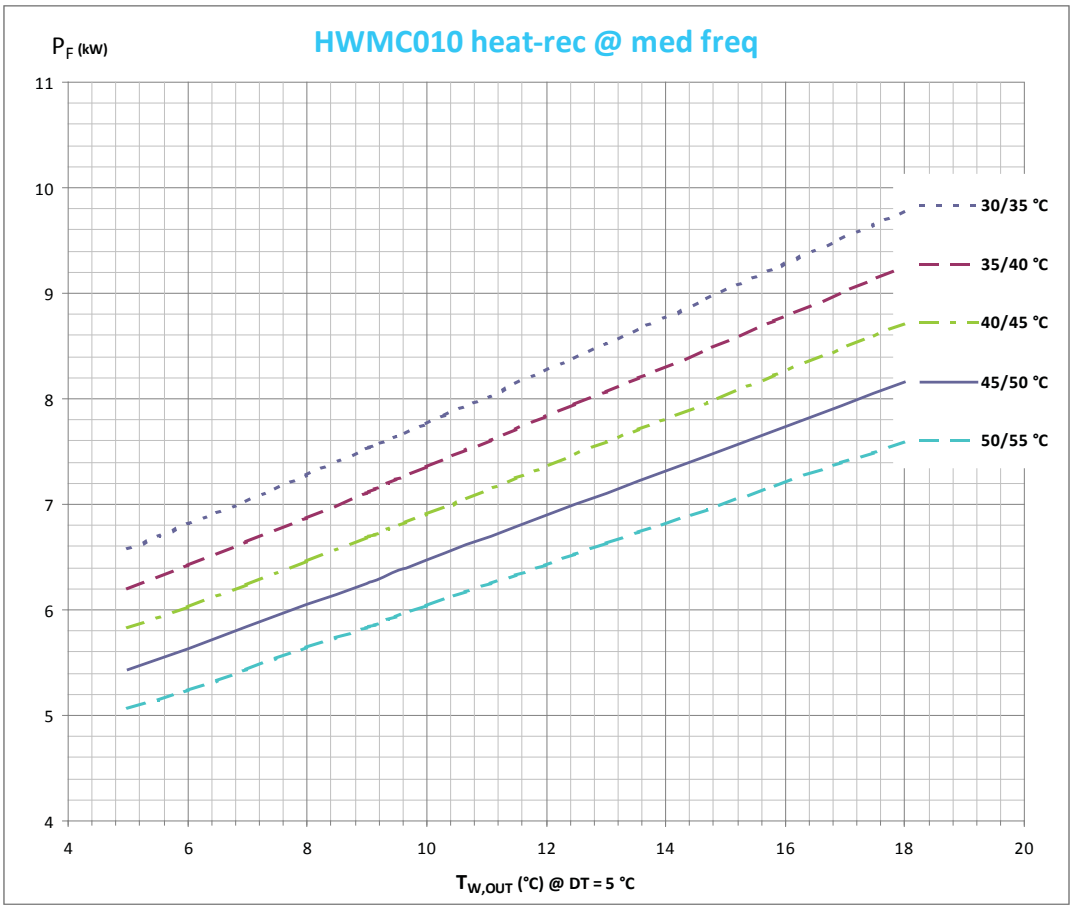

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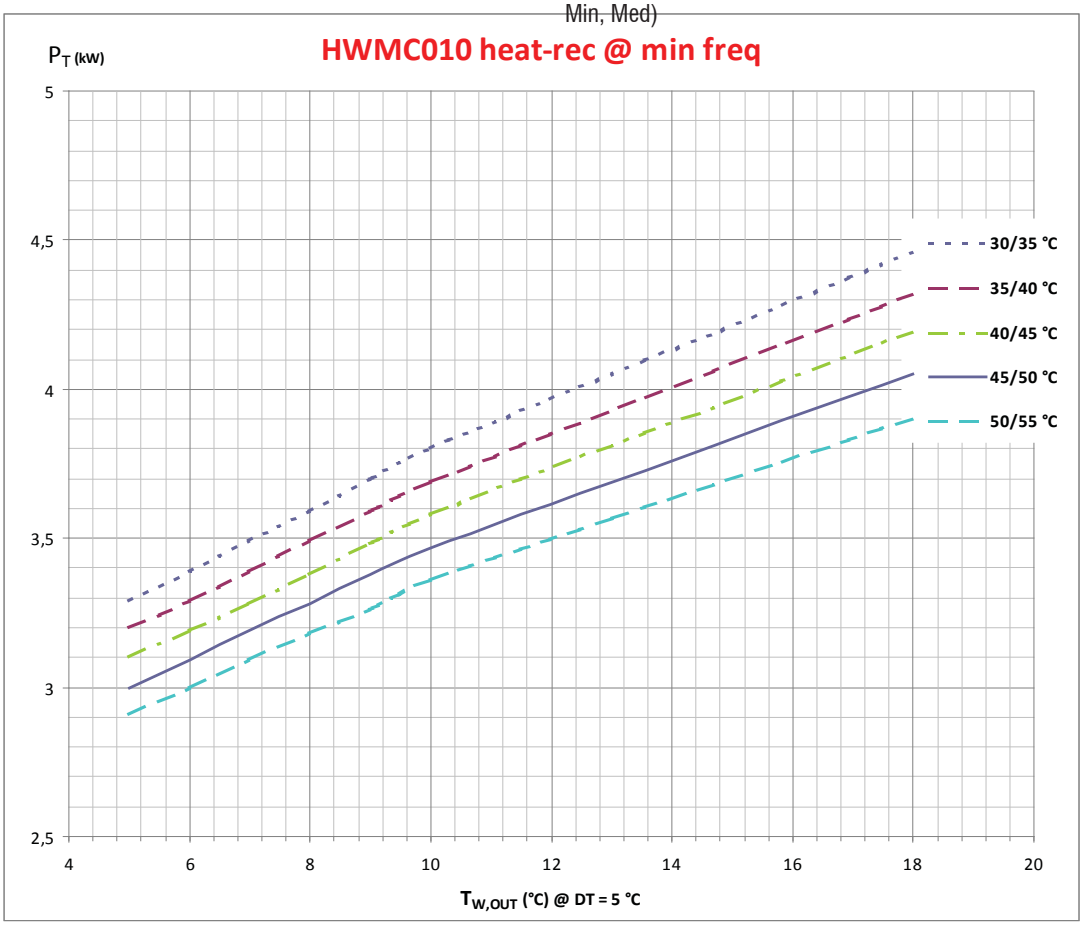

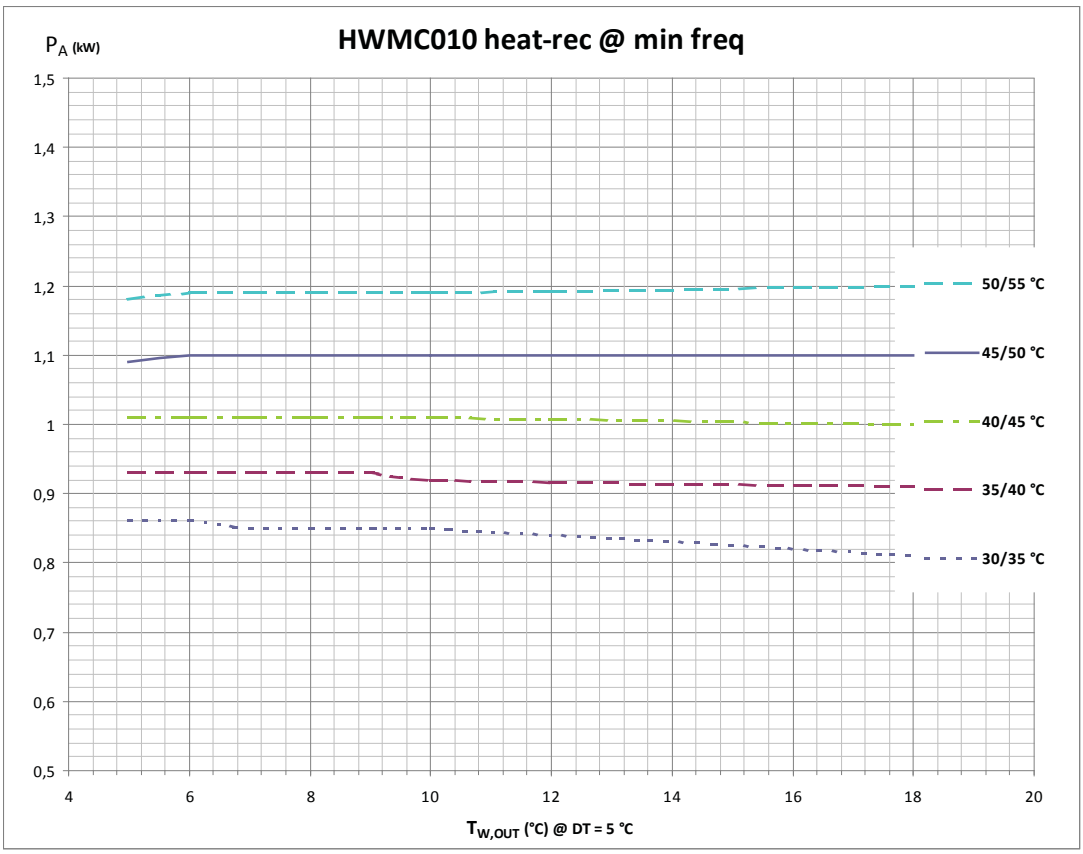

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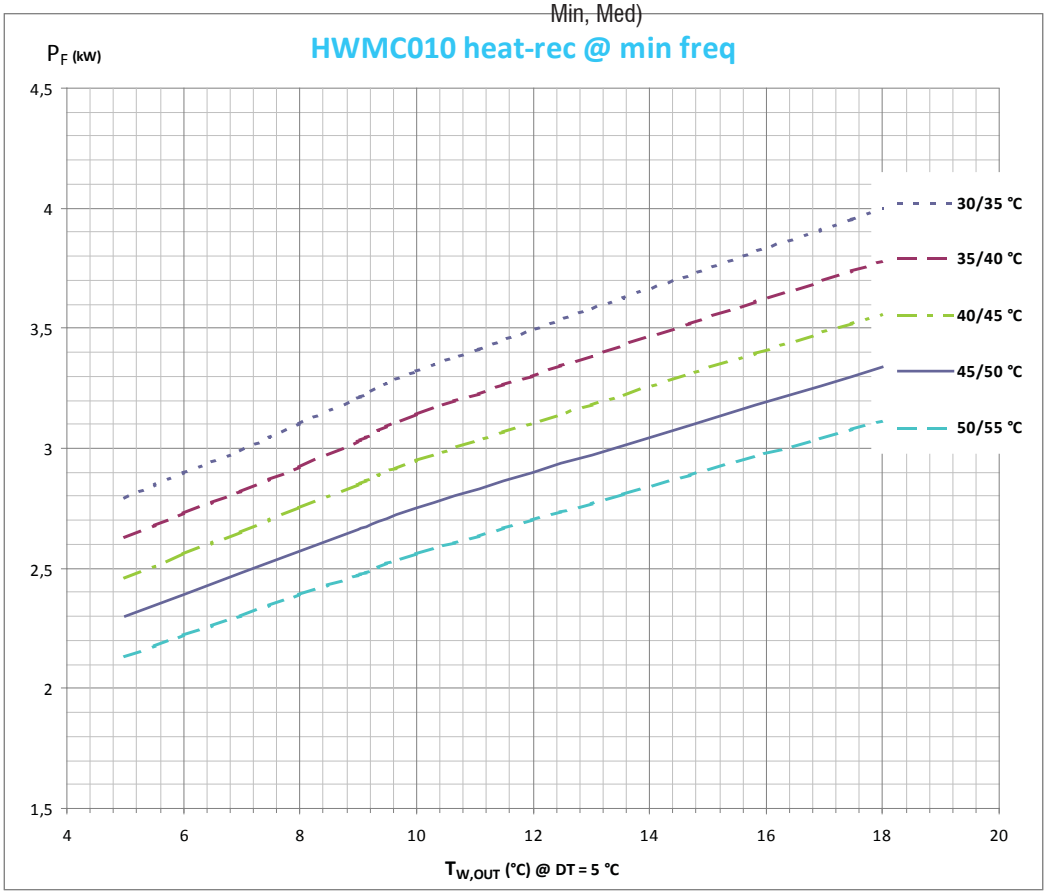

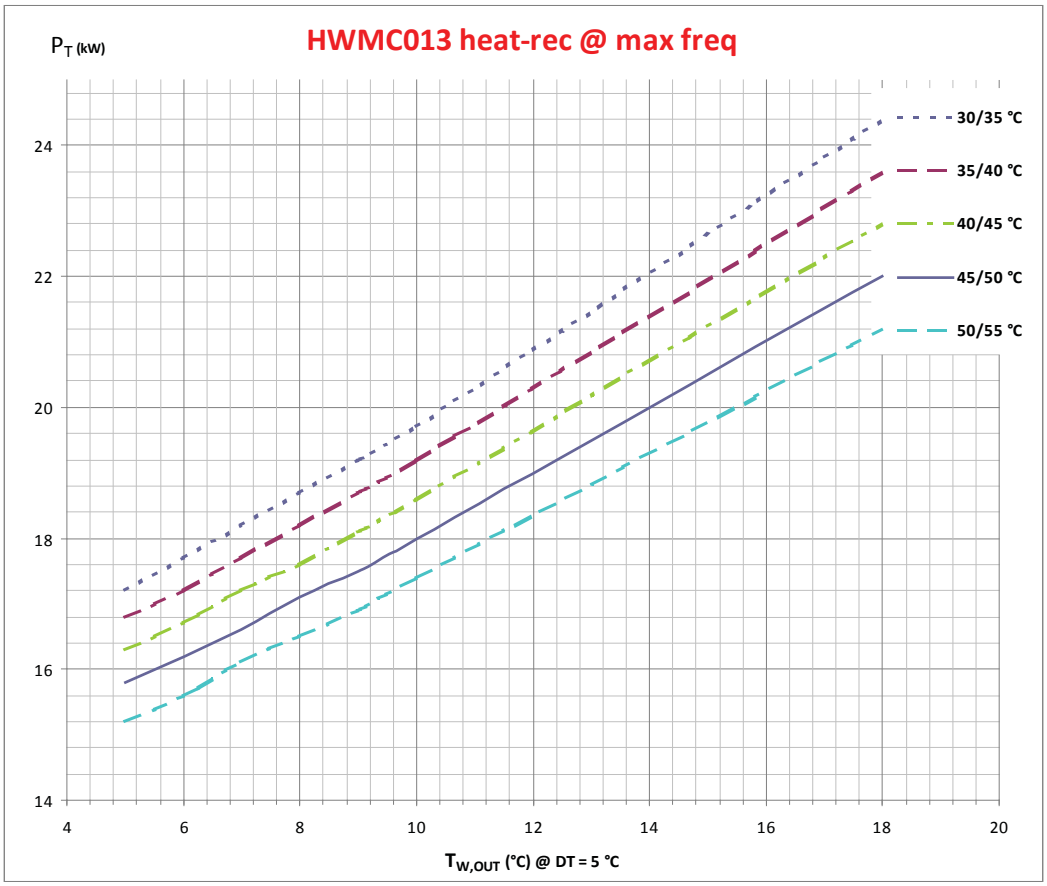

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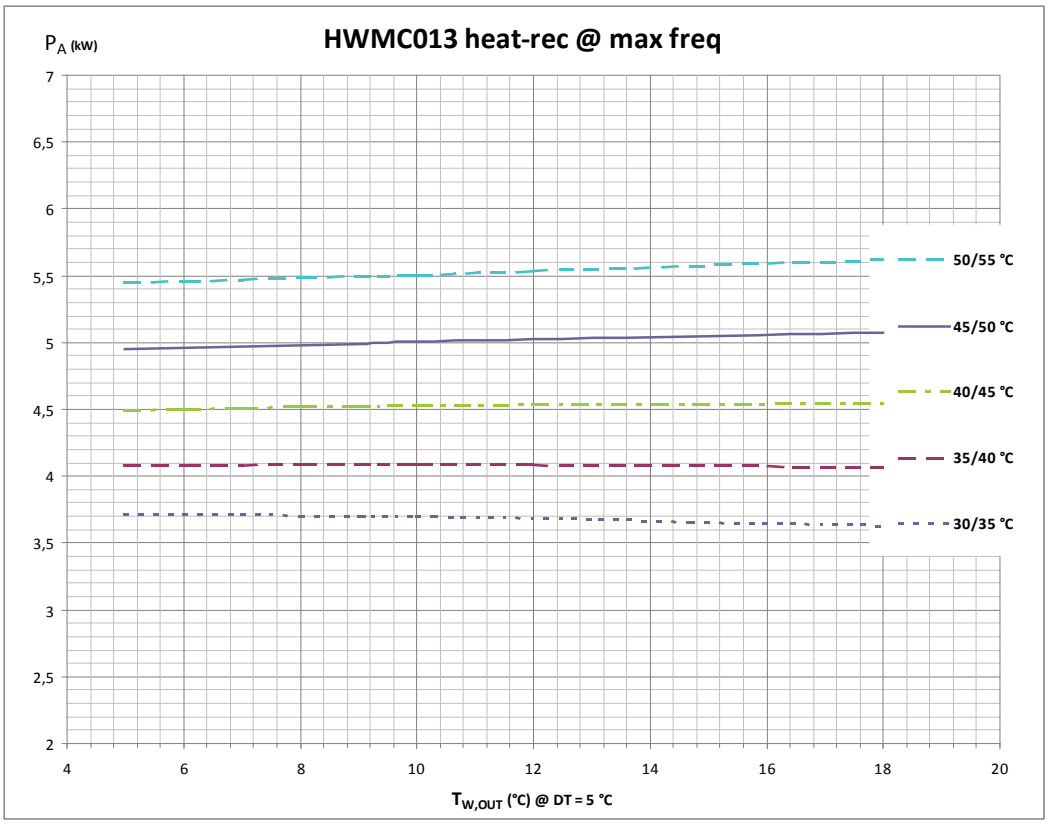

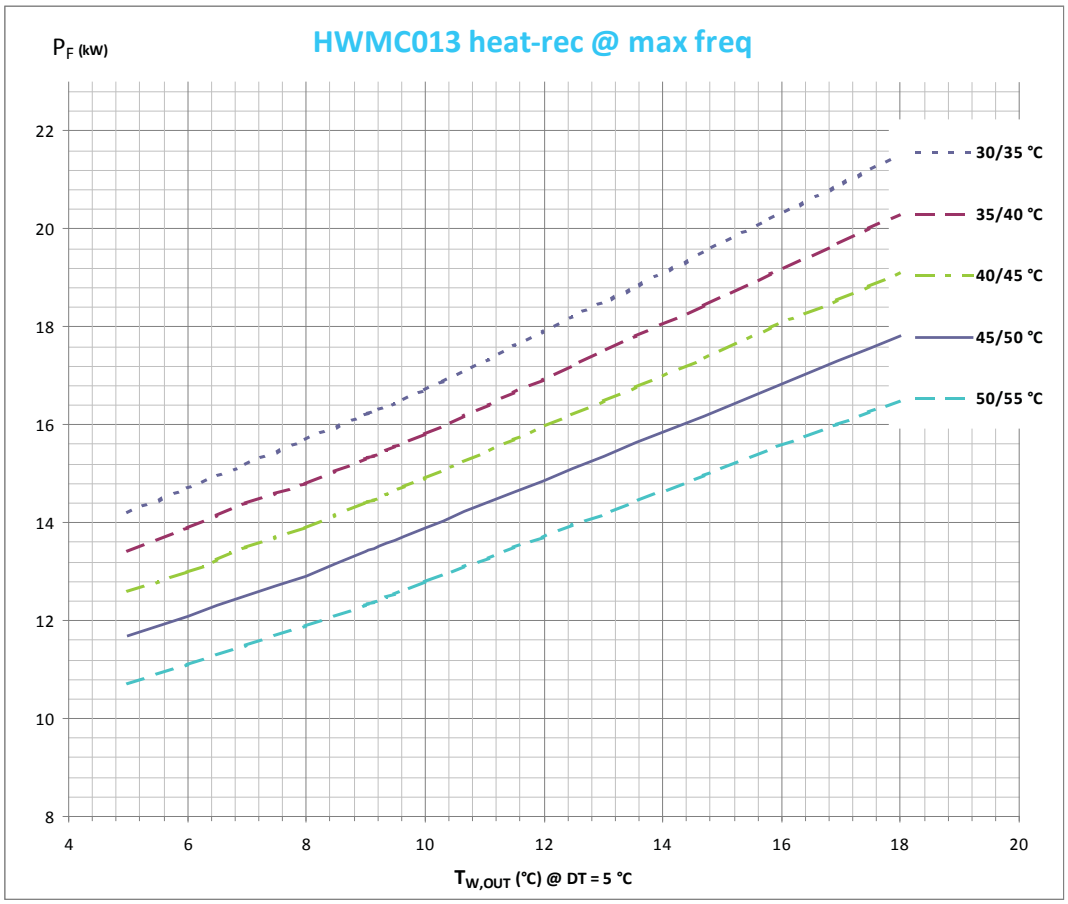

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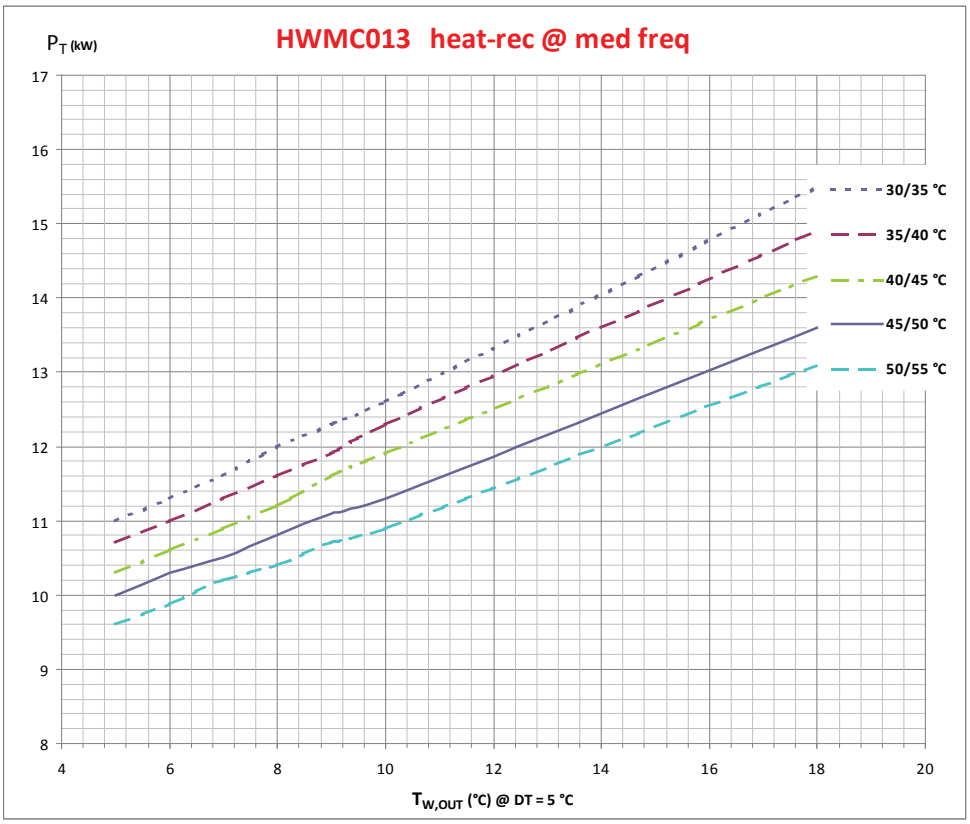

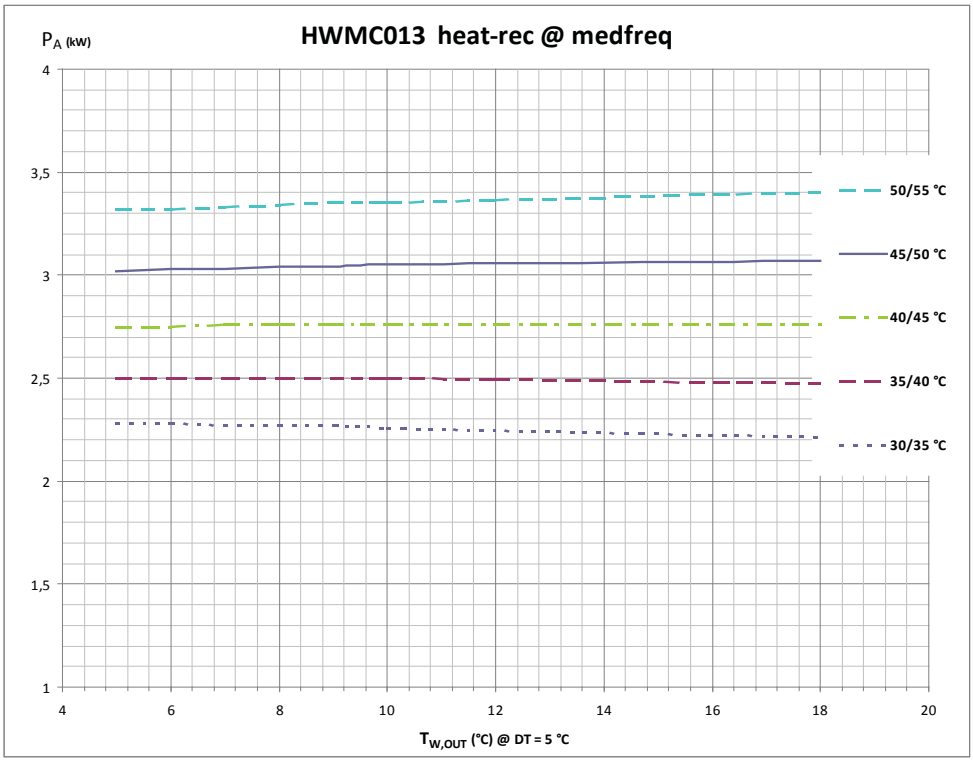

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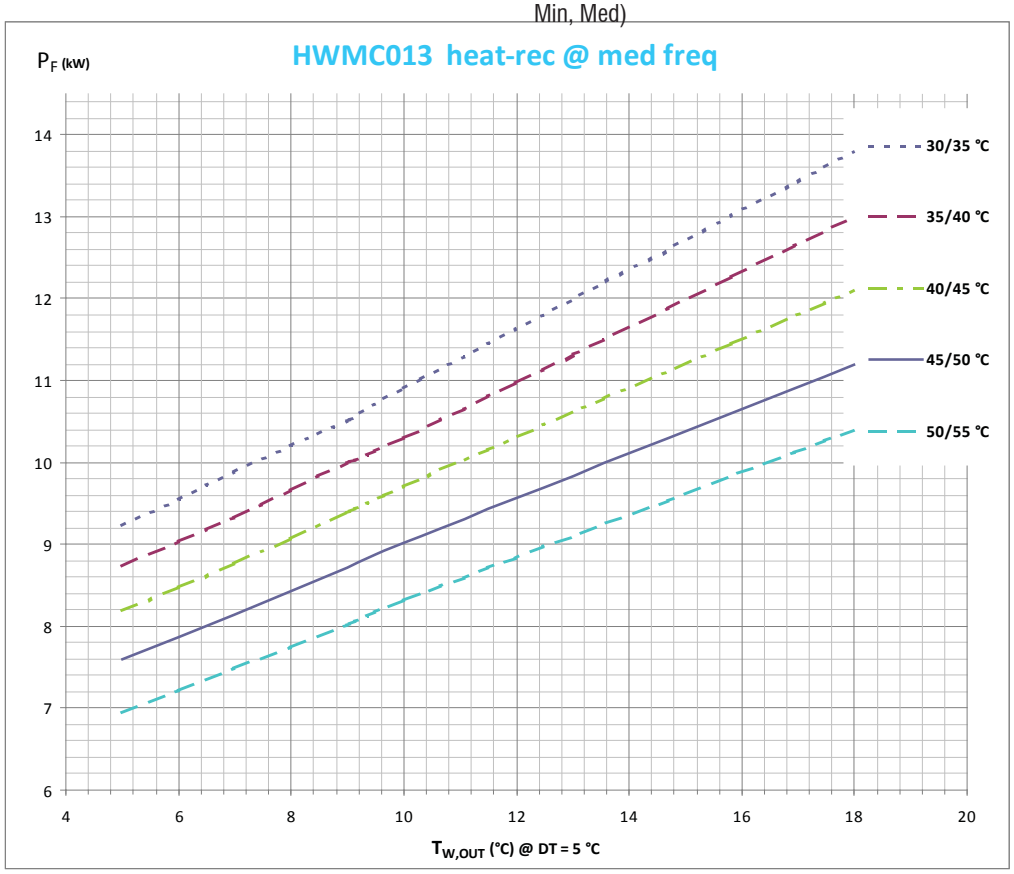

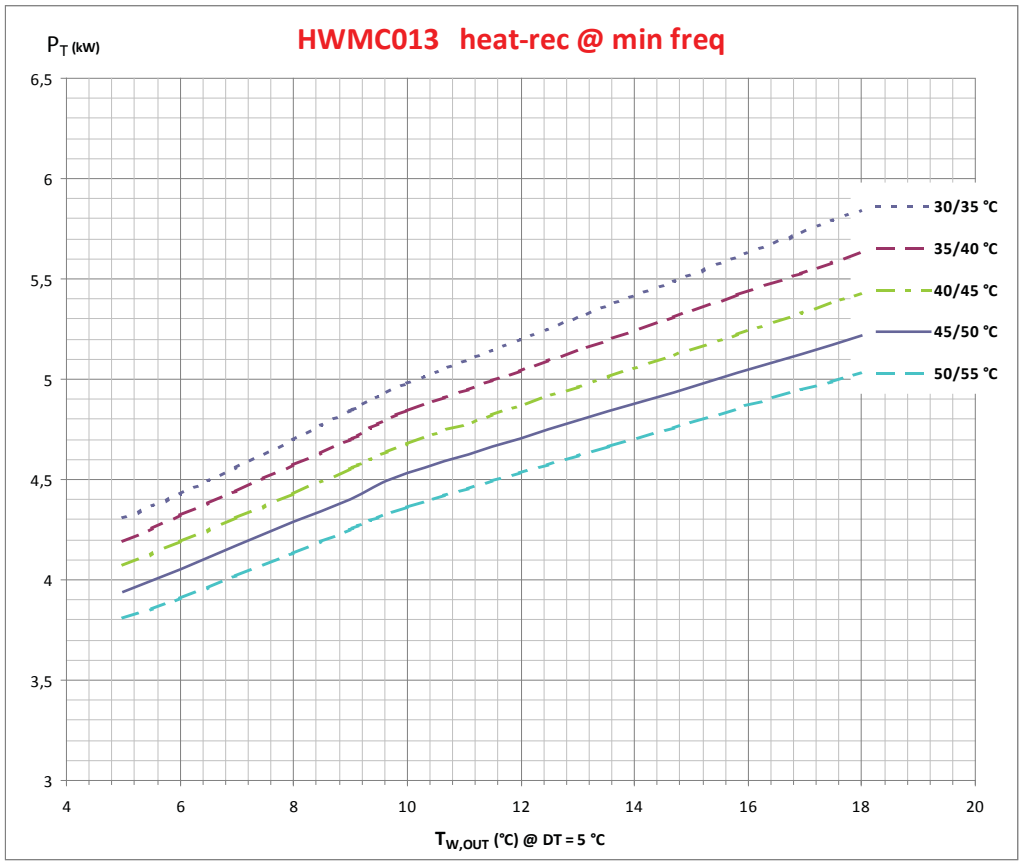

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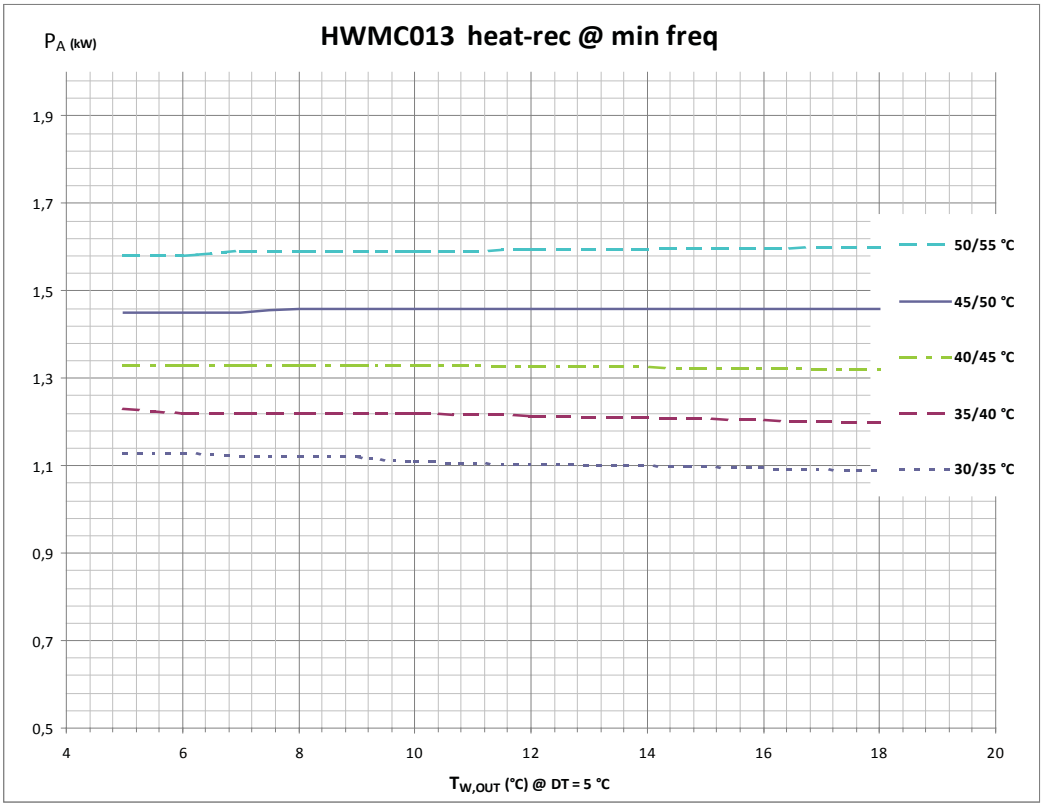

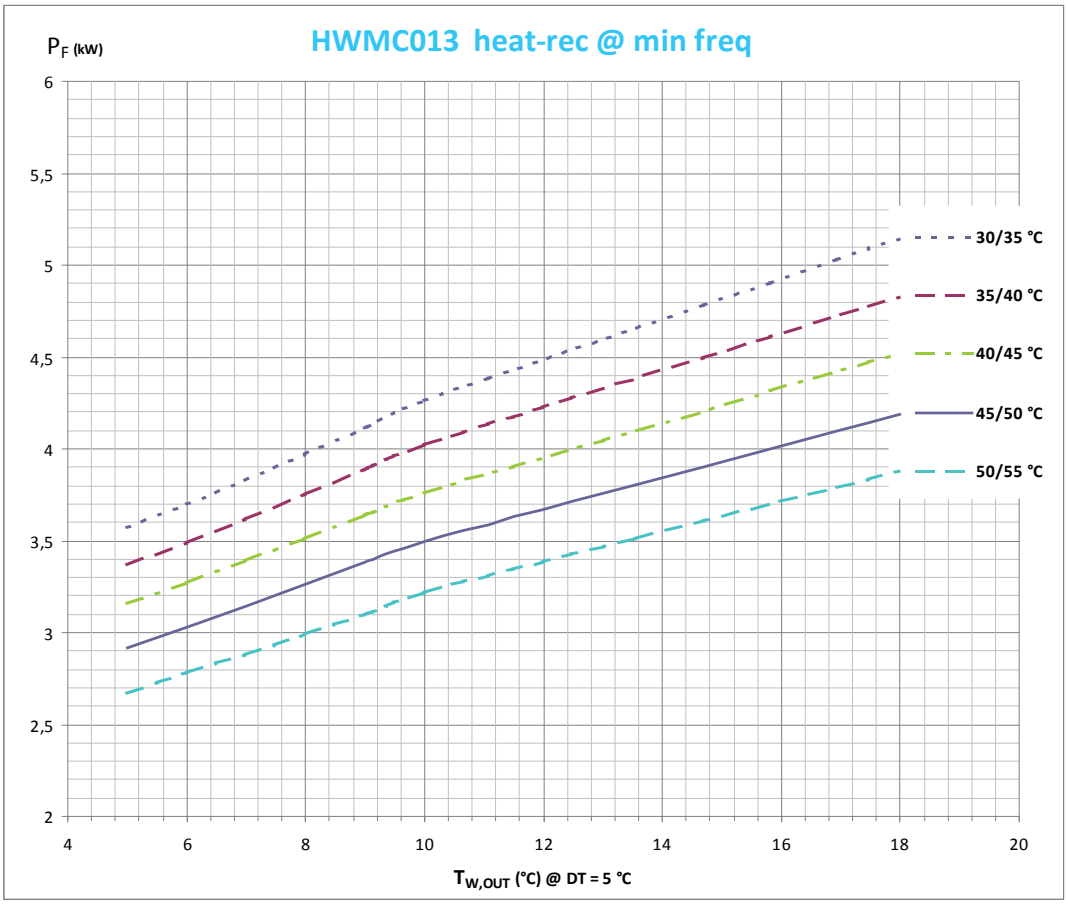

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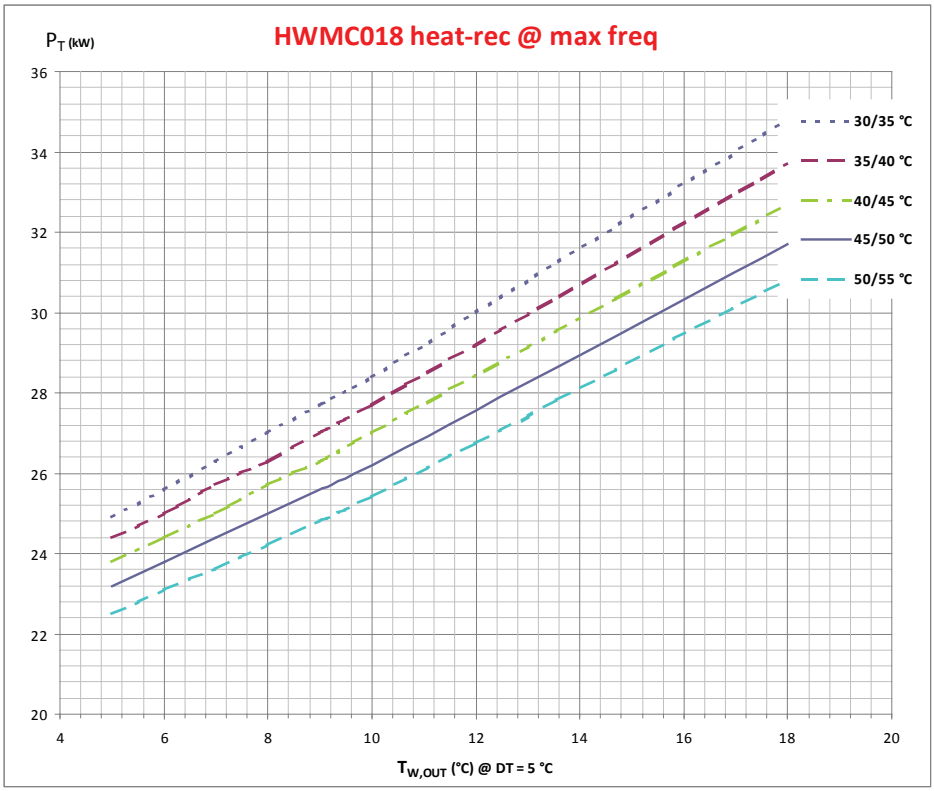

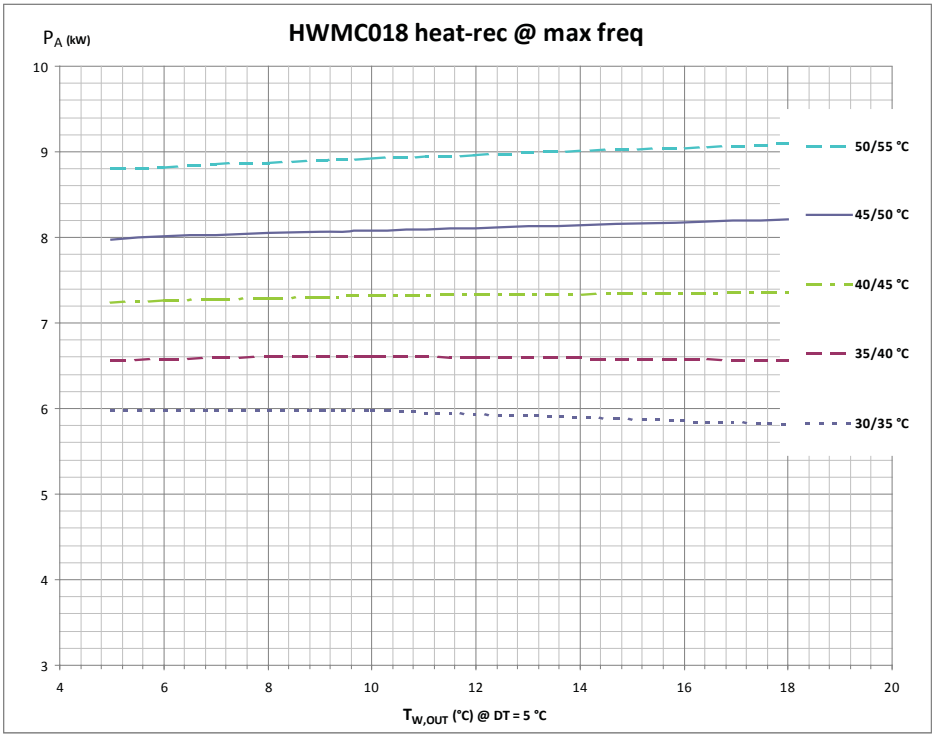

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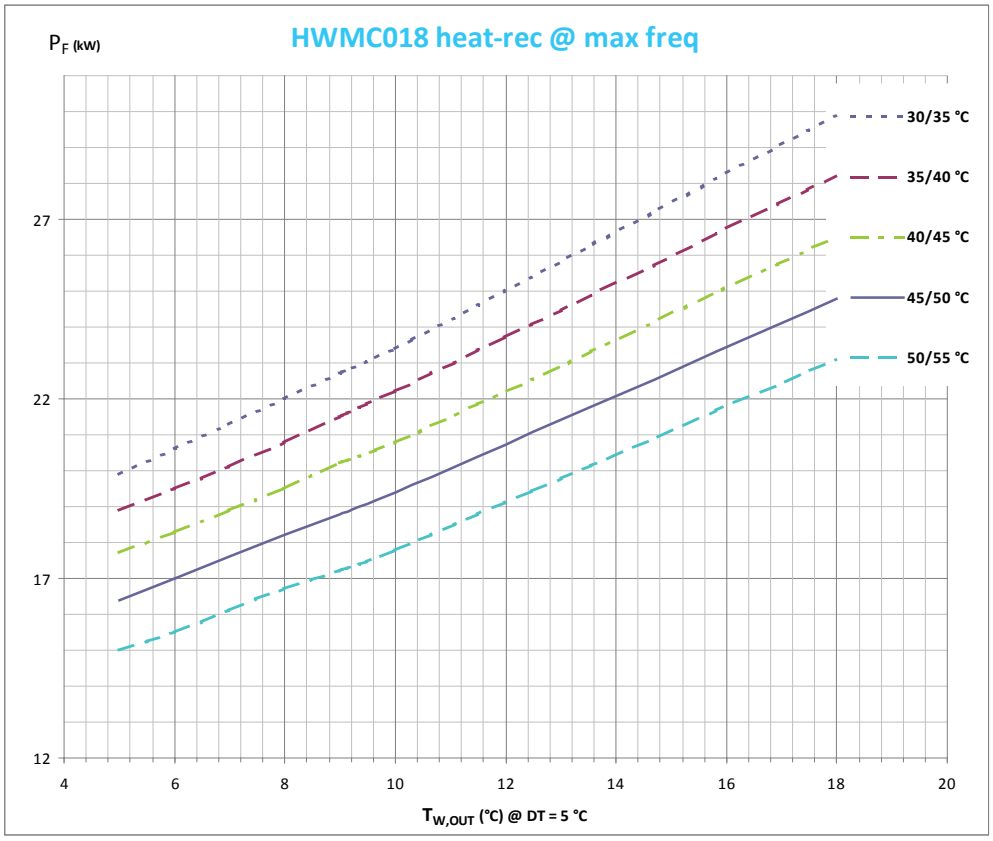

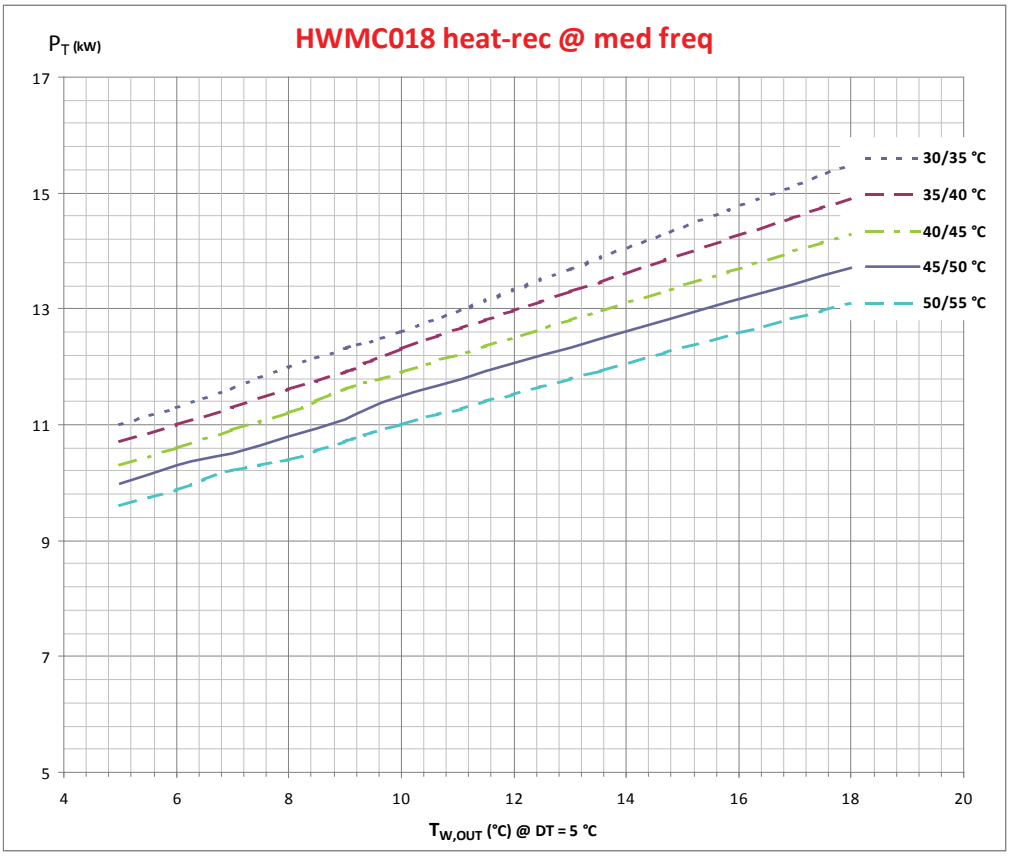

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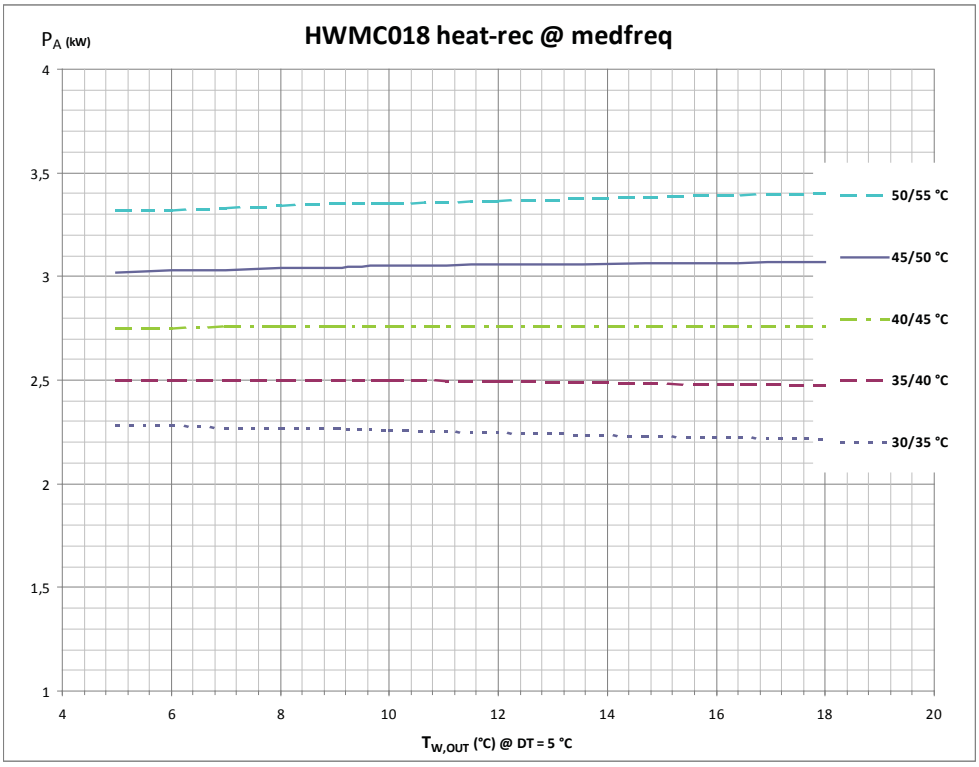

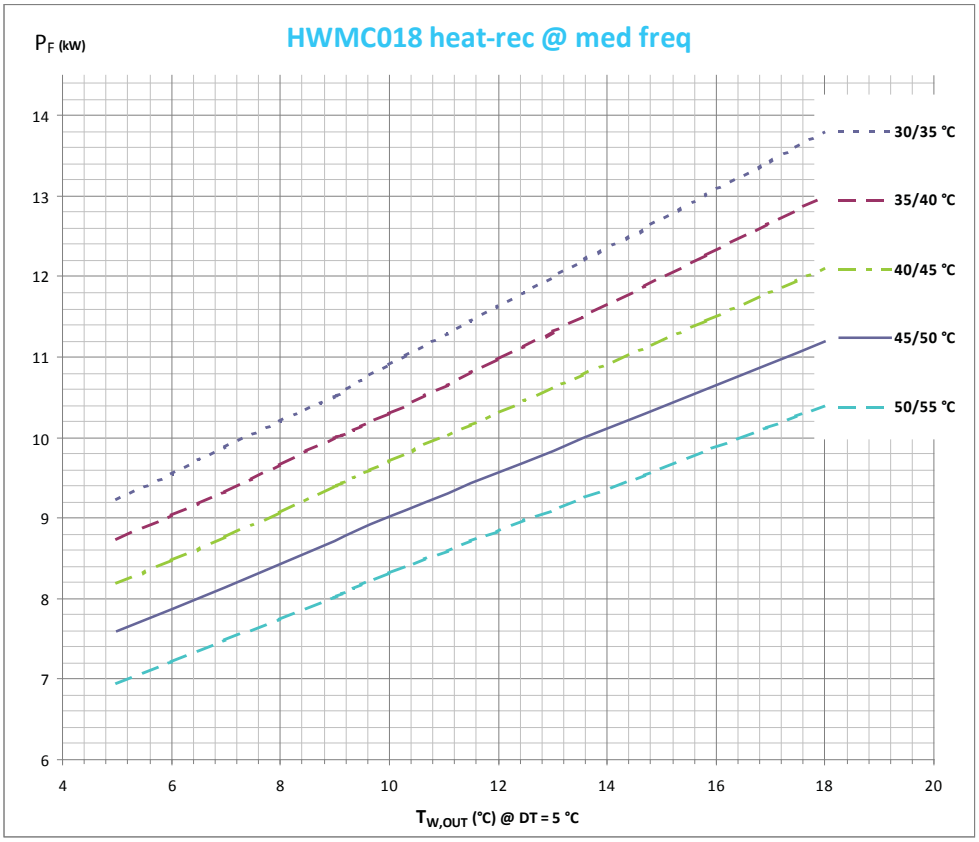

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5 PERFORMANCES

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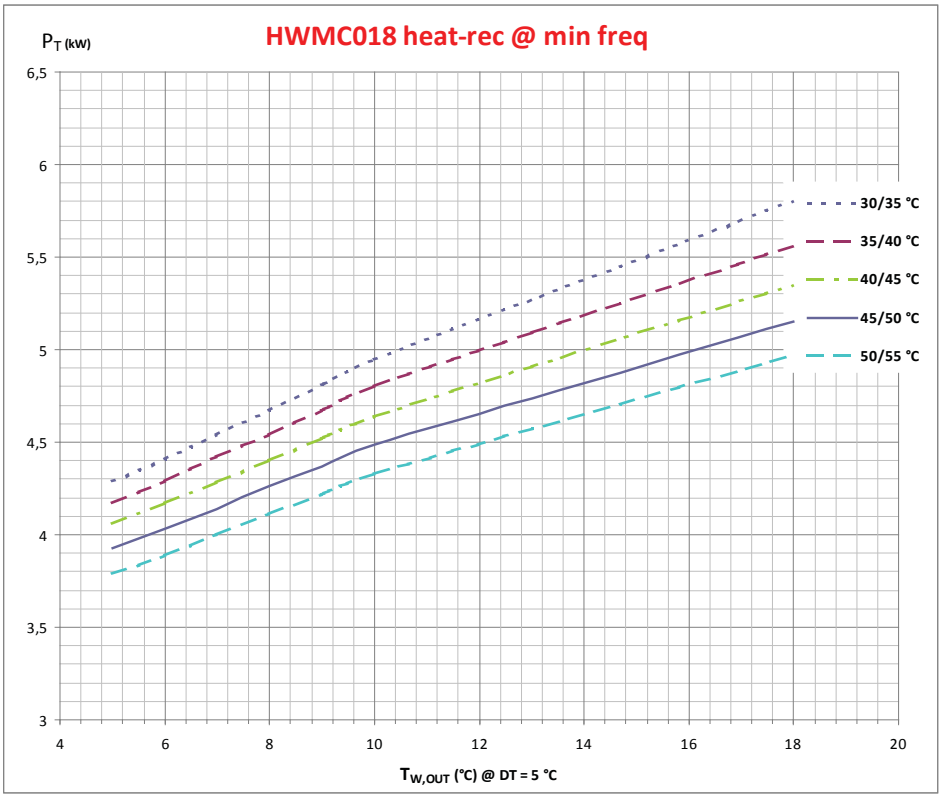

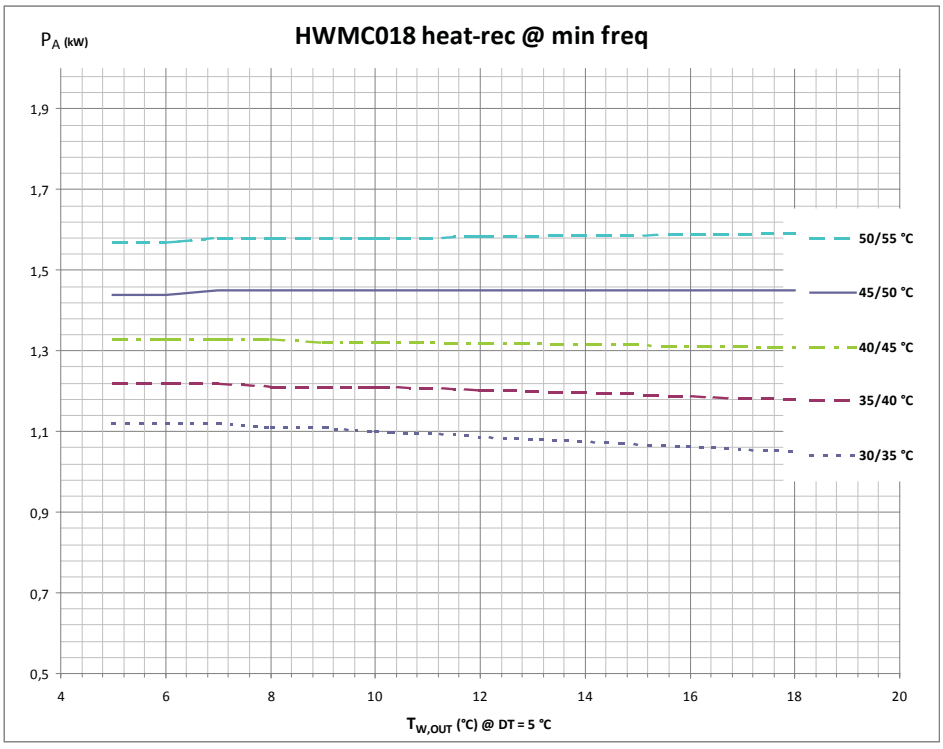

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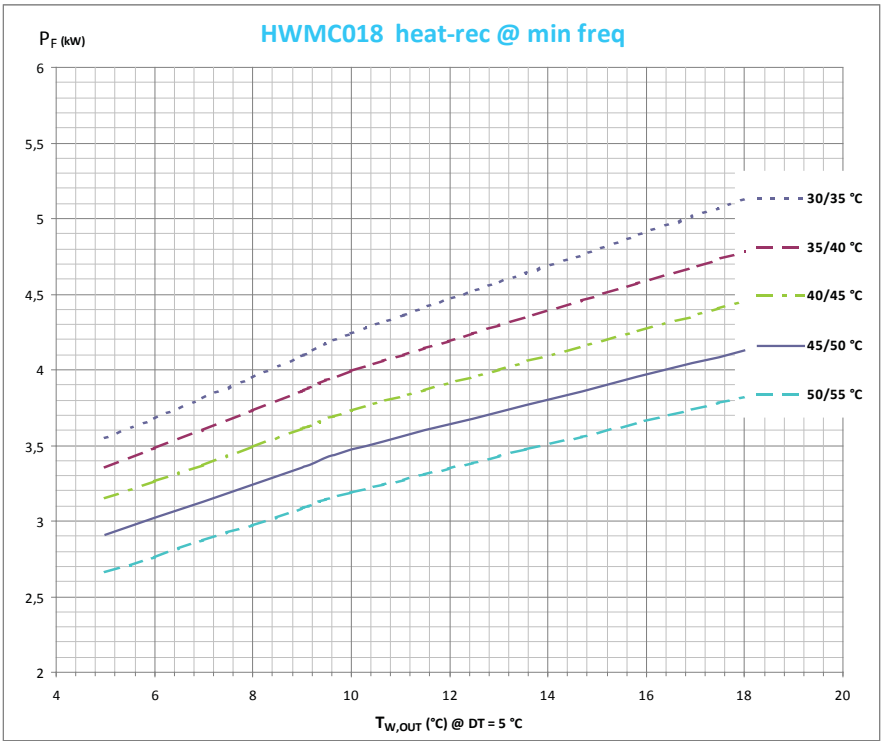

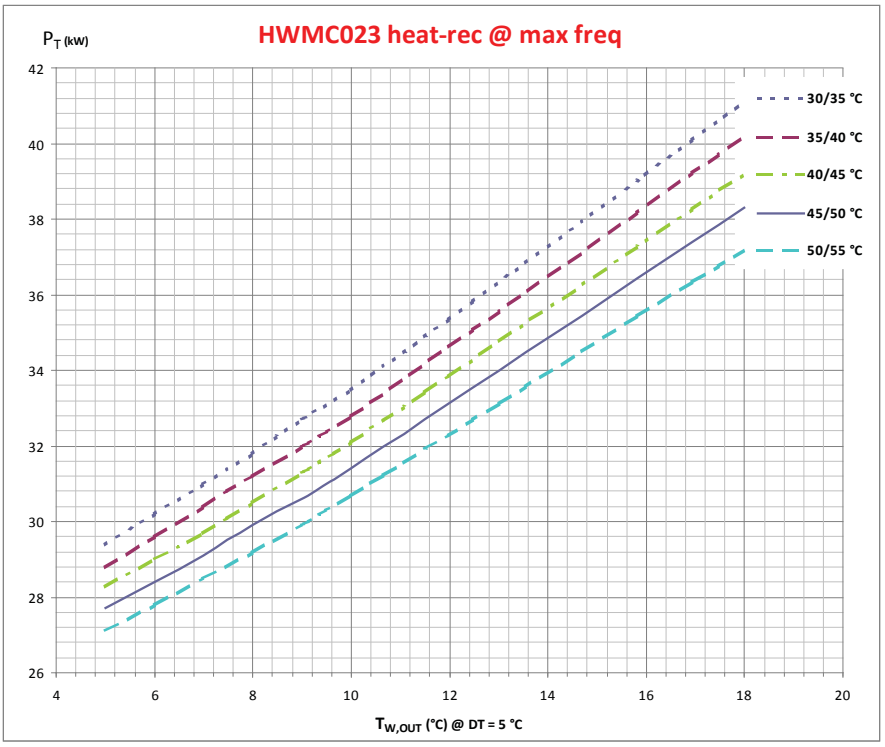

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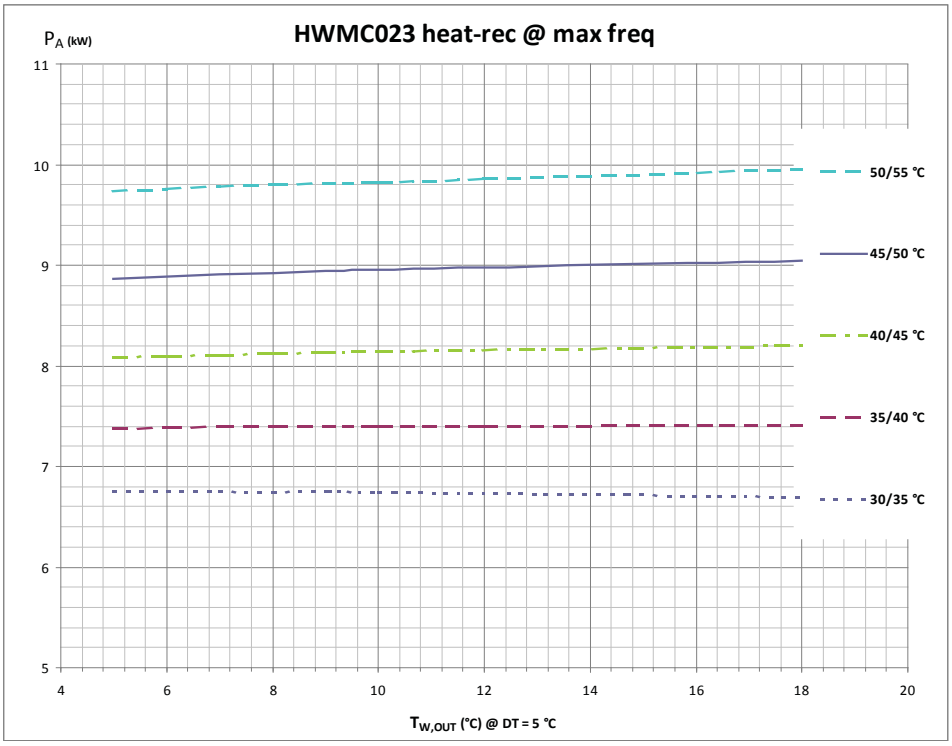

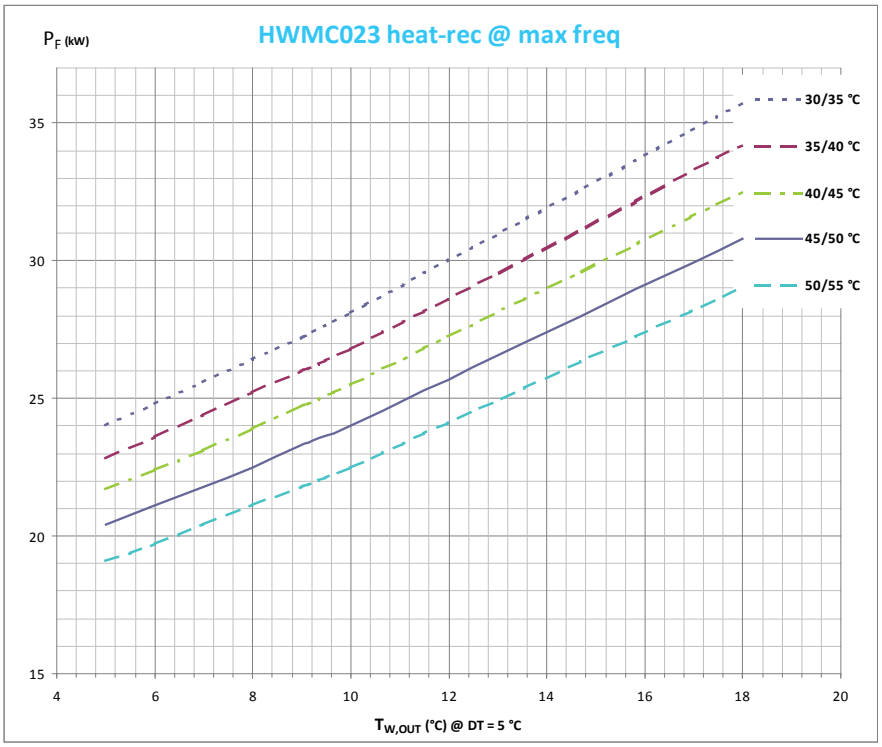

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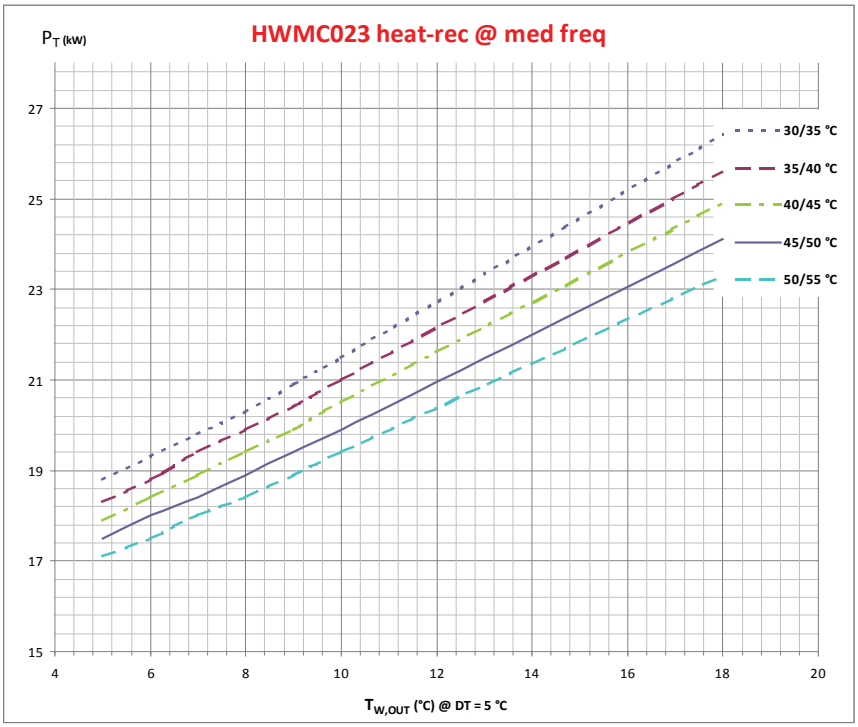

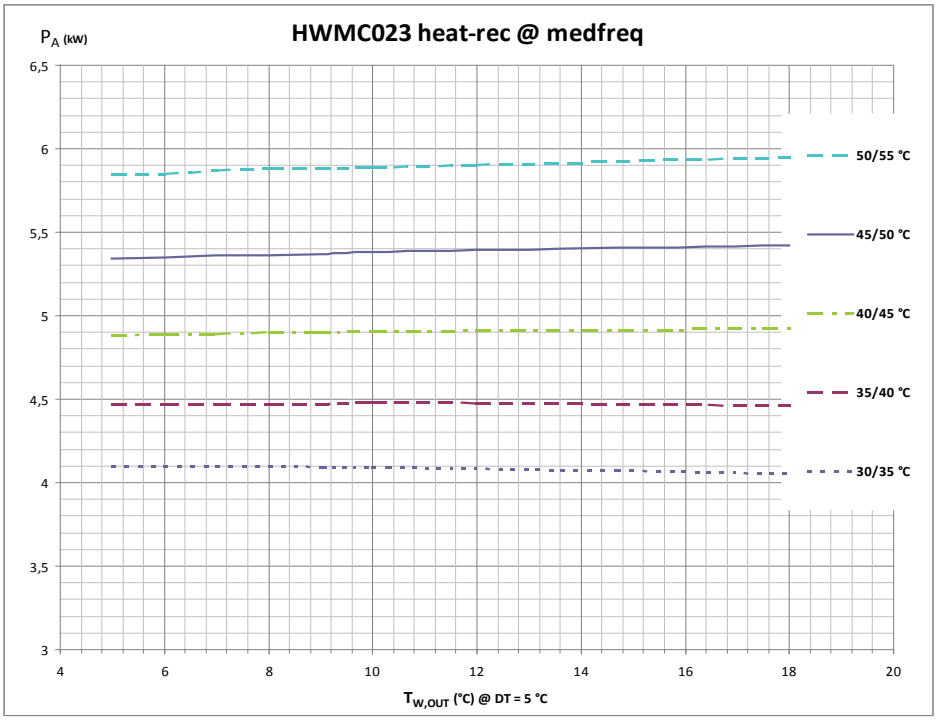

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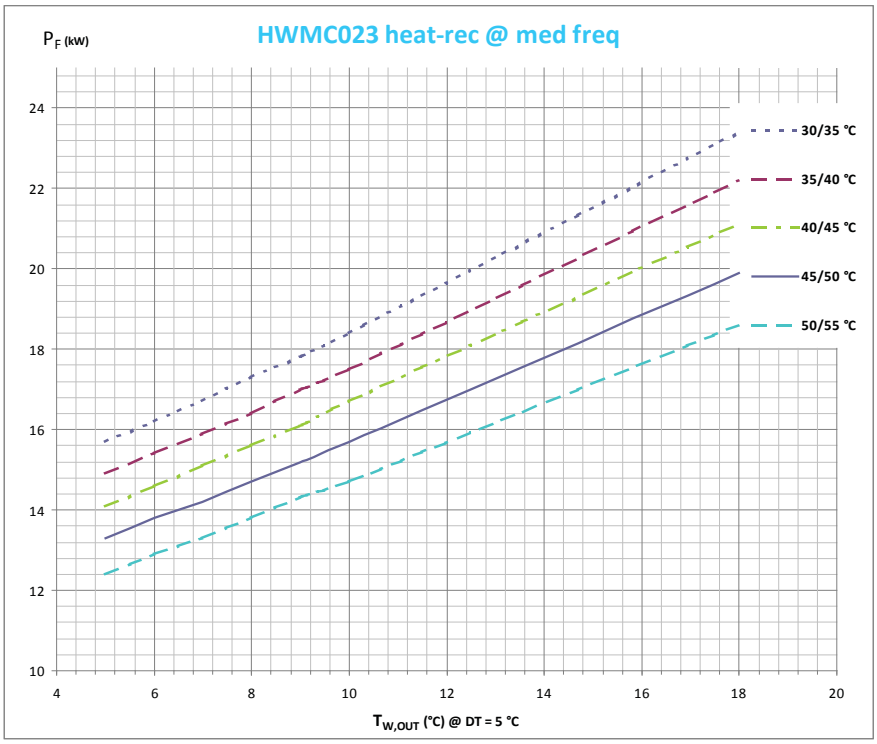

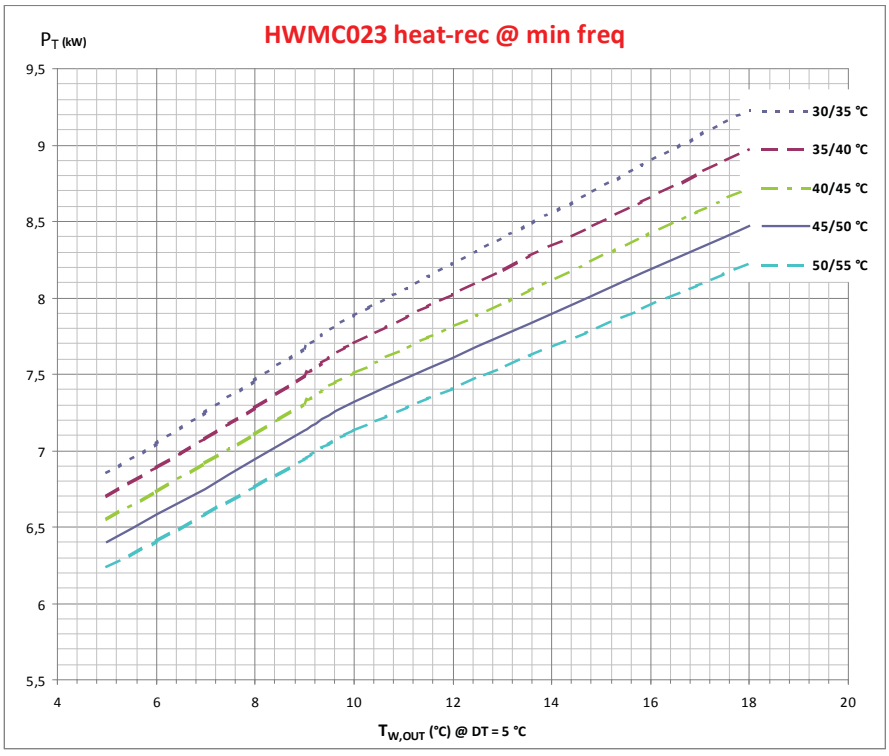

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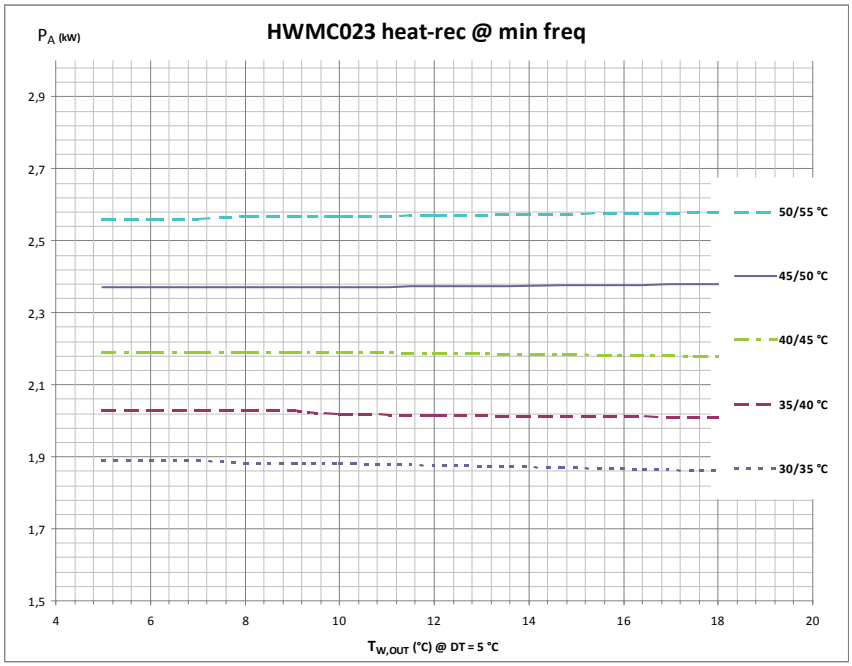

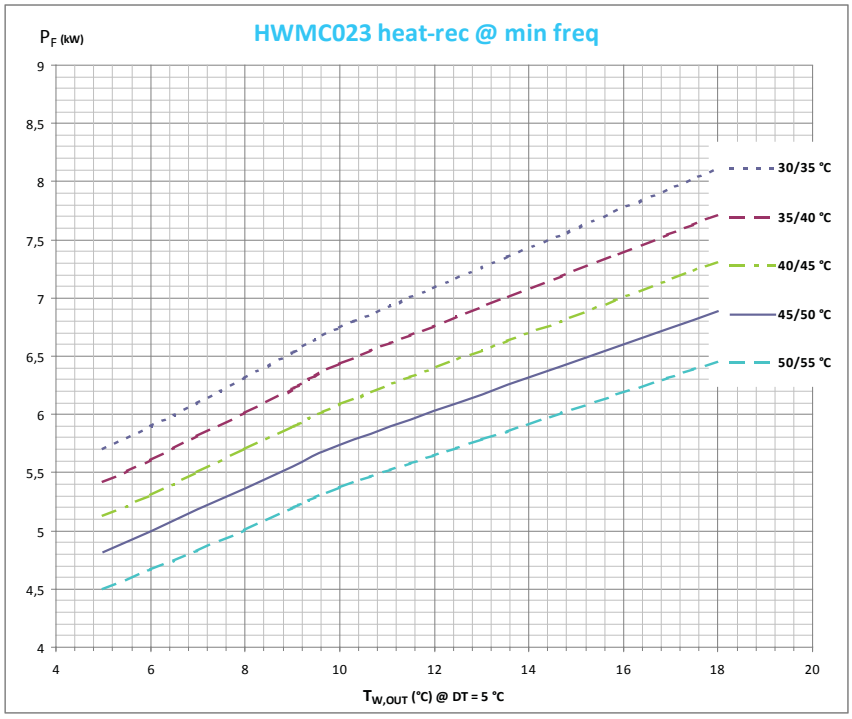

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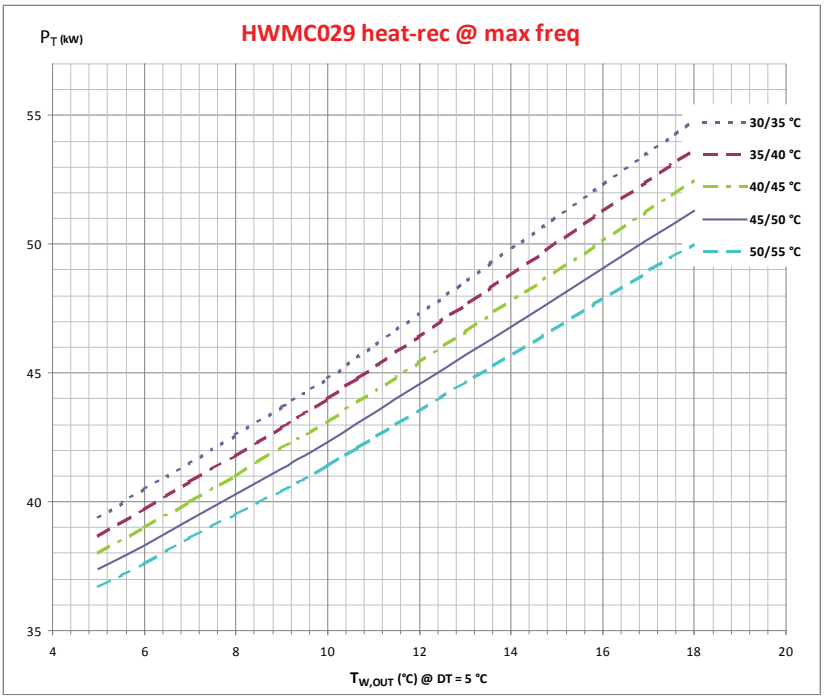

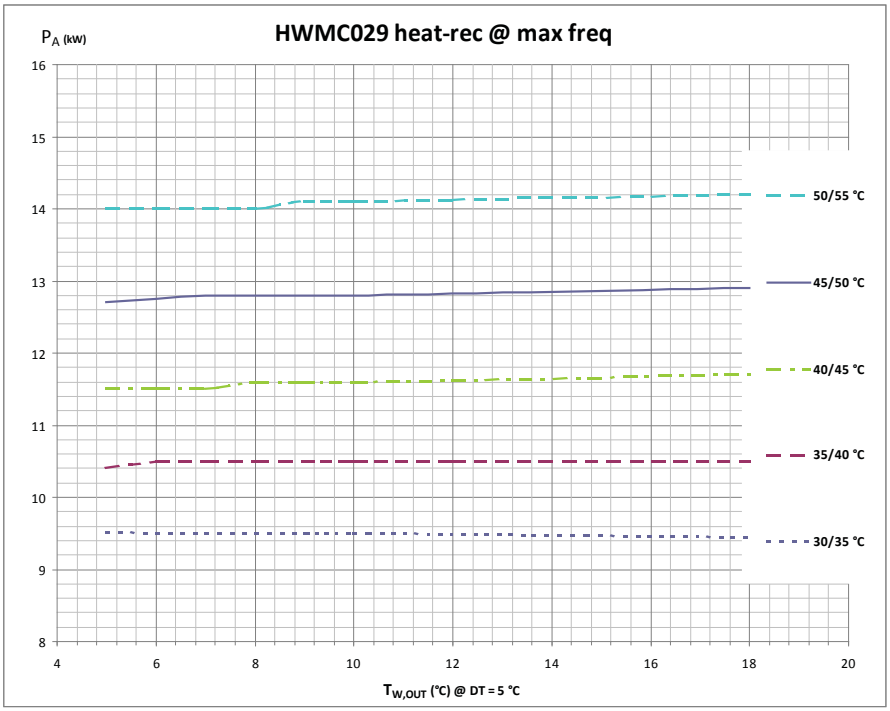

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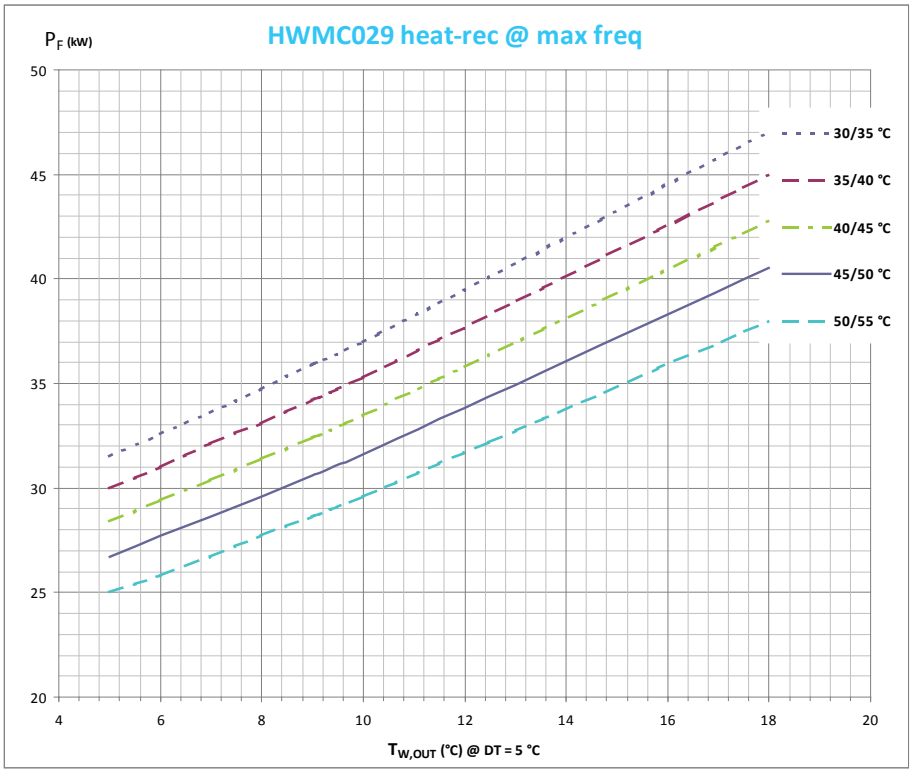

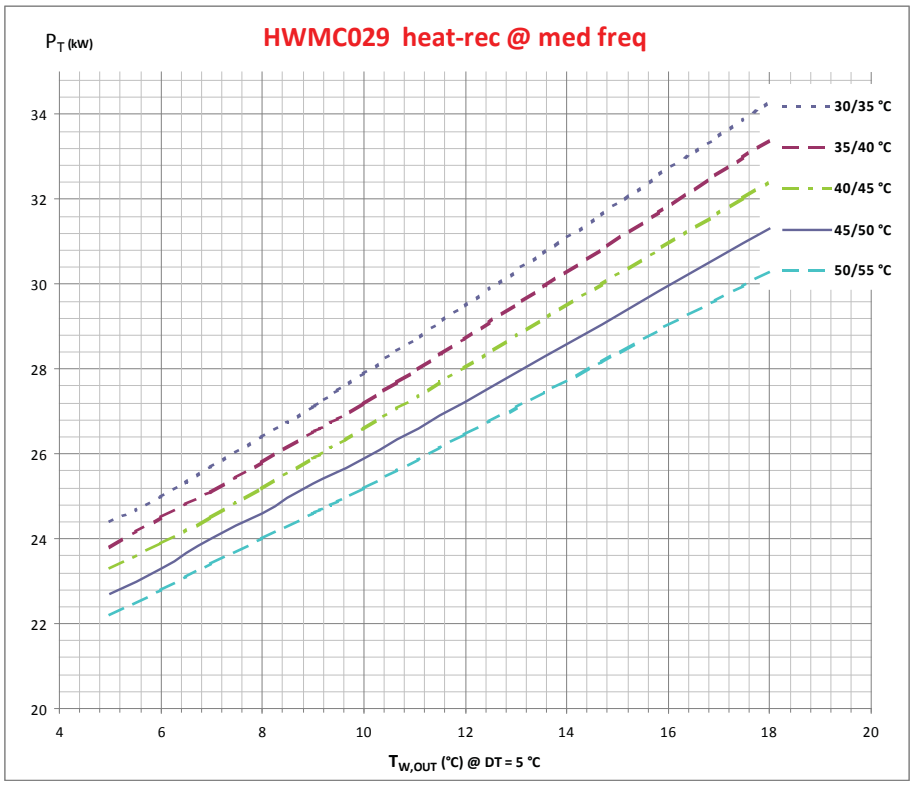

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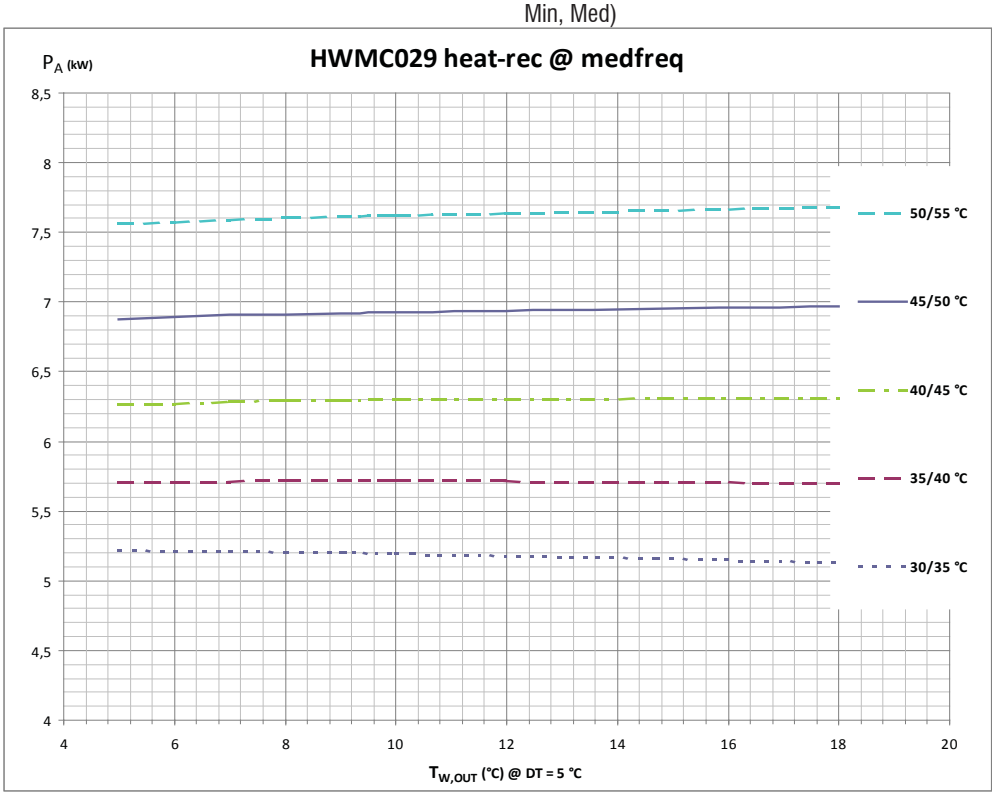

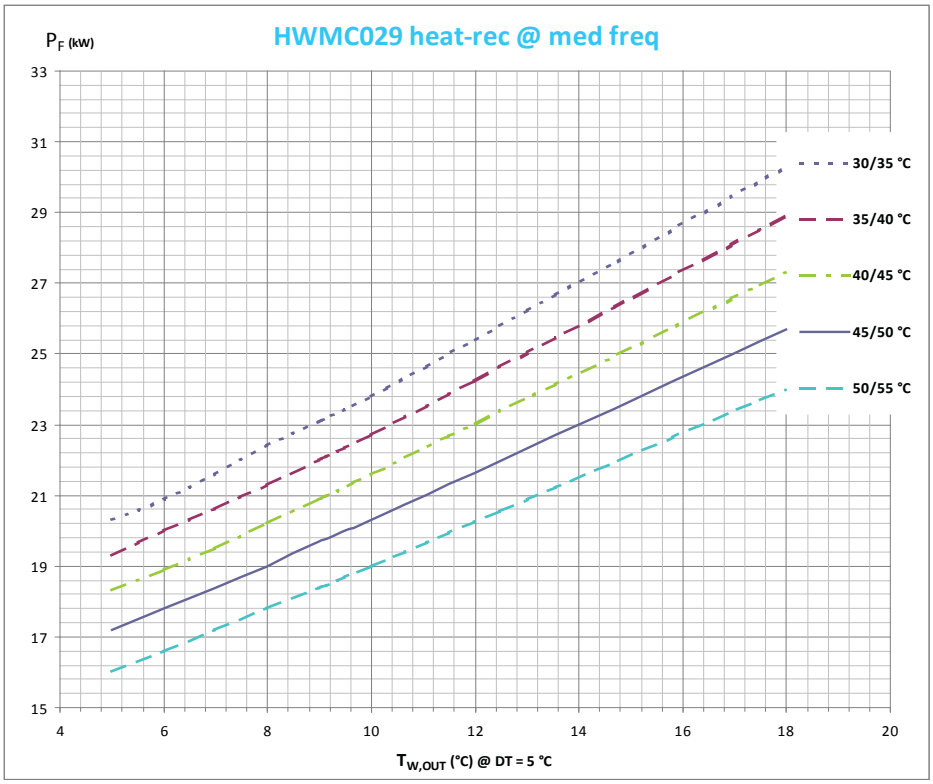

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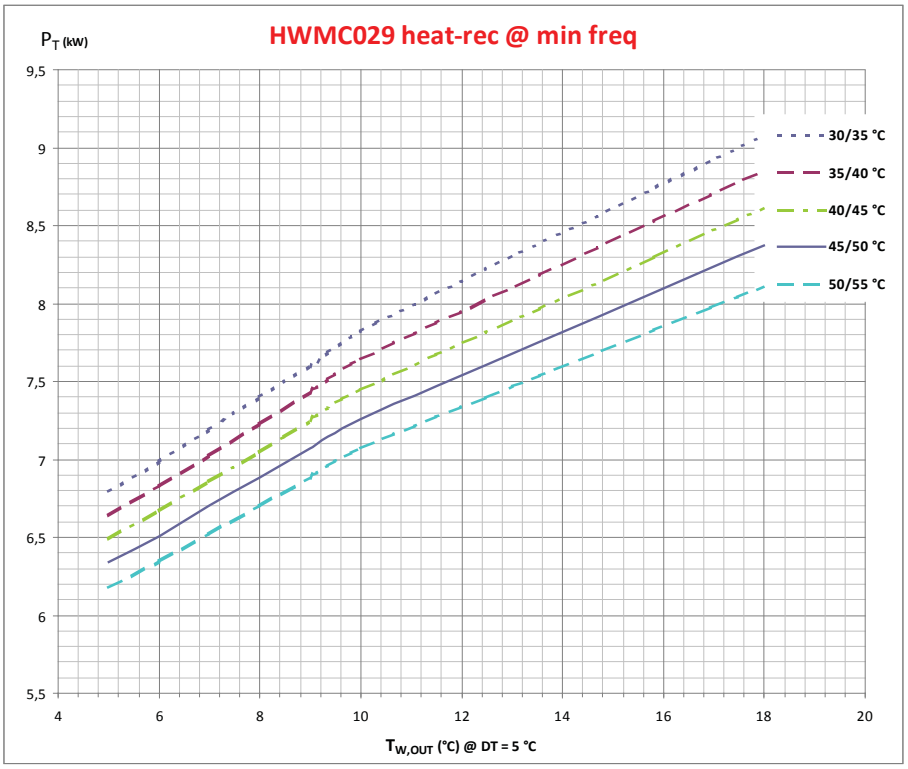

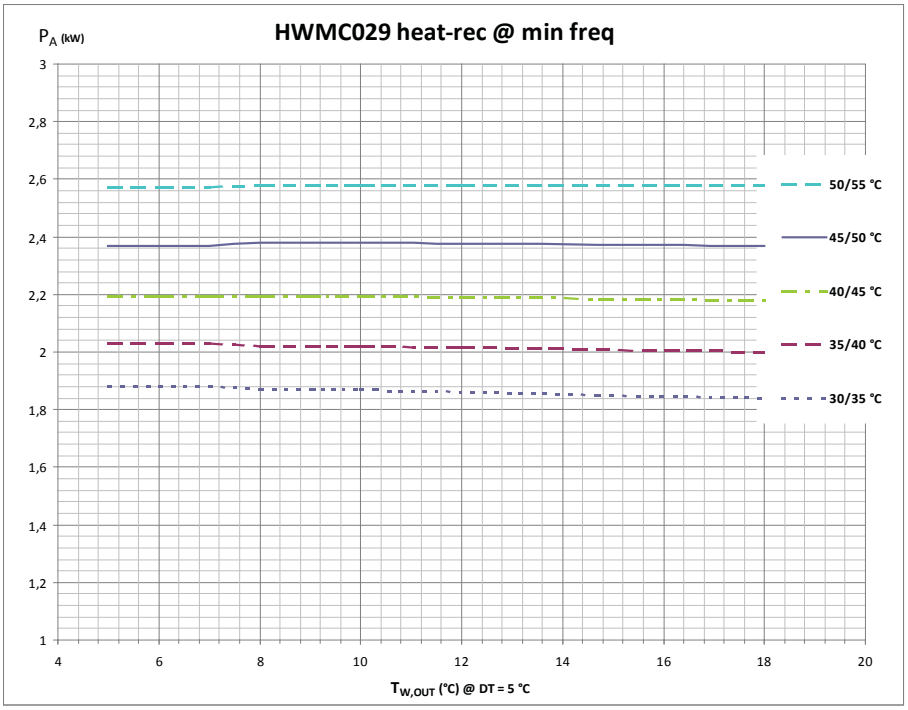

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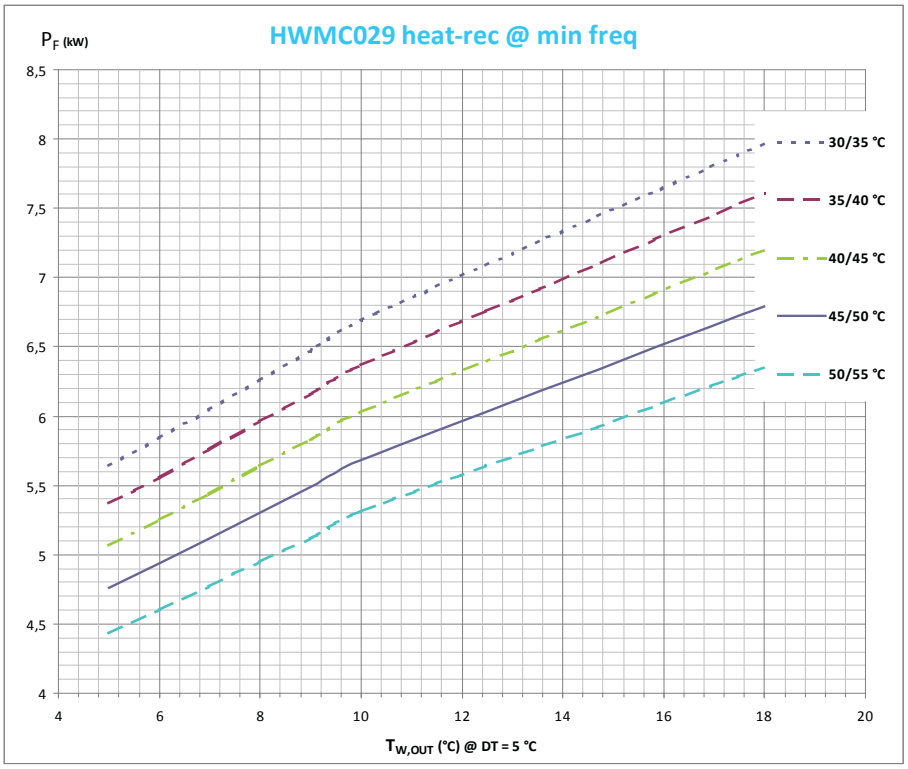

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5 PERFORMANCES

5.4 INTEGRATED CAPACITIES

In the heat pump operation (heating mode), the actual heating capacities of units may be lower than the values shown in the table, due to defrosting cycles. To obtain the actual heating capacity, multiply the capacity values by the corrective coefficients given below.

Control	Air temperature dry bulb (°C)			
	-5	0	5	>5
PCO 3	0.91	0.9	0.94	1

6 SOUND LEVELS

LEGEND:
Lw Sound power level by octave band, not weighted
Lw_A Total sound power level, weighted A
Lp_A Total sound pressure level, weighted A, measured at a distance of 10 m, with a directivity factor of 2.

Model	Lw							Lw_A			Lp_A		
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Total	Compr. compart. soundproofing	Compart. soundproof. + sil. hous.	Total	Compr. compart. soundproofing	Compart. soundproof. + sil. hous.
	dB	dB	dB	dB	dB	dB	dB	dB (A)	dB (A)	dB (A)	dB (A)	dB (A)	dB (A)
HWMC 010	79.1	71.2	66.1	61.2	58.9	58.4	57.0	70.0	68.0	67.0	42.0	40.0	39.0
HWMC 013	76.6	70.2	69.6	65.6	58.3	53.3	49.6	71.0	69.0	68.0	43.0	41.0	40.0
HWMC 018	76.6	70.2	69.6	65.6	58.3	53.3	49.6	71.0	69.0	68.0	43.0	41.0	40.0
HWMC 023	77.9	72.0	70.3	67.7	67.8	59.7	58.3	74.0	72.0	71.0	46.0	44.0	43.0
HWMC 029	77.9	72.0	70.3	67.7	67.8	59.7	58.3	74.0	72.0	71.0	46.0	44.0	43.0

7 OPERATING LIMITS

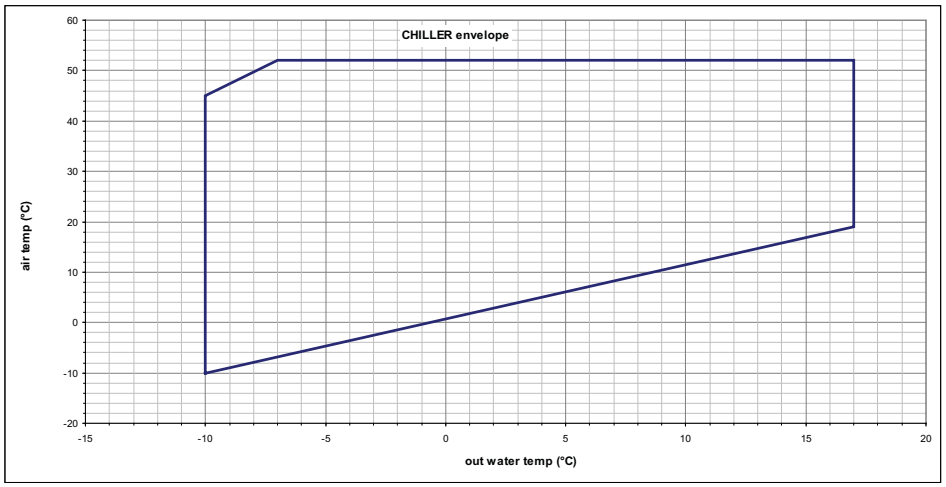
The graphs below illustrate the operating limits of the **HMWC** units (in the case of continuous operation) in relation to the outlet water temperature and outdoor air temperature.

OPERATING LIMITS	CHILLER		HEAT PUMP	
	MIN	MAX	MIN	MAX
INLET WATER TEMPERATURE (°C)	8	20 [1]	25	42
OUTLET WATER TEMPERATURE (°C)	5	19	28	58 [2]
WATER TEMPERATURE DIFFERENTIAL (°C)	3	8	3	8
OUTDOOR AIR TEMPERATURE (°C)	-10 [3]	48	-10	35

1 For transitory periods (e.g. equipment start up) values up to 25 °C are allowed
2 Value that may be reached only for outdoor air temperatures exceeding 0°C.
3 With condensation control: Outdoor air T min -15 °C

Warning!
The units are designed to work with water and air temperatures falling within the range defined by the operating limits.
Attempting to operate the units beyond these limits could cause irreparable damage to the units themselves.

7.1 OPERATING LIMITS IN CHILLER MODE



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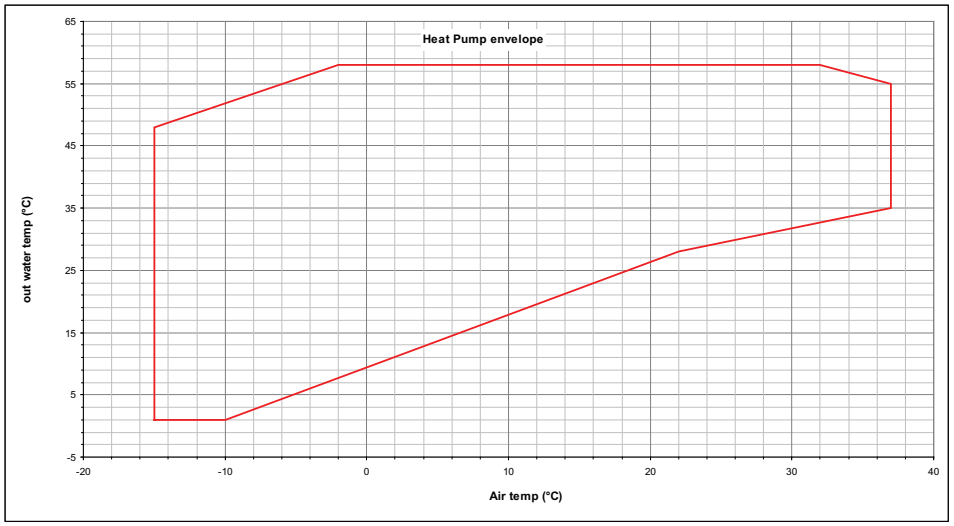
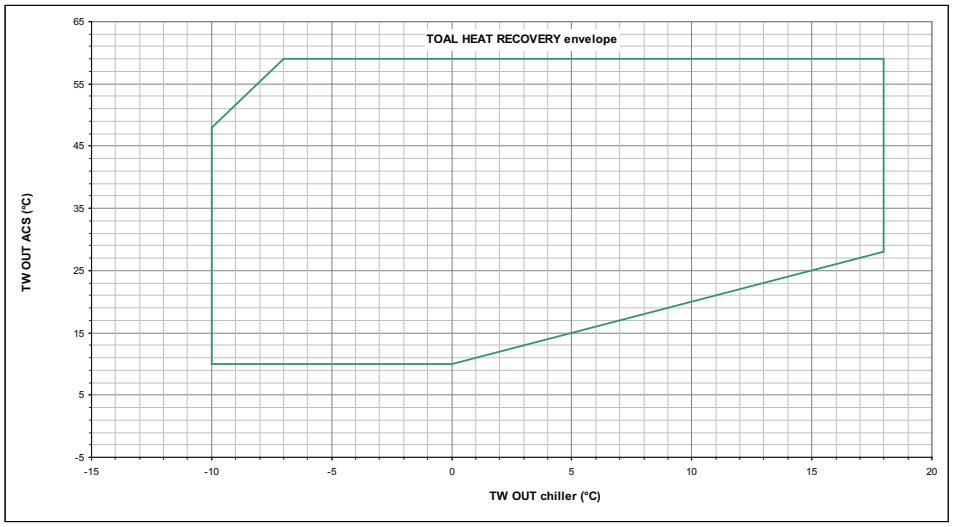
7 OPERATING LIMITS

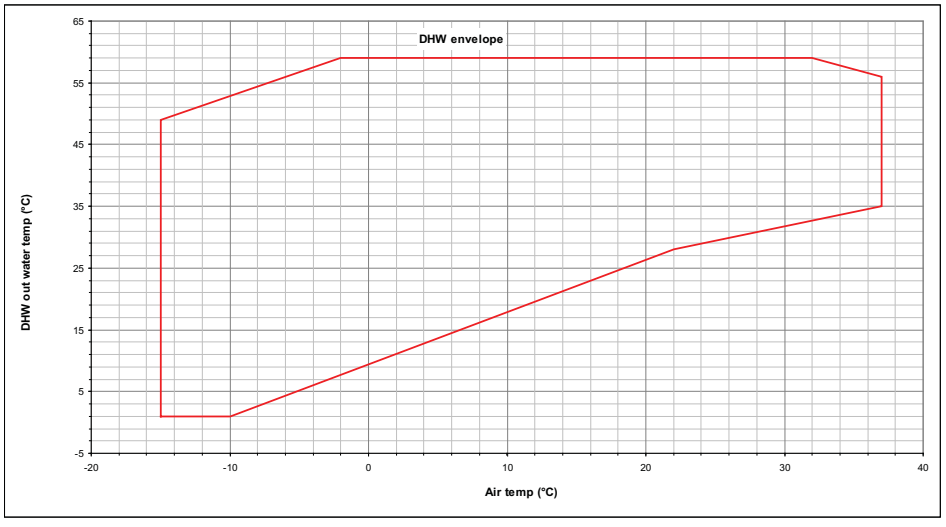
7.2 OPERATING LIMITS IN HEAT PUMP MODE



7.3 OPERATING LIMITS IN TOTAL HEAT RECOVERY DHW MODE



7.4 OPERATING LIMITS DHW PRODUCTION ONLY



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7 OPERATING LIMITS

7.5 THERMAL CARRIER FLUID

The units belonging to the **HWMC** series can work with mixtures of water and up to 30% ethylene glycol.

Percentage of ethylene glycol	0%	10%	20%	30%	40%
Minimum temp. of water produced	5°C	2°C	-5°C	-10°C	-15°C
Mixture freezing temp. (°C)	0°C	-4°C	-14°C	-18°C	-24°C
Capacity correction factor	1.000	0.998	0.994	0.989	0.983
Water flow rate correction factor	1.000	1.047	1.094	1.140	1.199
Pressure drop correction factor	1.000	1.157	1.352	1.585	1.860

WARNING:
The use of propylene glycol is not admitted with standard pumps.
For further information, contact the manufacturer.

8 CALCULATION FACTORS

8.1 CHANGE IN OPERATING PARAMETERS WITH ΔT OTHER THAN 5°C

After identifying the unit's performance in the terms of the desired outlet water temperature, correct the value by multiplying it by the following corrective coefficients.

ΔT_W	$C_{PF/PT}$	C_{PA}	C_{Qw}	$C_{\Delta pw1}$
3	0.975	1	1.63	2.64
4	0.99	1	1.24	1.53
5	1	1	1	1
6	1.015	1	0.85	0.72
7	1.03	1	0.74	0.54
8	1.04	1	0.65	0.42

LEGEND

ΔT_W Difference between water inlet temperature and water outlet temperature
$C_{PF/PT}$ Corrective coefficient of cooling/heating capacity
C_{PA} Correction coefficient of electrical input
C_{Qw} Correction coefficient of water flow rate
$C_{\Delta pw1}$ Correction coefficient of pressure drop

8.2 WATER AND GLYCOL MIXTURE

Based on the minimum outlet water temperature, you can derive the percentage of ethylene glycol and the corrective coefficient using the table below.

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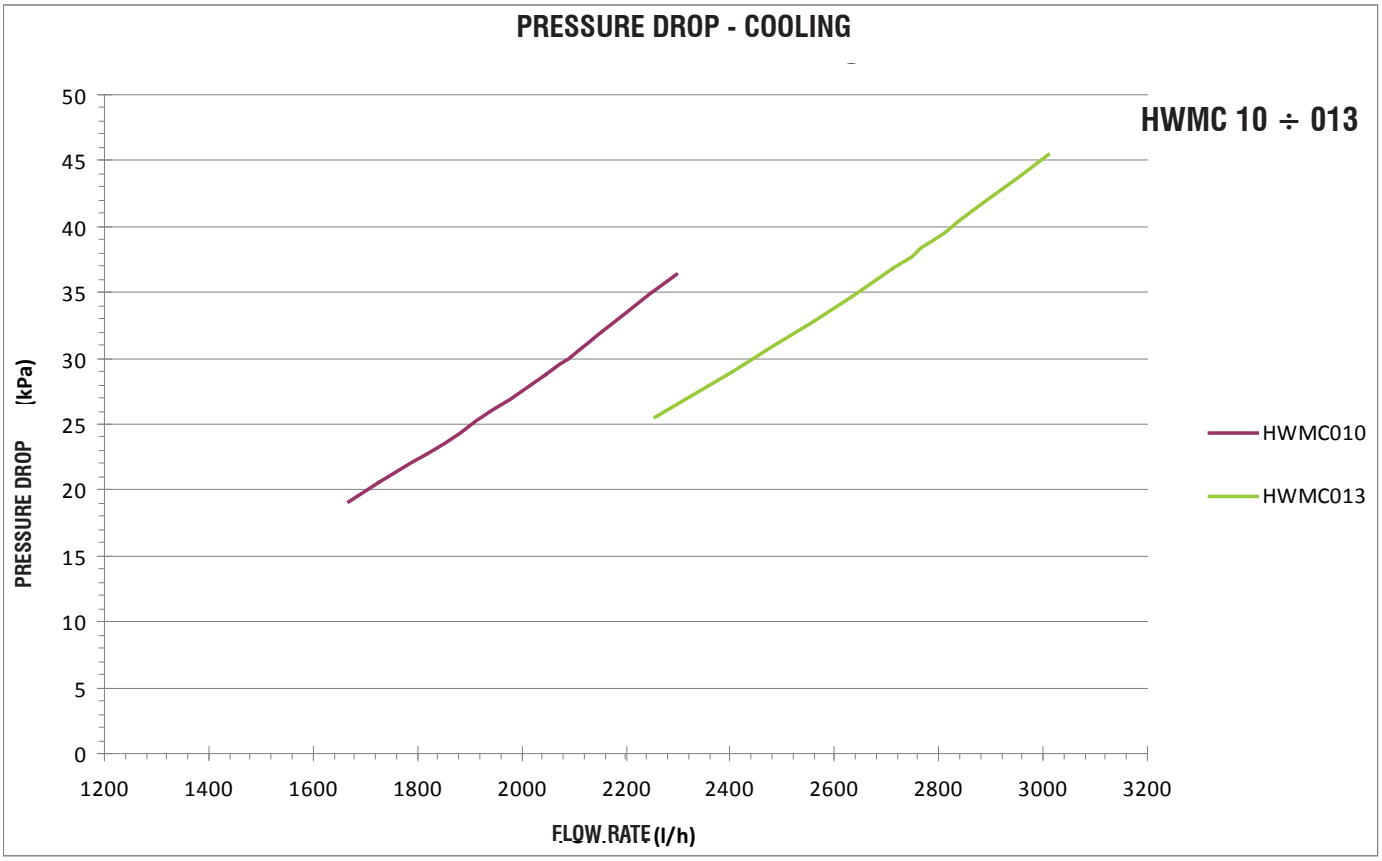
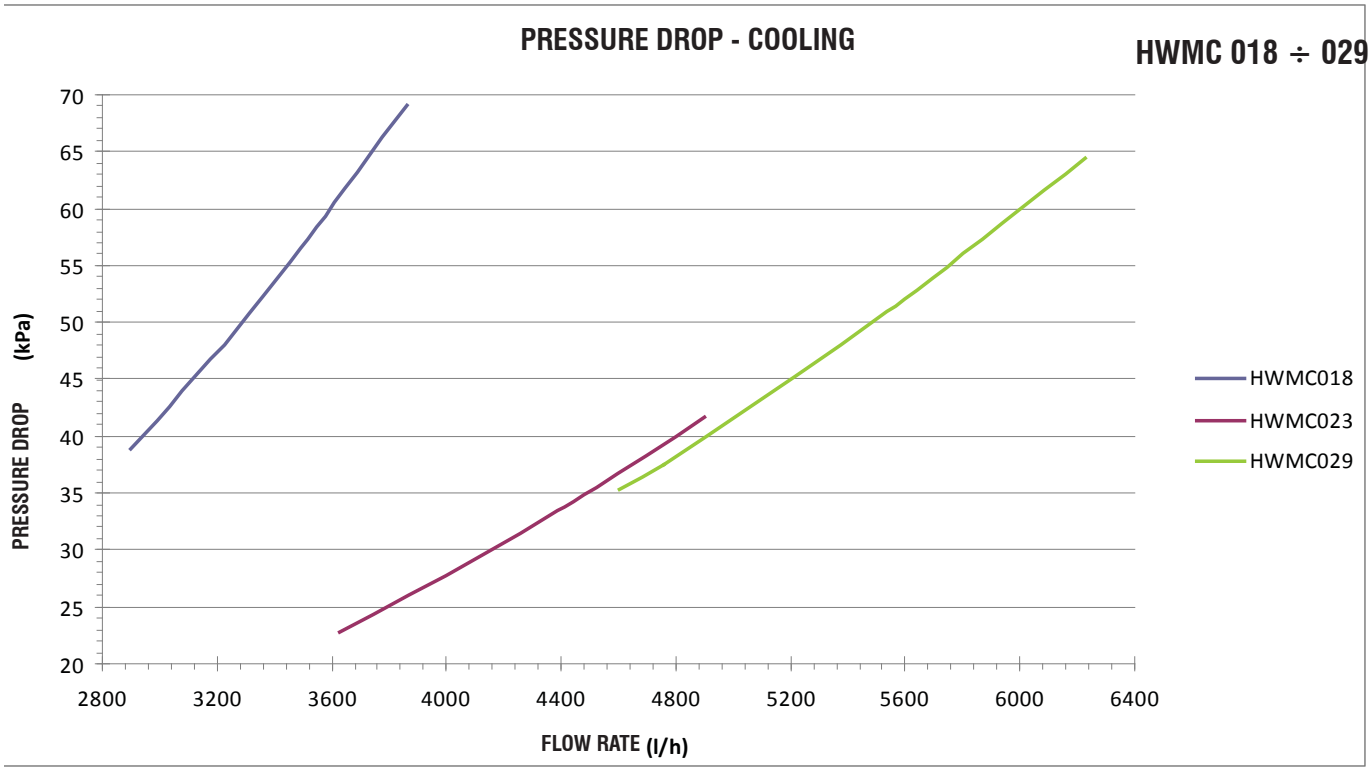
9 PRESSURE DROPS

9.1 PRESSURE DROPS ON THE WATER SIDE

The diagram shows the evaporator pressure drops (**Δp**) according to the water flow rate (**Qw**), assuming an average water temperature of 10°C.





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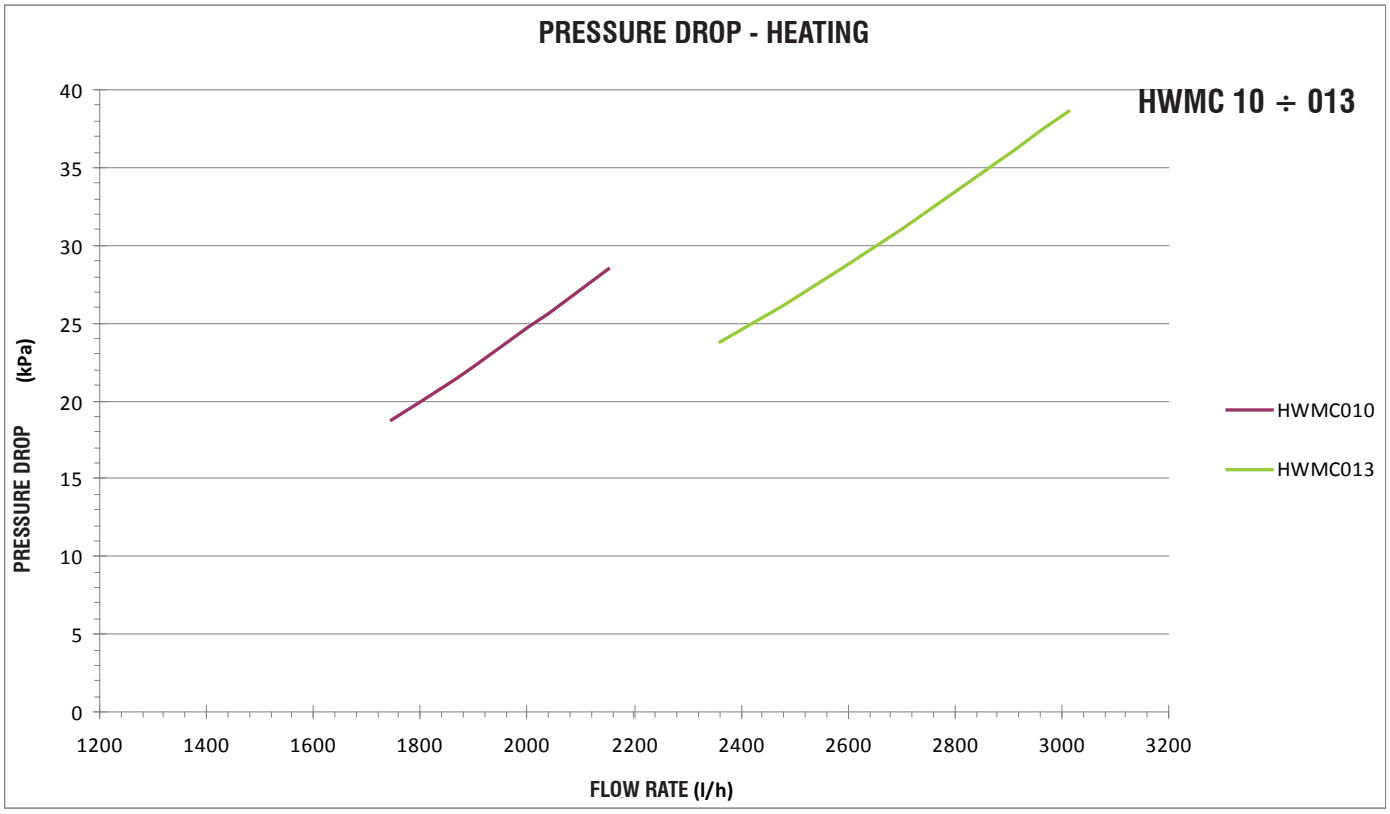
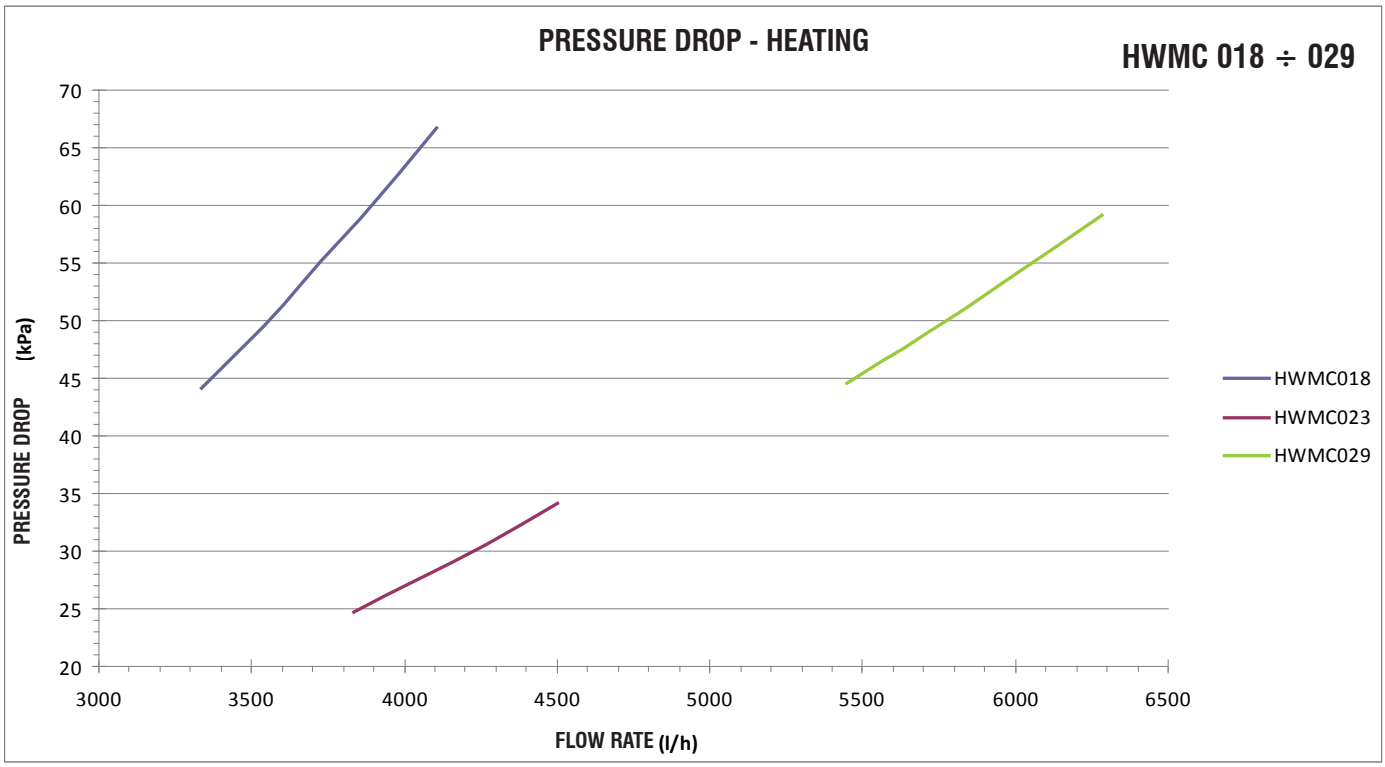
9 PRESSURE DROPS

9.1 PRESSURE DROPS ON THE WATER SIDE

The diagram shows the evaporator pressure drops (**Δp**) according to the water flow rate (**Qw**), assuming an average water temperature of 40°C.





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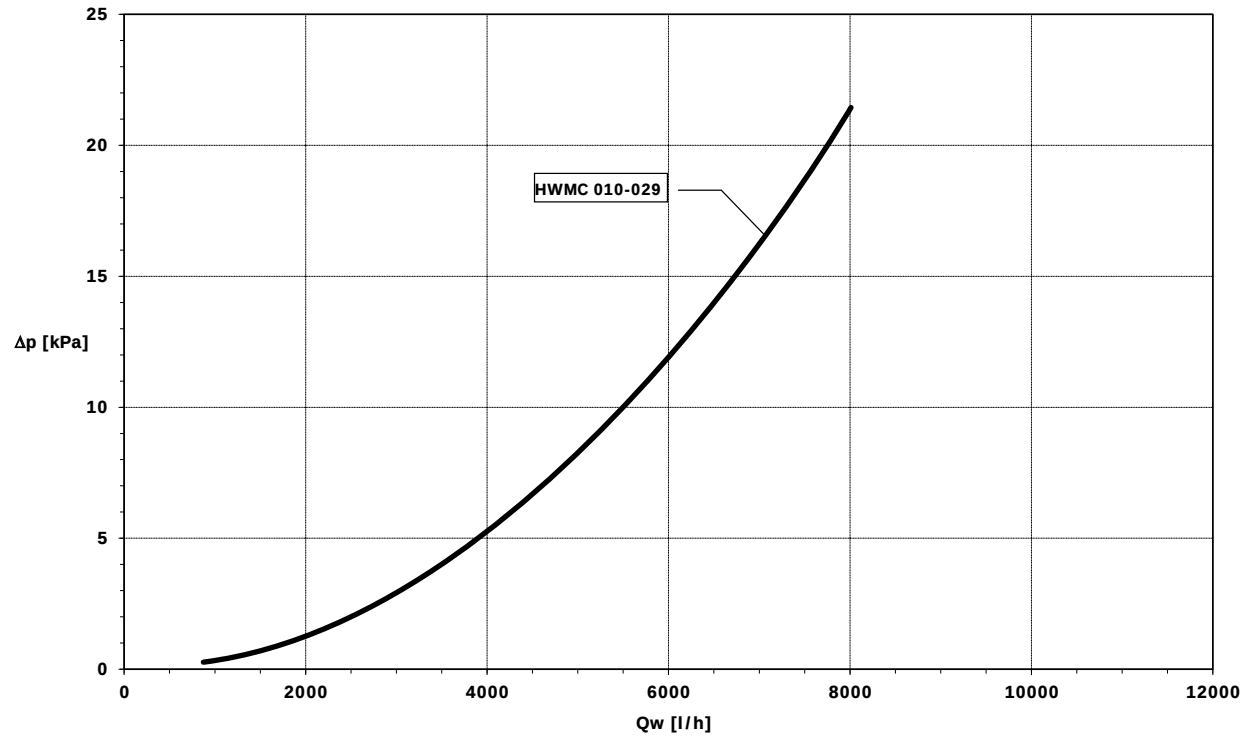
9 PRESSURE DROPS

9.2 PRESSURE DROPS OF Y FILTER

The diagram shows the evaporator pressure drops (**Δp**) according to the water flow rate (**Qw**), assuming an average water temperature of 10°C.



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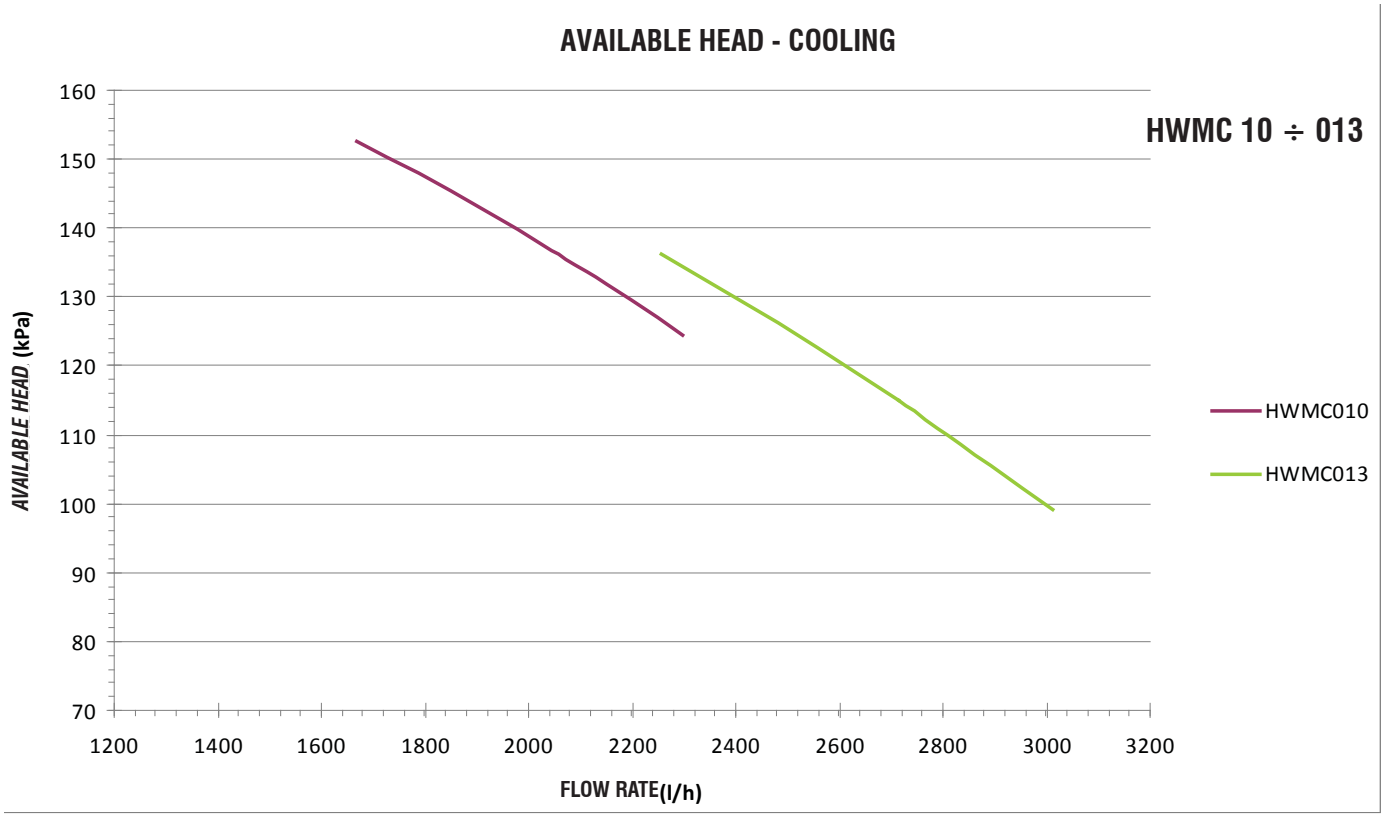
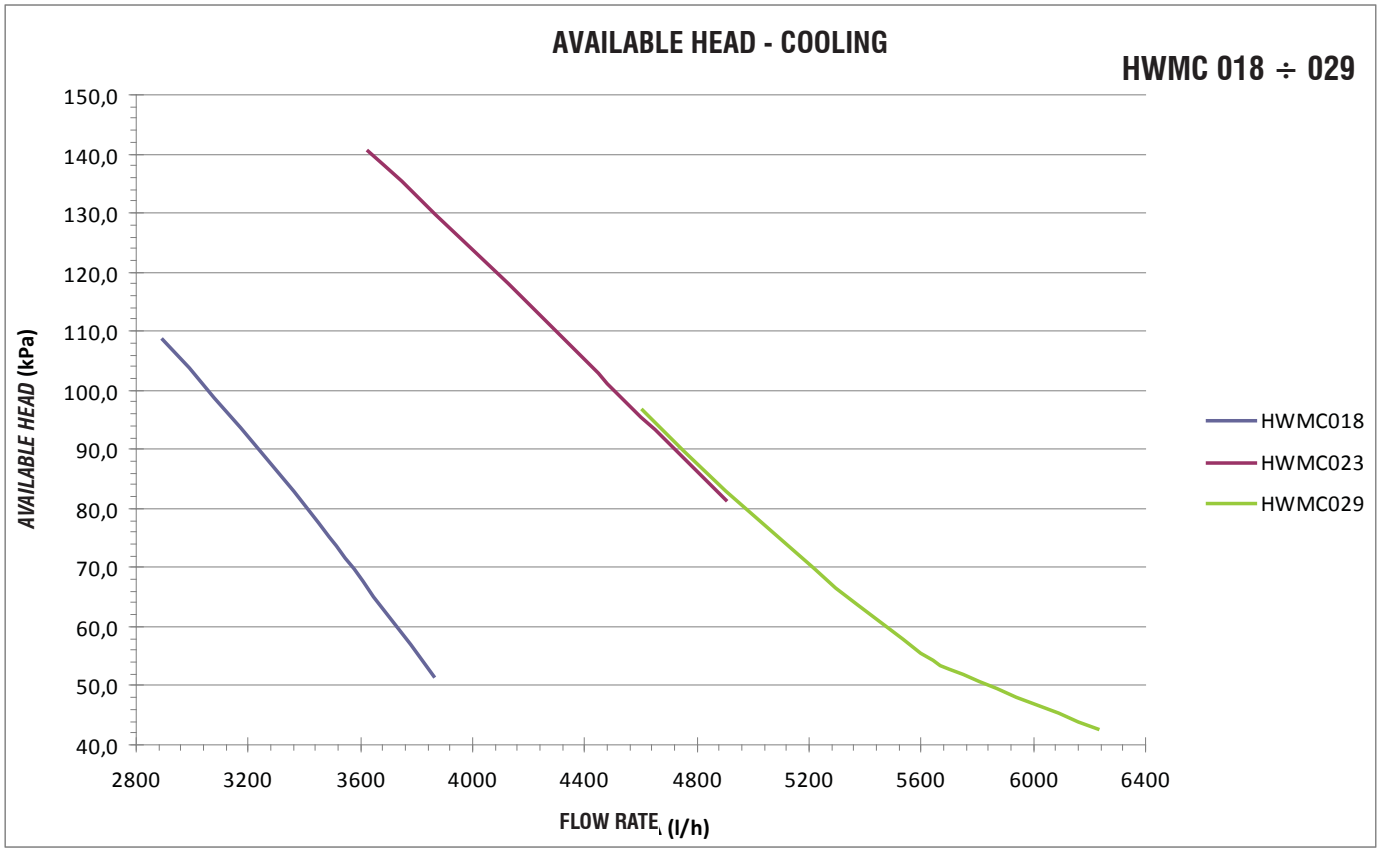
10 AVAILABLE HEAD OF THE UNIT

The diagram below shows the available head (**Pu**) of the unit according to the water flow rate (**Qw**), assuming an average water temperature of 10°C, net of pressure drops. Pressure drops of the Y filter are not counted.





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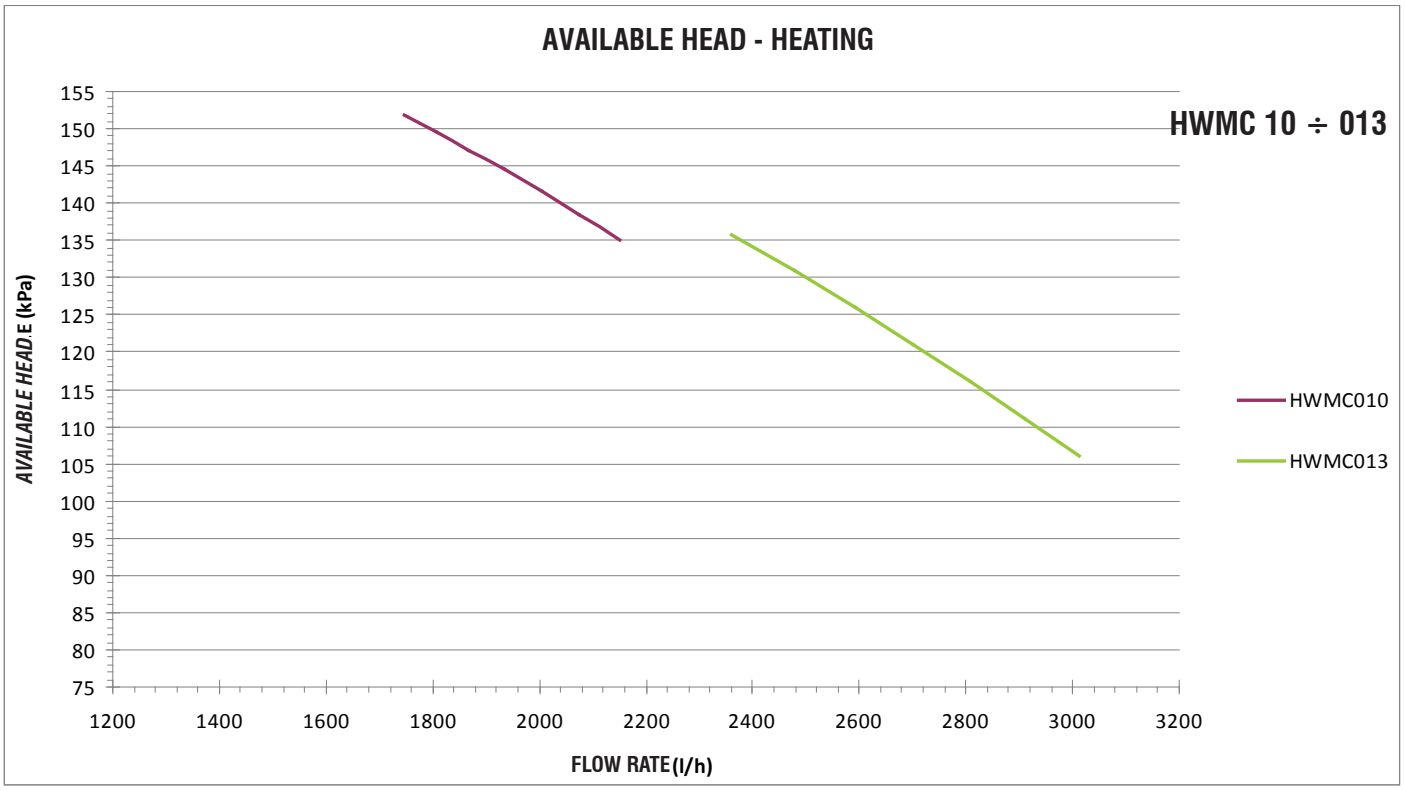

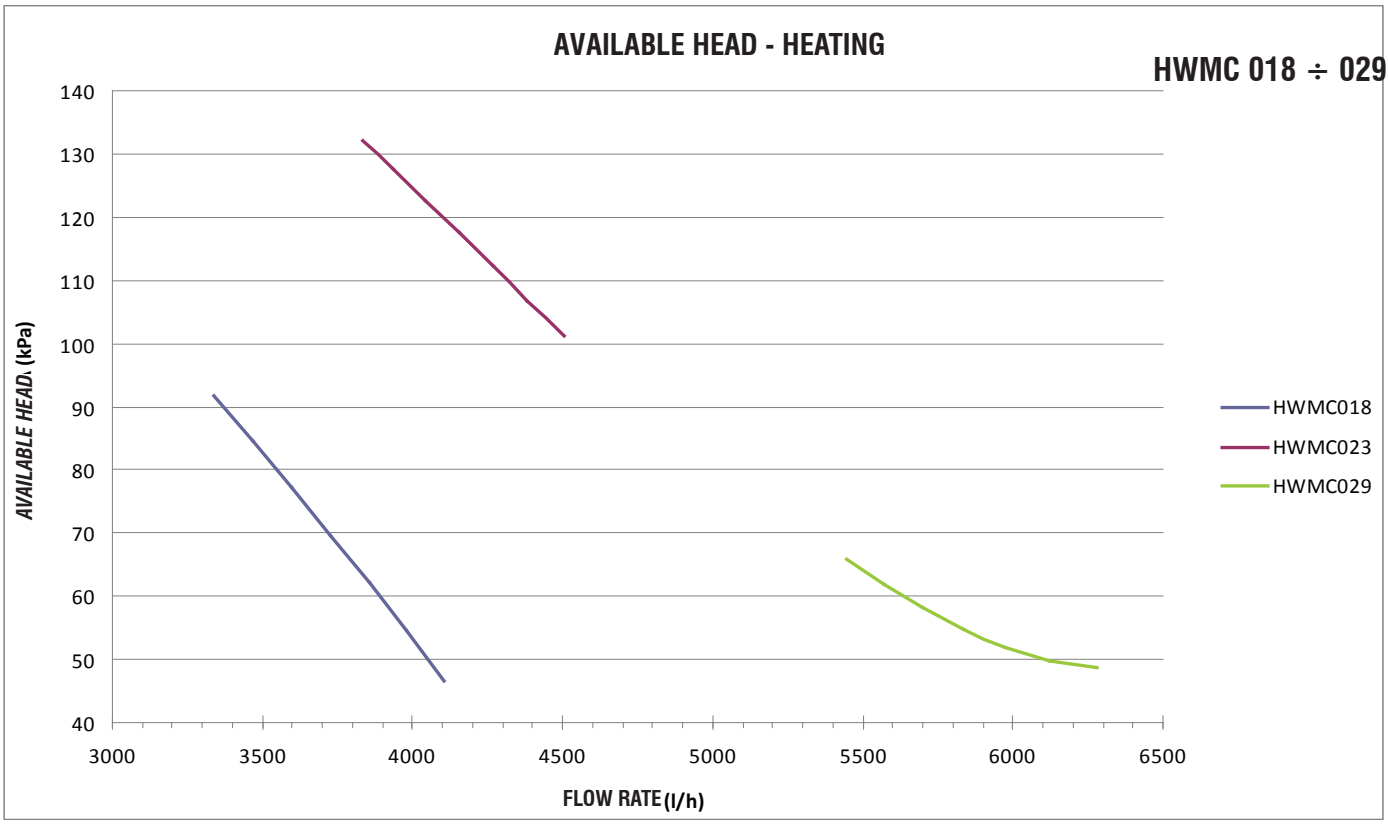

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11 WATER CIRCUIT

When setting up the water circuit of the unit, it is advisable to follow the directions below and in any case comply with local or national regulations.
Connect the pipes to the chiller using flexible couplings to prevent the transmission of vibrations and to compensate thermal expansions.
It is recommended to install the following components on the pipes:

- Temperature and pressure indicators for routine maintenance and monitoring of the unit. Checking the pressure on the water side will enable you to verify whether the expansion tank is working efficiently and to promptly detect any water leaks within the equipment.
- Traps on incoming and outgoing pipes for temperature measurements, which can provide a direct reading of the operating temperatures.
- Regulating valves (gate valves) for isolating the unit from the water circuit.
- **Metal mesh filter (supplied), with a mesh size no greater than 1 mm, to be fitted on the inlet pipe to protect the exchanger from scale or impurities present in the pipes.**
- Air vent valves, to be placed at the highest points of the water circuit for the purpose of bleeding air. The internal pipes of the unit are fitted with small air vent valves for bleeding the unit itself. This operation may only be carried out when the unit is disconnected from the power supply.
- Drainage valve and, where necessary, a drainage tank for emptying out the equipment for maintenance purposes or when the unit is taken out of service at the end of the season. (A 1" drainage valve is provided on the optional water buffer tank: this operation may only be carried out when the unit is disconnected from the power supply).

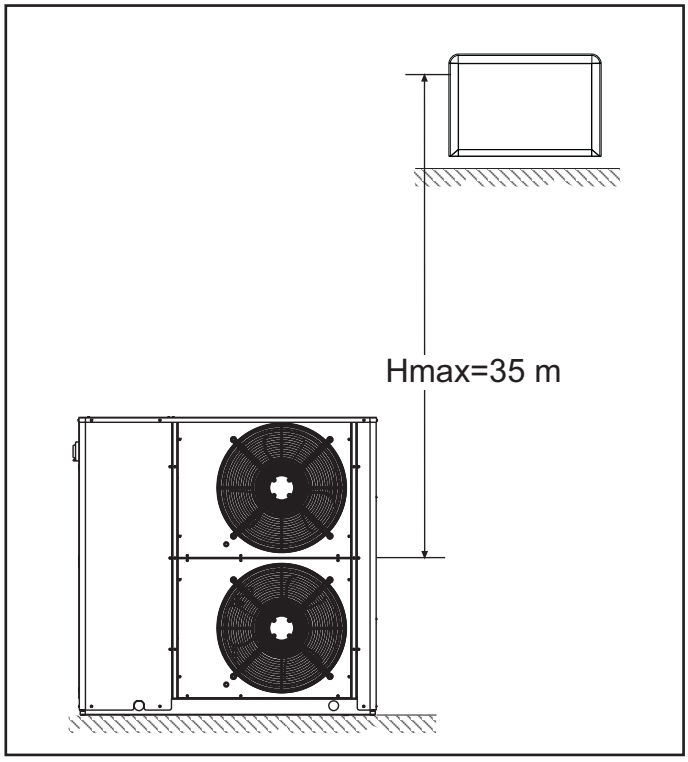
It is of fundamental importance that the incoming water supply is hooked up to the connection marked "Water Inlet".
Otherwise the evaporator would be exposed to the risk of freezing since the antifreeze thermostat would not be able to perform its function; moreover the reverse cycle would not be respected in the cooling mode, resulting in additional risks of malfunctioning.
The dimensions and position of plumbing connections are shown in the dimension tables at the end of the manual.
The water circuit must be set up in such a way as to guarantee that the nominal flow rate of the water supplied to the evaporator remains constant (± 15%) in all operating conditions.
A standard feature of HWMC units is a device for controlling the flow rate (flow switch or differential pressure switch) in the water circuit in the immediate vicinity of the evaporator.

11.1 WATER CONTENT WITHIN THE SYSTEM AND CHARGING OF EXPANSION TANK

In models without a water storage reservoir it is necessary to assure that the content of water within the system does not fall below 3.5 litres/kW in the case of cooling-only models and 4.5 litres/kW in the case of heat pump models. This level is necessary to prevent the water temperature from falling below the indoor unit enabling threshold during defrost cycles.

N.B kW in reference to rated capacity

The expansion tank is pre-charged to a pressure of 1.5 bars, sufficient for systems with a maximum height difference (H in the figure at the side) of 13 metres.
For greater height differences, refer to the table below in order to adjust the charging pressure of the expansion tank accordingly.
In no case should you exceed the maximum height difference Hmax = 35 m.



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11 WATER CIRCUIT

11.2 CHARACTERISTICS OF SYSTEM STORAGE

The influence of the size of the buffer tank in relation to the temperatures in the defrost phase.
We propose performing a simple verification, for example after selecting a tank for its buffer effect, by requiring that at the end of the defrost cycle its minimum temperature (for the sake of simplicity and uniformity) be at least equal to a value that we consider to be the lower limit (for example, the one which keeps the heat power exchanged by the indoor units, or the temperature of the air produced, at a sufficient value).

Once the following parameters are defined:

P_{DEF}	Cooling capacity during defrost cycle (chiller)
t_{def}	Operating time in chiller mode for defrosting
T_{INIZ}	Initial temperature of fluid (e.g. water)
T_{FIN}	Total time with compressors off
p	Fluid density
C_S	Specific heat of the fluid
ΔT_{DEF}	Fluid temperature decrease after defrost
E_{DEF}	Energy transferred to fluid during defrost
V_{H2O}	Minimum volume of fluid in order to have a final temperature not lower than T_{FIN}
$V_{H2O, SP}$	Minimum volume per kW of heat pump heating capacity

We can express the following simple equation:

$$V_{H_2O} = \frac{E_{DEF} \times 1000}{\rho_{DEF} \times C_S \times \Delta T_{DEF}}$$

Where:

$$E_{DEF} = P_{DEF} \times t_{DEF} \times 60$$

$$\Delta T_{DEF} = T_{IN} - T_{FIN}$$

To better clarify the concept, we propose an example of calculation (with the assumption to consider defrost power approximately equal to the heat pump's heating capacity, if tables are not available containing the changes in cooling capacity depending on air and water temperatures):

Input data

Powers and times			Temperatures		Physical properties	
P_{HEAT} (kW)	P_{DEF} (kW)	t_{def} (min)	T_{INIZ} (°C)	T_{FIN} (°C)	p (kg/m3)	CS (kJ/kg °C)
45.0	45.0	2.0	50	40	990	4.187

Which gives us the defrost data as well as the minimum content of the buffer tank:

Defrost data		Minimum content	Specific content
DT DEF (°C)	E DEF (kJ)	V_{H20} (l)	V_{H20} (l/kW)
10	5400	130	2.9

Note: The above method is obviously simplified; since the thermal powers, especially that for cooling, are a function of the water temperature, the problem would be solved using a comprehensive approach and not with a simple balance.

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11 WATER CIRCUIT

11.3 CHARACTERISTICS AND SELECTION OF DHW STORAGE

The objective of this section is to estimate the minimum temperature of the buffer tank for the purpose of taking a hot water sample that can be considered (for the project data) a “sampling peak.”

Note: Also in this case we will use a simplified method.

For the sake of simplicity let’s imagine we are collecting, for a certain amount of time, a certain volume of hot water (which enters the buffer tank at the temperature of the network and exits at the design temperature). We can image that, in a worst-case scenario, the buffer tank’s temperature drops immediately and the multi-purpose unit is activated to counter this temperature drop. Under these conditions there will be heat flow entering the buffer tank (the multi-purpose unit’s power) and exiting it (the DHW collected); the difference between these two will determine the net energy withdrawn from the tank.

In other words, once the following parameters are defined:

V_{DHW} Collection of domestic hot water from the buffer tank, in litres
P_{HP} Power of the heat pump (or fraction) operating on the buffer tank, in kW
t_{DHW} Duration of the collection of DHW from the buffer tank, in minutes
T_{IN} Inlet temperature of the DHW from the network (typically 15 °C)
T_{DHW} Outlet temperature of the DHW from the buffer tank (typically 40 °C)
T_{INIT} Initial temperature of the buffer tank (average), in °C
T_{FIN} Final temperature of the buffer tank (average), in °C (acceptable minimum value)
E_{HP} Energy transferred to the buffer tank by the heat pump during the collection time, in kJ
E_{DHW} Energy removed from the DHW during the collection time, in kJ
V_{H2O} Minimum volume of the buffer tank, to have a final temperature of no less than T_{FIN}

We will have:

$$V_{H_2O} = \frac{(E_{ACS} - E_{PDC}) \times 1000}{\rho \times C_S \times (T_{INIZ} - T_{FIN})}$$

Where:

$$E_{PdC} = P_{PdC} \times t_{ACS} \times 60$$
$$E_{ACS} = \rho \times V_{ACS} \times C_S \times (T_{ACS} - T_{IN})$$

Also in this case a numerical example can help clarify the application:

Input data

Powers and times			DHW temperatures		Buffer tank temp.	
V_{ACS} (litres)	P_{PdC} (kW)	t_{ACS} (min)	T_{IN} (°C)	T_{ACS} (°C)	T_{INIZ} (°C)	T_{FIN} (°C)
60	5.0	10	15	40	50	45

From which can be obtained the two input and output energies and, therefore, also the minimum volume of the water in the buffer tank:

Exchanged heat		Minimum content
E_{PdC} (kJ)	E_{DHW} (kJ)	V_{H2O} (l)
10	5400	155

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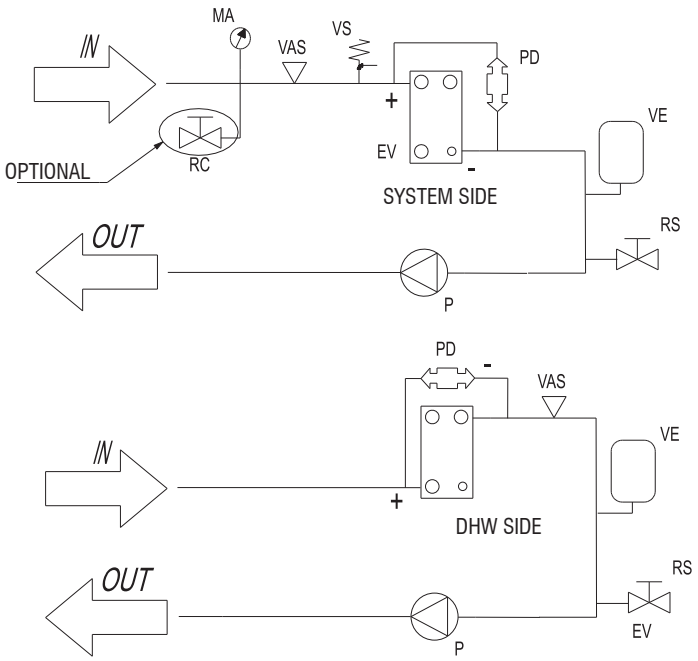
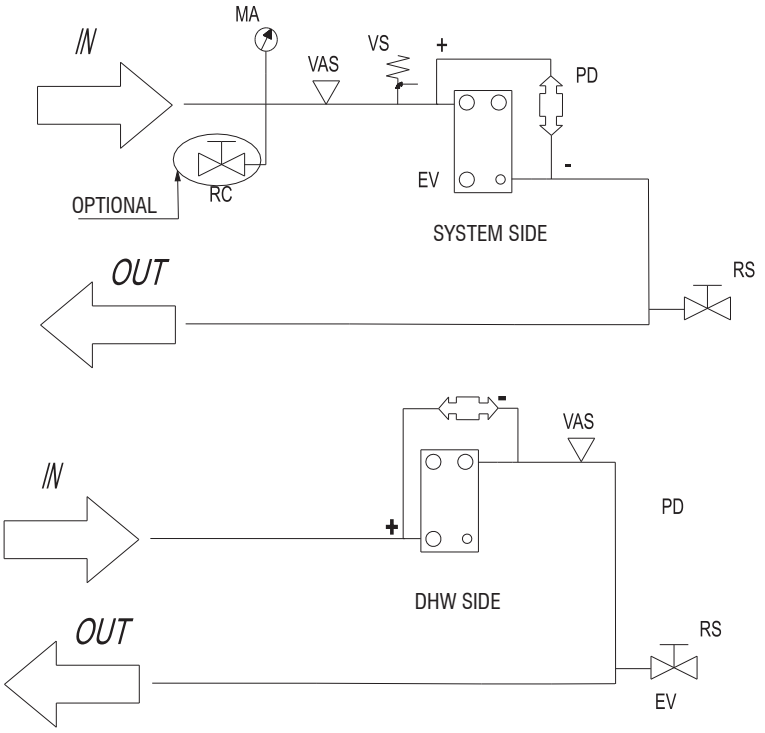
11 WATER CIRCUIT

HWMC (EVAPORATOR AND PUMP)



HWMC (EVAPORATOR)



	Legend
VR	Filling valve
VS	Safety valve
EV	Evaporator
PD	Differential pressure switch
MA	Water pressure gauge
VAS	Air vent valve
VE	Expansion tank
P	Pump
RS	Drainage valve
RC	Water filling cock
VU	Check valve

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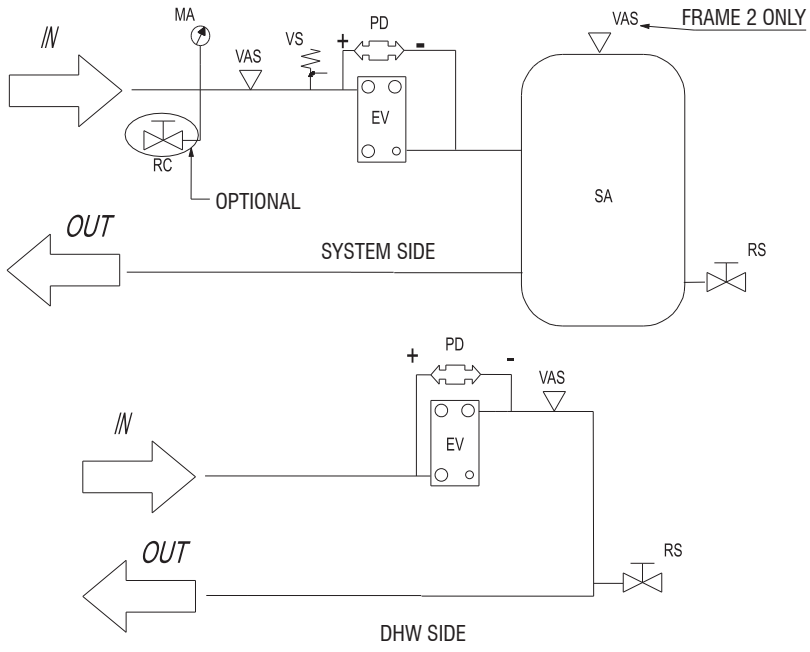
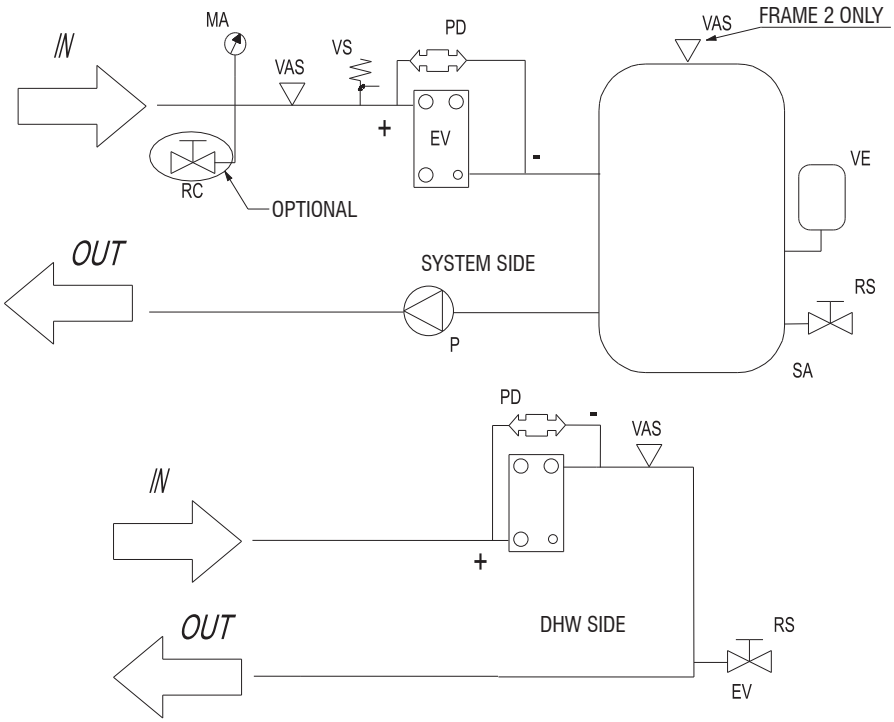
11 WATER CIRCUIT

HWMC (EVAPORATOR AND TANK)



HWMC (EVAPORATOR, PUMP AND TANK)



	Legend
VR	Filling valve
VS	Safety valve
EV	Evaporator
PD	Differential pressure switch
MA	Water pressure gauge
VAS	Air vent valve
VE	Expansion tank
P	Pump
RS	Drainage valve
RC	Water filling cock
VU	Check valve
SA	Buffer tank

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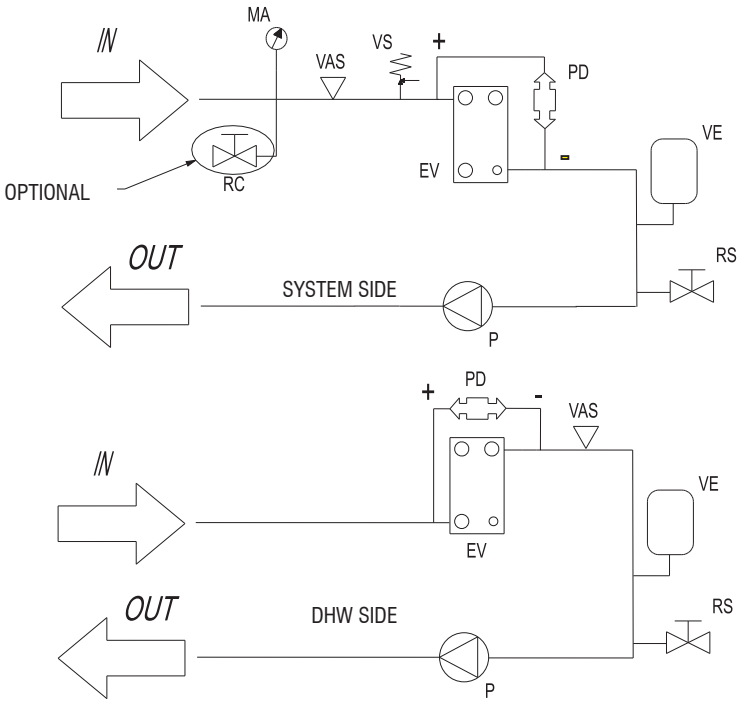
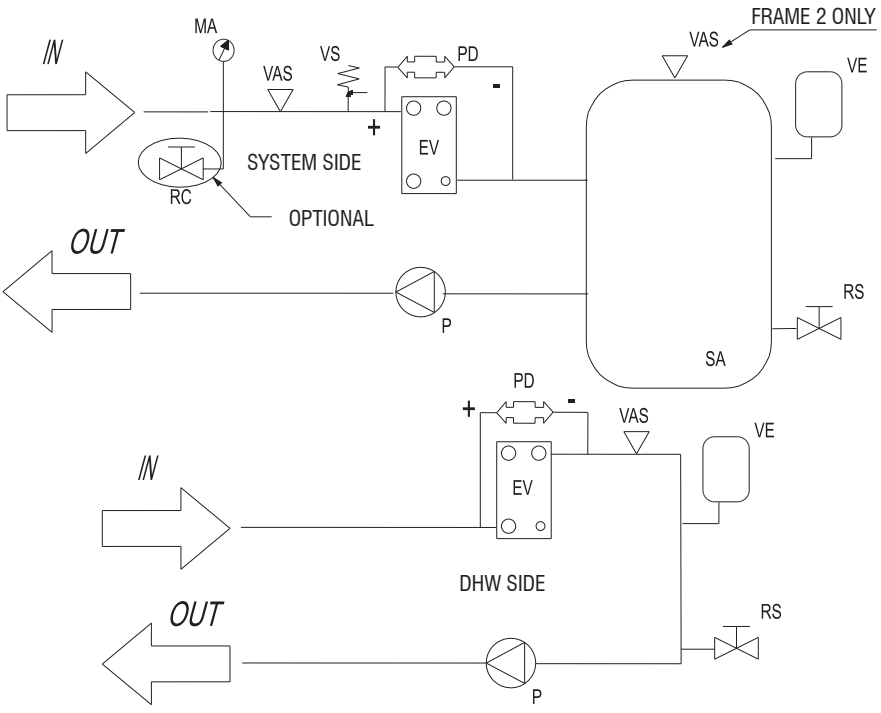
11 WATER CIRCUIT

HWMC (EVAPORATOR AND DUAL PUMP)



HWMC (EVAPORATOR, DUAL PUMP AND TANK)



	Legend
VR	Filling valve
VS	Safety valve
EV	Evaporator
PD	Differential pressure switch
MA	Water pressure gauge
VAS	Air vent valve
VE	Expansion tank
P	Pump
RS	Drainage valve
RC	Water filling cock
VU	Check valve
SA	Buffer tank

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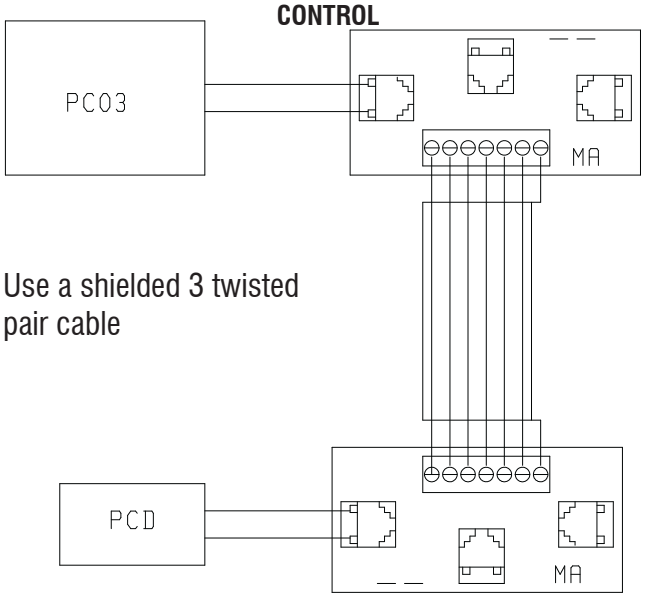
12 ELECTRICAL DATA AND CONNECTIONS

HWMC		010 M	013	018	023	029
Maximum power absorbed	kW	5.6	7.1	10.7	10.8	21.9
Maximum current absorbed	A	26.6	20	22	28.5	43
Starting current	A	10	10	10	10	10
Rated power of fan motor	kW	0.14	0.14	0.14	0.14	0.14
Rated power of fan	A	0.64	0.64	0.64	0.64	0.64
Rated power of pump motor	kW	0.48	0.65	0.65	0.65	0.65
Rated current of pump	A	2.7	3	3	3	3
Power supply	V/Ph/Hz	230/1/50	400/3N/50			
Auxiliary power supply	V/Ph/Hz					
Cross-section of power cables	mm^2	4	6	6	10	10
PCD connecting cables	mm^2	AWG22	AWG22	AWG22	AWG22	AWG22
PCDS connecting cables	mm^2	1	1	1	1	1
Safety fuse F	A	20	25	25	32	32
Main switch IL	A	20	25	25	40	40

- The maximum power input is the mains electricity that must be available in order for the unit to work.
- The maximum current absorbed refers to the current that will trigger the internal safety devices of the unit.
  It is the maximum current allowed in the unit.This value may never be exceeded; it must be used as a reference for determining the size of the power supply line and the related safety devices (refer to the wiring diagram supplied with the units).

DIAGRAM SHOWING HWMC ELECTRICAL CONNECTIONS BETWEEN REMOTE PCD CONTROL PANEL AND pCO3 REMOTE CONTROL



Note: Should the unit go into an alarm status, a voltage of 24V will be present on the terminals of the electric control panel at the terminals 50/24V; where an interface with a voltage-free contact is desired, a relay must be fitted by the installer.

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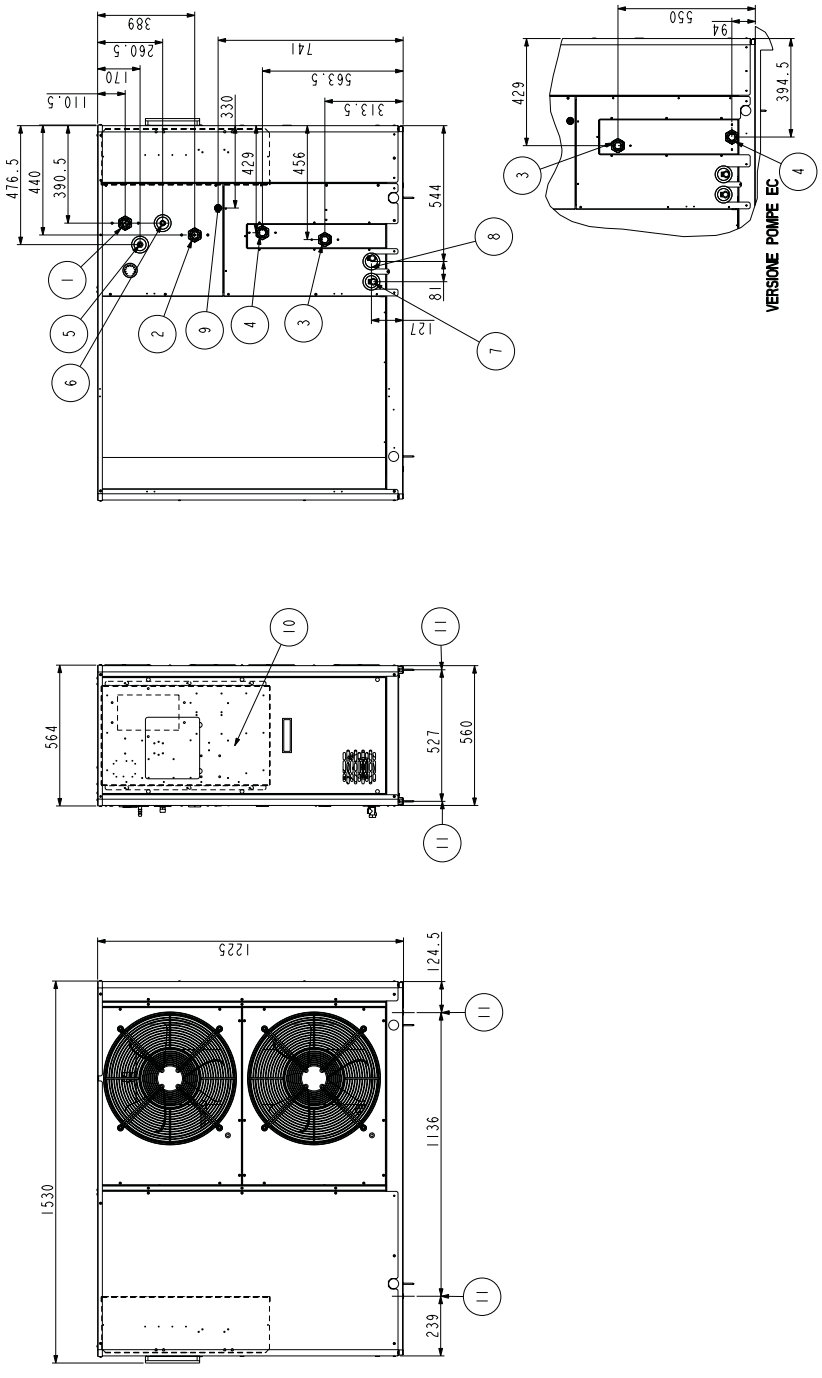
13 DIMENSIONS

HWMC 10 ÷ 13 ÷ 18



Legend:

1 Water inlet 1" ¼ female
2 Sanitary hot water inlet 1" ¼ female
3 Water outlet 1" ¼ female
4 Sanitary hot water outlet 1" ¼ female
5 Safety valve discharge outlet with rubber ring holder
6 Water supply ½" male (optional tap)
7 Water drainage ½" female
8 Sanitary hot water drainage ½" female
9 Power supply Ø 28 mm
10 Electric control board
11 Fastening points for vibration dampers

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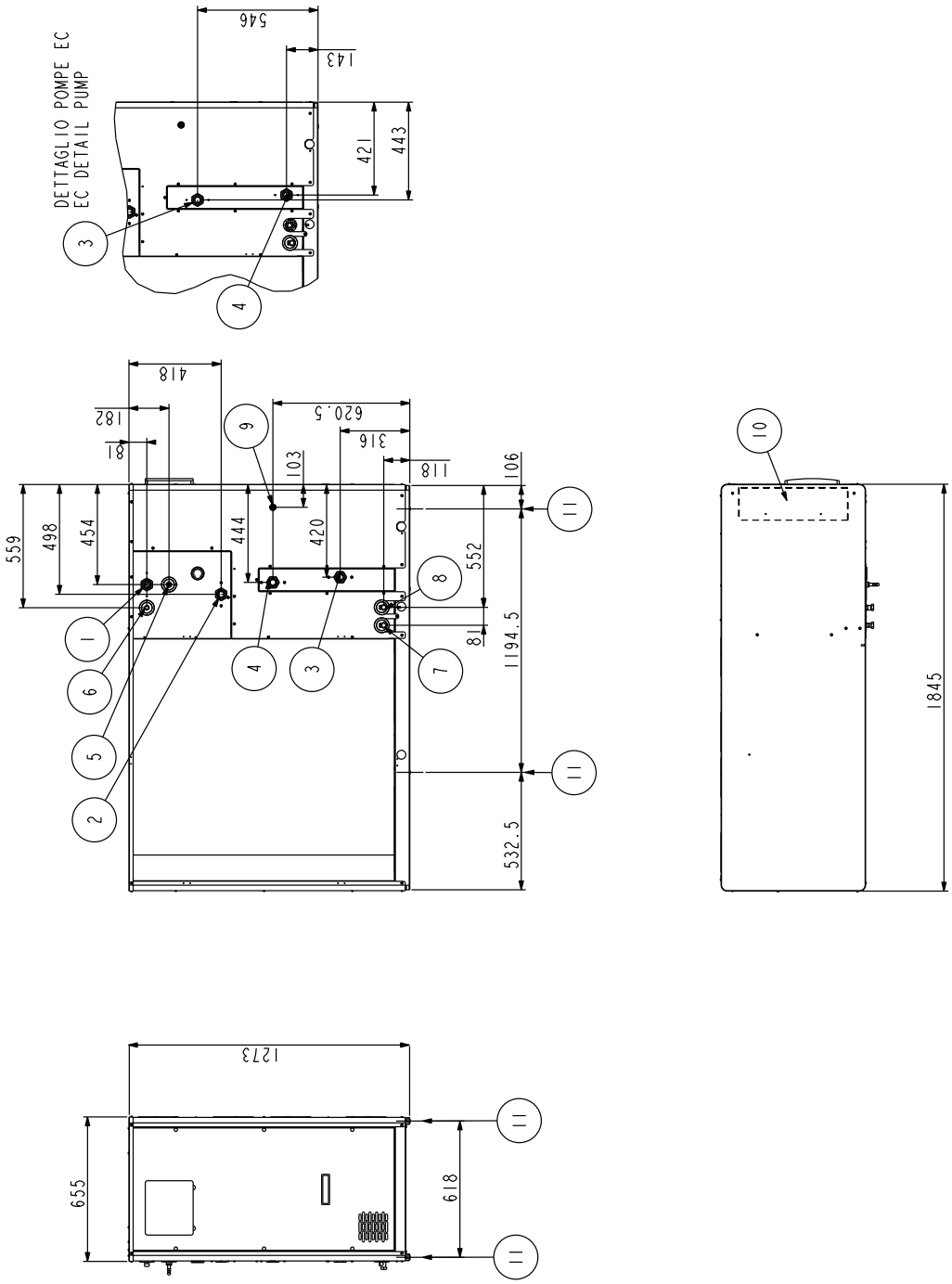
13 DIMENSIONS

HWMC 23 ÷ 29



Legend:

1 Water inlet 1" ¼ female
2 Sanitary hot water inlet 1" ¼ female
3 Water outlet 1" ¼ female
4 Sanitary hot water outlet 1" ¼ female
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6 Water supply ½" male (optional tap)
7 Water drainage ½" female
8 Sanitary hot water drainage ½" female
9 Power supply Ø 28 mm
10 Electric control board
11 Fastening points for vibration dampers

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14 INSTALLATION CLEARANCE REQUIREMENTS

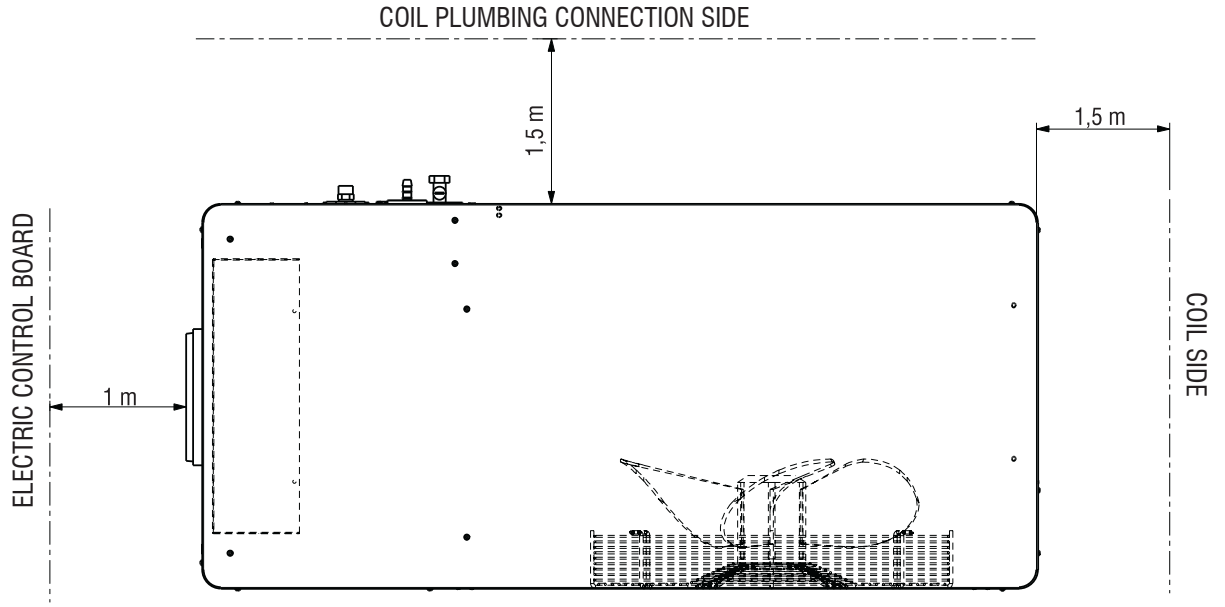
To guarantee the proper functioning of the unit and access for maintenance purposes, it is necessary to comply with the minimum installation clearance requirements shown in figures 1, 2 and 3.
There must be no obstacles blocking the path of the air flow from the fans.
Avoid any and all situations of backflow of hot air between air outlet and inlet of the unit.
If even only one of the above conditions is not fulfilled, please contact the manufacturer to check for feasibility.

In the design of the HWMC series, special care has been taken to minimise noise and vibrations transmitted to the ground.
Even greater insulation may be obtained, however, by using vibration damping base supports (available as optional accessories).
If vibration damping base supports are adopted, it is strongly recommended also to use vibration damping couplings on the water pipes.
Whenever the unit is to be sited on unstable ground (various types of soil, gardens, etc.) it is a good idea to provide a supporting base of adequate dimensions.

Warning ⚠ while operating in heating or DHW mode, the units produce condensation.

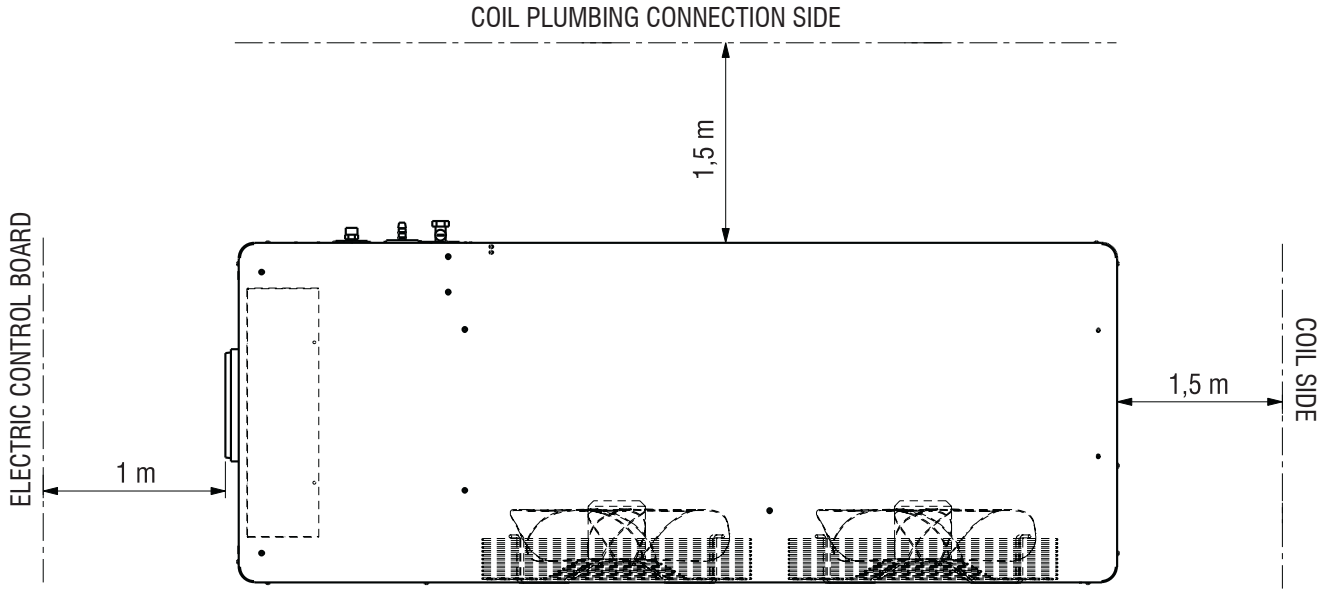
1

HWMC 10 ÷ 18



2

HWMC 23 ÷ 29



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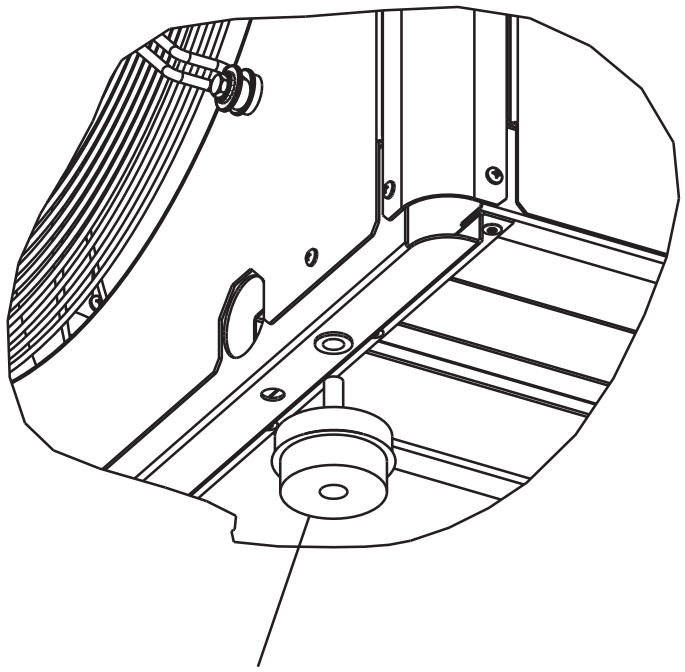
15 SITING

It is important to bear in mind the following aspects when choosing the best site for installing the unit:
- size and origin of water pipes;
- location of the power supply;
- solidity of the supporting surface;
- avoid obstacles to the outflow of air from the fan which could cause back suction (see section on “installation clearance requirements”);
- direction of prevalent winds: (position the unit so that prevalent winds do not alter the fan air flow).
  A prevalent wind blowing from a direction opposite to the fan air flow will reduce the maximum air temperature to a lower value than specified in the operating limits, a wind blowing in the same direction as the fan air flow will increase the minimum air temperature to a higher value than specified in the operating limits.
  Also in the heat pump mode, wind may have the effect of reducing the unit's operating range.
- Avoid the possible reverberation of sound waves; do not install the unit in narrow or cramped spaces.
- Ensure adequate accessibility for maintenance or repairs (see section on “installation clearance requirements”).

15.1 POSITIONING OF VIBRATION DAMPERS (ACCESSORY)



HWMC	NO. OF VIBRATION DAMPERS
10 - 18	4
23 - 29	4

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