FACULTY OF ENGINEERING
AND ARCHITECTURE

Design and dimensioning of the energy system for the Mobble

Marilyn Dierick
Student number: 01313603

Supervisors: Prof. dr. ir. Michel De Paepe, Prof. dr. ir.-arch. Nathan Van Den Bossche
Counsellors: Katarina Simi, Willem Faes

Master's dissertation submitted in order to obtain the academic degree of
Master of Science in Electromechanical Engineering

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Traveller,

there is no path

you make the path as you walk

and as you walk

you make the path

that you will never walk again.

Traveller there is no path

just the wake of ships upon the ocean

Antonio Machado

Voorwoord

De grote CO_2 uitstoot van de vorige decennia's begint zijn tol te eisen. De aarde warmt op met grote natuurrampen zoals orkanen en overstromingen tot gevolg. De verwachting is dat deze weersextremen zullen toenemen in aantal en hevigheid. De vele klimaatacties van 2019 bevestigen dat de noodzaak om klimaatregelen te nemen alleen maar groter wordt. Het verleden valt niet te wijzigen, maar de toekomst moeten we in handen nemen.

Uit recente studies blijkt dat Europese gebouwen instaan voor 40% van het totale energieverbruik. Daarom moeten we maatregelen treffen om het verbruik te verlagen en de energie-efficiëntie van gebouwen te verhogen, terwijl het comfort van de gebruikers gewaarborgd wordt. De Solar Decathlon wedstrijd daagt universiteitsstudenten van over de hele wereld uit om een energiezuinig en duurzaam gebouw te ontwerpen, te bouwen en te bewonen. Het gebruik van hernieuwbare energiebronnen wordt aangemoedigd en out of the box denken beloond. Zoals de Franse gezegde beweert: "Dans le choc des pensées, jaillissent des idées."

Graag zou ik mijn promotoren prof. dr. ir. Michel De Paepe en
prof. dr. ir. Nathan Van Den Bossche, willen bedanken voor het mogelijk maken van deze thesis. Ik wil hen, evenals mijn begeleiders ir. Willem Faes en ir. Katarina Simić, danken voor hun advies en feedback tijdens het ontwikkelingsproces van deze thesis.
Ook zou ik graag ir. Dirk Poot bedanken voor het geven van technische inzichten en het nalezen van mijn thesis. Ten slotte wil ik mijn ouders bedanken voor hun steun en aanmoediging tijdens mijn studies.

Marilyn Dierick, mei 2019

Toelating tot bruikleen

Design and dimensioning of the energy system for The Mobble

door

Marilyn DIERICK

Scriptie ingediend tot het behalen van de academische graad van
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Abstract

Scientific evidence indicates that the world and its habitants are confronted with a dramatic climate change and hence the conditions of living, partly (or mainly) due to human abuse of natural resources and especially fossil fuel. For mankind it is now time to take responsibility to mitigate the impact. Since buildings, and the energy needed to live comfortably, are responsible for the major part of worlds energy consumption (40%), it seems logic to focus on reducing the energy use in this area. In this regard, the student competition Solar Decathlon aims in providing the insight of the alternative ways of living in an optimized energy efficient household. The team of Ghent University has developed a project named The Mobble. While the architects designed a way of constructing housing with the lowest life cycle effect on environment, the required energy system was created with the same target. The approach was to use existing technology in a creative and versatile way in order to maximize the use of the abundant and free energy sources "the sun", the ambient air and radiation and tried to overcome the limits of these resources (discontinuity of availability). This has been realized by using in a controllable way phase change material, radiation and the energy of the air (by air-to-air heat pumps). Passive cooling is achieved by night radiative cooling of a H_2O-PCM buffervolume by PVT panels.

Keywords

solar, life cycle, human comfort, sustainability, state-of-the-art, HVAC, zero emission, gradient, night radiative cooling, phase change material, thermal energy storage, Solar Decathlon Europe 2019, affordable, versatile, peak shaving

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DESIGN AND DIMENSIONING OF THE ENERGY SYSTEM FOR THE MOBBLE

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ABSTRACT

Scientific evidence indicates that the world and its habitants are confronted with a dramatic climate change and hence the conditions of living. For mankind it is now time to take responsibility to mitigate the climate change.

Since buildings, and the energy needed to live comfortably, are responsible for the major part of worlds energy consumption (40%), it seems logic to focus on reducing the energy use in this area.

This was the challenge for the people behind the Mobble. While the architects designed a way of constructing houses with the lowest life cycle effect on environment, the required energy system was created with the same target.

The approach was to use existing technology in a creative and versatile way in order to maximize the use of the abundant and free energy sources as "the sun", the ambient air and radiation and tried to overcome the limits of these resources (discontinuity of availability). This has been realized by using in a controllable way phase change material, radiation and the energy of the air (by heat pumps).

Keywords- solar, life cycle, human comfort, sustainability, state-of-the-art, HVAC, zero emission, gradient, night radiative cooling, phase change material, thermal energy storage, Solar Decathlon Europe 2019, affordable, versatile, peak shaving

INTRODUCTION

The world is living on a historical turning point in the field of energy and environment. The continuation of emissions at the same pace will lead to a catastrophic situation. Today, zero energy buildings are a leading topic in the field of energy efficiency of buildings. The expected energy use and cost reduction starts to convince the population to build and renovate buildings following the most recent developments.

However, recent research shows that the difference in actual energy use between poor and well-insulated buildings is smaller than expected.[1] This phenomenon is partly caused by the user behaviour but is mainly due to the Heating, Ventilation and Air Conditioning (HVAC) system and control, accounting for nearly half the building energy use. Also the energy performance regulations which do not capture the real energy use because of the absence of dynamic calculations increase the building energy demand. Currently there is an evolution towards low temperature distribution systems. Due to the low temperature gradient of these systems, they react slowly and people leave these installations in stand-by 24/7.

The energy savings due to more efficient techniques are partially offset by the transition towards uniform and continuous systems and the associated poor control.

Fast reacting systems, integrated in buildings with low thermal mass, can be the key towards lower energy use. By implementing demand-control in a lightweight building structure, HVAC systems can anticipate and be adjusted to a variable user behaviour. The challenge for the future is to find creative solutions for a conflicting trend: to improve the quality of living for a growing world population while reducing substantially the impact on our environment.

Within this thesis, the best of both worlds are combined i.e. having the comfort of the traditional concept with high thermal mass build in the construction without the disadvantages linked to it (slow reaction time, high impact of energy for the construction elements and heavy). However also energy efficiency and renewable energy-use are essential if we want to achieve a reduction of greenhouse gases.

NOMENCLATURE

$\dot{Q}$	[W]	heat transfer rate
R	[W/m^2]	effective outgoing infrared radiation from a terrestrial surface
T	[K]	temperature
$\dot{m}$	[kg/s]	mass flow rate
v	m/s	velocity
Special characters		
ε	[-]	Emissivity
σ	[W/m^{2}K^4]	Stefan Boltzmann constant, 5,93*10^(-8)
Subscripts		
↓		absorbed by the surface
↑		emitted by the surface

This study is performed in the context of the Solar Decathlon Europe 2019 (SDE19) competition and aims to find an innovative energy efficient HVAC design for the Mobble (SDE19 house of team Ghent University).

The small permissible temperature and humidity range imposed by the competition resulted in the need for an accurate control system. Furthermore two consecutive passive days (no Carnot cyclus) were imposed by the organization which had a significant impact on the dimensioning of the installation.

The technical installations are designed according to the setup for the competition, namely 5 Mobbles placed in a line, still creating a global HVAC concept that can provide a zero energy building (ZEB) solution.

THE MOBBLE

In particular, the pavilion of the University of Ghent represents a test set-up to inform the broad audience about renovation strategies for apartment buildings. On the other hand, it also tries to offer solutions for the housing challenges in cities, by moving away from the static residential market. Hence a basic modular building block, The Mobble, was designed. This system is modular and circular: the user can freely combine according to your demand.

The difference between the pavilion and the renovation of apartment buildings is speaking. Apartment buildings are constructed out of reinforced concrete, while a wooden structure was designed for the SDE pavilion. This results in a completely different building structure and energy design.

The design of the technical installations will focus on satisfying the energy needs of the Mobble, and thus will be an appropriate HVAC design approach in circular and lightweight building applications.

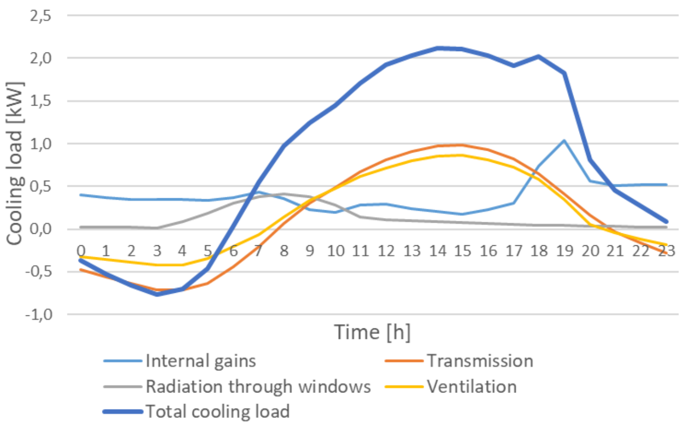


Figure 1: Total average cooling load with sunscreen (July)

When dimensioning the HVAC system, the first step is to estimate the heating and cooling loads by stationary calculations. Based on the design and materials of the pavilion the U-values were determined. The average daily cooling load for summer (July), with different parameters is given in **Figure 1**, as cooling was the design condition for the competition.

DESIGN ENERGY EFFICIENT HVAC SYSTEM FOR THE MOBBLE

Various innovative techniques are investigated to increase the building performance of the Mobble. Insulation, compactness and airtightness are of course well-known principles for energy-efficient buildings. But also thermal inertia, renewable energy and passive cooling strategies were reviewed in order to design a suitable HVAC system.

Thermal inertia: H_2O-PCM buffer

The traditional way of building has the advantage that you build in the construction not only the functional envelope but also a high thermal inertia. But to make concrete you need special lime kilns with very high energy input, the same counts for bricks. Adding transport costs and the equation becomes quite negative. Wooden buildings can offer a CO_2 neutral solution.

For comfort one needs fast reaction time together with the smoothening effect of the thermal mass. This was absent in the old approach but was our headache for which we think to be able to solve. This is certainly not the first time this way of thinking has come up but still underdeveloped. In order to optimize the installed capacity and hence the specific energy consumption it seemed logic to find the possibility to store excess energy and to reuse this to do the peak shaving. By doing so a high degree of control can be obtained.

All these reflections led us to scrutinize all possible alternatives for thermal energy storage (TES) with following features:

- Light
- Compact
- Cheap
- Good thermal conductivity
- Fast response

Five different types of energy storage are possible. *Thermochemical* and *mechanical* storage are powerful storage mechanisms, but not practically applicable in the Mobble. A *electrical battery* storage system is implemented in order to overcome the mismatch between energy need and supply (due to the intermittency of renewable energy sources) and to reduce power peaks.

The storage of *sensible heat* by water is the most cost-efficient method. Water has a high conductivity and relatively high heat capacity. However, *latent heat* storage can offer a much higher storage density in small temperature intervals. Heat is absorbed or discharged during a phase transition. A large number of phase change materials (PCM)'s with high latent heat and melting temperatures at a wide range are available.

The profit of PCM is mainly found in the modularity and compactness, which fits perfectly with the Mobble concept. Nevertheless PCM's also have less suitable properties, namely the low thermal conductivity coefficient and the volume change during phase transition. The thermal resistance to heat transfer from a PCM to a heat carrier was investigated in order to determine its likelihood for thermal storage.

A simplified buffer model, a tube-in-tank design filled with PCM, was set up, in order to fulfil the cooling load for the two consecutive passive days.[2] It followed that the thermal conductivity of PCM is not high enough to deliver the required power for indoor temperature conditioning.

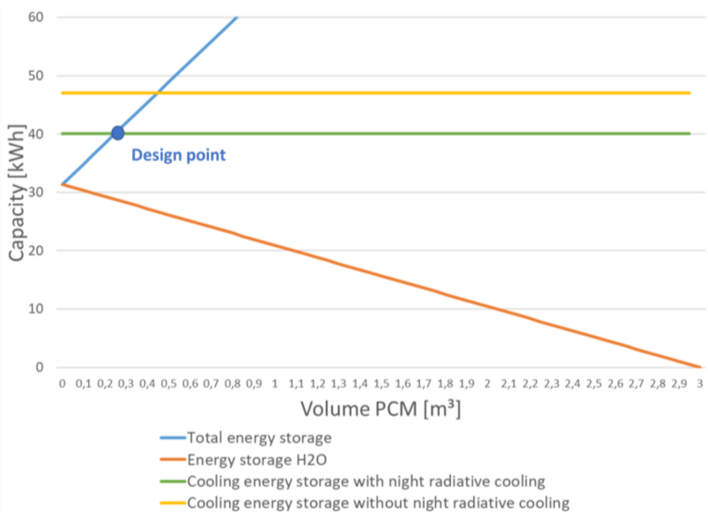


Figure 2 : The effect on the cooling energy storage by replacing H_2O by PCM

A H_2O-PCM buffer offers the solution. The advantages of sensible, high conductivity, and latent, high storage density, heat storage are combined in one design.

In order to guarantee the power output of the buffer and to limit the costs, this resulted in three cubic containers of water with one filled with PCM plates. The design amount of PCM necessary to cover the two passive days is shown in **Figure 2**, taking into account the cooling energy by night radiative cooling (see below). Enlarging the heat transfer area between both materials is crucial for the performance of the thermal energy storage system.

Solar energy: PVT panels

The sun is an inexhaustible, zero-carbon energy source that is throughout available. As solar energy has a huge potential for reducing energy supply, it is exploited in the Mobble design. Passive solar energy building integration was considered, but also thermal, electrical and even chemical measures are possible.

By choosing the orientation of the pavilion to the south-east, satisfactory natural heating occurs in winter. By selecting a double glazing with a low solar heat gain coefficient (0,53) and adding a sunscreen, there is no unaccepted overheating in summer. Furthermore the canopy lowers the cooling load in summer while maintaining the solar gains in winter.

For the active solar system PVT panels were selected. These hybrid photovoltaic and thermal (PVT) panels combine the two solar use approaches: *heat* and *electricity* generation in one panel, thereby making efficient use of the small available roof area of the Mobble (and apartment blocks). Furthermore PV panels heat up during operation, thereby reducing the efficiency and thus electricity output. When using PVT panels, the thermal collectors serve as a cooling system for the solar PV, increasing the electrical performance of the system.

Based on the detailed information about solar radiation availability in Hungary the optimal angle for the exposed PV surface was set at 35°. A maximum of 5 kWp of photovoltaic installation size connected to the building was enforced, resulting in 18 panels. The thermal heat is stored in a buffer volume, providing domestic hot water (DHW) in combination with a heat pump boiler. This principle is shown in **Figure 3**.

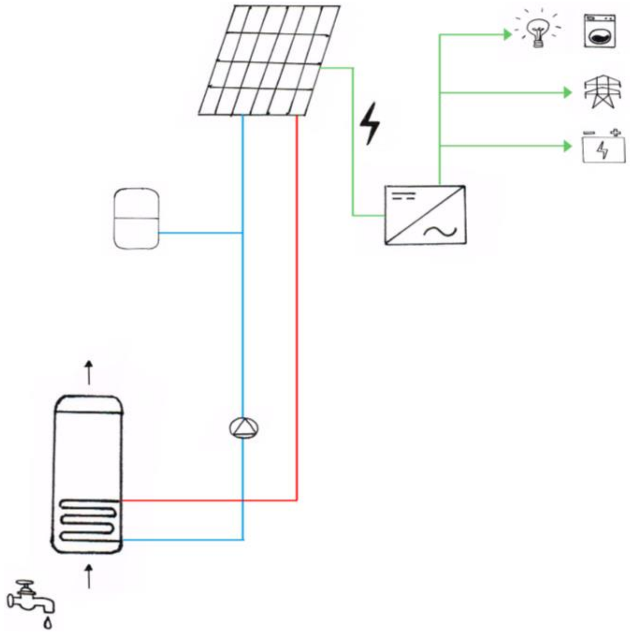


Figure 3: PVT panels for both electrical and thermal energy, in combination with a heat pump boiler for the DHW

Passive cooling strategies: Night radiative cooling

The rising demand for space cooling is putting enormous strain on electricity systems and environment. Passive cooling strategies e.g. free, evaporative or solar cooling could offer a solution. Since the competition takes place in summer a perfect opportunity arises to investigate an innovative energy efficient cooling technique: night radiative cooling.

Nowadays buildings are completely covered by PVT panels that produce water during the day and stay untapped during the night. Using these panels for radiative cooling against the night sky could provide a cost-effective solution. The 18 PVT panels will be used to cool down the H_2O-PCM buffer volume during nighttime after which the room can be conditioned by circulating the cold water through a cooling coil.

passive radiative cooling via the Atmospheric Window

A body can cool down by emitting long-wave radiation to another body at lower temperature. Night radiative cooling is based on this principle with the cold sky acting as heat sink.

The effective outgoing infrared radiation from a terrestrial surface (R) can be defined as the difference between the radiative power emitted by the surface (R↑) and the amount of incident atmospheric radiation, absorbed by the surface (R↓).

$$R = R_{\uparrow} - R_{\downarrow}$$

The Earth atmosphere has a highly transparent window in its spectral wavelength region between 8-13 µm. Outside this infrared Atmospheric Window, the atmosphere is highly emissive. This window falls within the peak thermal radiation of a blackbody at the ambient temperature (300K), making the atmosphere an interesting heat sink. [3]

A terrestrial body can be cooled to below the ambient temperature, because the outgoing radiative emission can exceed the absorbed incoming radiation.

The steady state energy balance for the radiator is specified as:

$$\dot{Q}_{nightcooling} = \dot{Q}_{sky} - \dot{Q}_{conv} - \dot{Q}_{cond} - \dot{Q}_{solar}$$
$$\dot{Q}_{sky} = A_s \cdot (\varepsilon_s \cdot \sigma \cdot T_s^4 - R_{\downarrow})$$

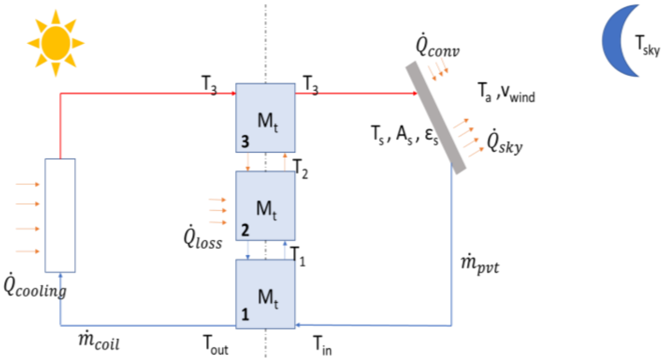


Figure 4: Thermal model system

In order to maximize the cooling, selective radiators with high emissivity in the atmospheric window wavelength band and high reflection elsewhere are ideal. Recent research on radiative cooling with nanophotonic devices even proves that it is possible to use radiative cooling under direct sunlight.

The potential of this cooling technology also depends on other parameters, being the geographic location and the weather conditions.

Modelling night sky temperature

There are two methods to determine incoming infrared radiation from the atmosphere ($R_{\downarrow}$)

1. Assume the sky acting as a blackbody emitter at an effective sky temperature (T_{sky}), such that by Stephan Boltzmann: $R_{\downarrow} = \sigma \cdot T_{sky}^4$
2. Assume the sky has the ambient dry bulb temperature (T_a) with an effective sky emissivity (ε_{sky}) such that $R_{\downarrow} = \varepsilon_{sky} \cdot \sigma \cdot T_a^4$

A good estimation of the sky temperature is crucial when modelling the performance of radiative cooling systems. A relation between the sky temperature and the ambient dry bulb temperature can be found by combining the two equations:

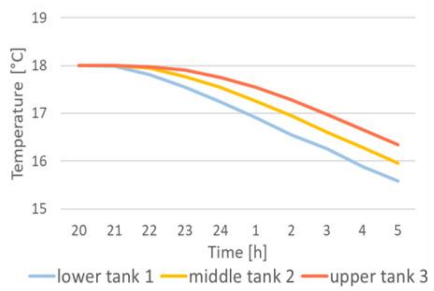
$$T_{sky} = \varepsilon_{sky}^{1/4} \cdot T_a$$

Many models based on empirical or semi-empirical correlations are available in literature to calculate the effective sky emissivity and thus respectively the sky temperatures. Different correlations for clear sky and cloudy sky conditions were set up. The transmission within the atmospheric window is mainly determined by the H_2O within the atmosphere, which can be associated with the dew point temperature T_{dp} or partial pressure of water vapour p_d of the location.

RT Dobson model

By using the RT Dobson model[4] for night radiative cooling, the heating performance of our system can be investigated. The thermal design calculations were applied by using the software package MATLAB and the most important components, variables and parameters of the cooling system are shown in **Figure 4**. The buffer volume exists of 3 cubic containers and for the simulations, they are assumed to be completely filled with water.

As the tank is relatively large and the circulating flow rates low, stratification will occur. Therefore it is important for the cold water coming from the PVT panels to enter in the bottom and the warmer water to supply the system from the top of the tank. During day time this principle is reversed, thereby taking the coldest water to condition the room.



Variable	$Q_{nightcooling}$ [kWh]	$T_{1,end}$
Base case	**8207,5**	**15,6**
0,75As	-2301,2	0,5
1,25As	269,5	-0,4
0,75Mt	-2252,7	-0,3
1,25Mt	-502,1	0,3
$0,75\dot{m}_{pvt}$	-737,0	-0,2
$1,25\dot{m}_{pvt}$	-1118,2	0,1
$0,75T_{start}$	-7545,3	-2,1
$1,25T_{start}$	8126,8	1,2

Figure 5: tank temperature progression by night radiative cooling under clear sky conditions and the results of a sensitivity analysis

Based on the Hungarian weather conditions for July and August an estimation for temperature T_{sky} was done, resulting in an average of 10,8 °C by using the most conservative correlation, being the one of Berdahl and Martin. [5]

In summer, on average 9 hours without solar irradiation can be distinguished, between 8 pm and 5 am. T_{start} of the tanks was chosen at 18 °C because this will be about the upper limit for cooling the building with the cooling coils.

The thermal modelling of the PVT panels and buffer during a clear nighttime resulted in the temperature distribution of the 3 cubic containers as shown in **Figure 5**. Also a cloudy sky simulation was done, where the effect of clouds was clearly visible, thereby reducing the cooling capacity. However, clear sky conditions during night generate high solar gains during the day. So a high cooling demand is generally matched with a high cooling production during the night.

A sensitivity analysis was performed for a variation of ± 25% of the most important system variables with performance parameters: tank temperature of the lower tank T_1 and the total heat removed during the night sky cooling period of 9 hours, $Q_{cooling}$. The results of this analysis are shown in **Figure 5.**

Increasing the radiating area has the biggest positive effect. Decreasing the mass flow rate through the panels encourages the stratification of the tanks, thereby decreasing the temperature of the first tank and increasing the cooling potential for the day. Also for a lower tank volume lower temperatures can be achieved, however the total cooling of the tanks is lowered.

Also a simulation of the two passive days was done, where a clear sky was presumed. Before the passive days start the heat pump will cool the buffer to 10 °C. The result is shown in **Figure 6** for different mass flow rates $\dot{m}_{coil}$, through the cooling coil inside.

This mass flow rate influences the stratification but also the limit temperature for which a cooling capacity of 2 kW can be maintained (green line). As stratification is useful to increase the cooling potential, $\dot{m}_{coil}$ will increase accordingly to the cooling loads.

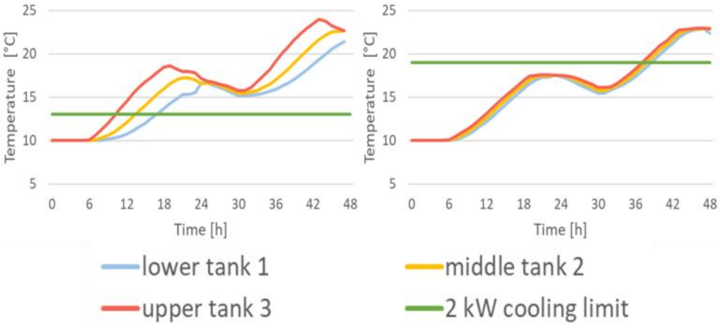


Figure 6: temperature evolution during the 2 passive days, for $\dot{m}_{coil}$ = 250 l/h (left) and 1250 l/h (right)

For a maximum flow rate of 1250 l/h it becomes clear that the inside set point temperature of 24 °C can be maintained during the passive days till 19h the second day. After 19h the loads lower and night radiative cooling can almost start again. In combination with the PCM implementation in the tank, which increases the buffer capacity and regenerates the lower tank between the two passive days, comfort will be achieved.

CONCEPT

In order to make the analysis and the control system of the technical installations of the Mobble simple and robust, the ventilation, DHW and the air conditioning system are decoupled. The concept and focus of the technical installations is schematically shown in **Figure 7.**

Ventilation

The ventilation system implemented is a D_{flow} system integrated in the technical panel. Two air supply boxes are installed at the bottom, thereby providing fresh air to the living room and bedroom. The outside air is blown through a battery which might preheat the incoming air in severe winter conditions when the heat pump is not able to work efficiently.

The D_{flow} system provides a controlled mechanical ventilation supply which is in balance with the exhaust rooms. This makes it possible to reduce the energy cost of a ventilation system D, since fresh air is only supplied when actually needed, no energy recuperation is provided. The exhaust ducts come together in the technical room and are guided via a bigger duct to the exhaust box at the top of the technical panel.

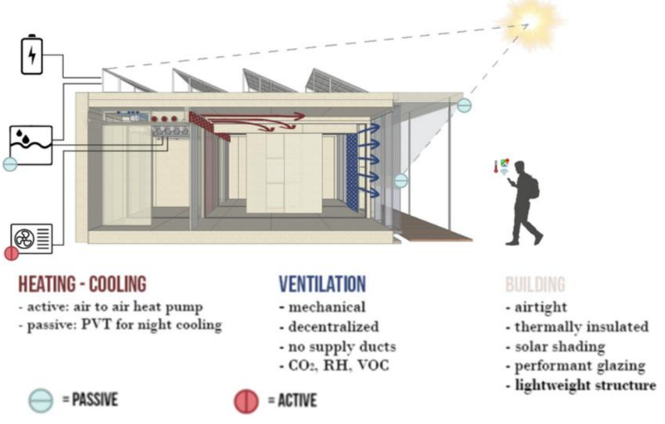


Figure 7: Concept of the technical installations [6]

Active cooling- heating system

An air-to-air heat pump was selected as active system to provide thermal comfort in the Mobble, thereby 80% of the energy used comes from the outside air, a free and infinitely renewable resource. The COP of air-to-air heat pumps is higher compared to air-to-water systems, since there are less heat losses.

Conditioned air is supplied via an air gap connected to the false ceiling, shown in **Figure 7**. Meanwhile, unconditioned air is sucked in at the end of the closet, thereby providing a good circulation of the airflow.

As an air-to-air system cannot fulfil the requirement of thermal comfort on passive competition days, an additional storage system is provided, which is also useful during grid peak hours.

Passive cooling-heating system

Demand based control and passive strategies were the main focus during the design of an efficient energy system. These passive strategies are encouraged by the competition. Two passive days are implemented, but also the electricity use of the Mobble is scored, therefore an innovative passive system was conceived to shift the peak loads.

Since cooling issues are gaining interest and the competition takes place in summer, the passive system was mainly designed for cooling purposes.

The passive cooling of the Mobble is achieved by night radiative cooling of a H_2O-PCM buffer by PVT panels. As the control is different during active days compared to the two consecutive passive days, a distinction was made. During the active days two approaches are possible when coming to the application of the cold H_2O-PCM buffer during daytime.

The passive strategy can be used *to apply peak shaving*, thereby leading to smaller active systems.

On the other hand it can shift the peak load of the heat pump to the noon, when an overproduction of electricity by the PVT panels is likely to occur, by using the passive cooling when the grid is overloaded.

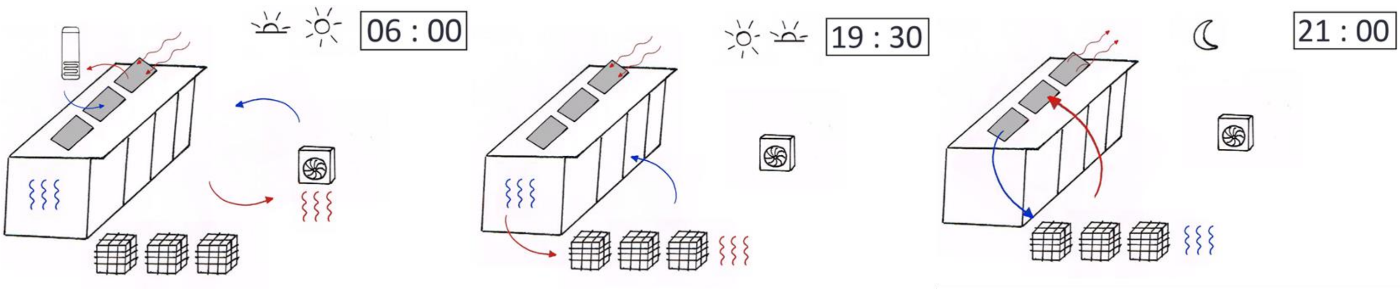


Figure 8: Working principle system on active days

In the competition points are lost when using electricity in the evening, so the second approach is applied. The principle is explained based on **Figure 8**.

When the sun comes up, around 6:00 am, and the habitants wake up the indoor temperature starts to rise. Once higher than the indoor set point temperature the active system (heat pump) starts to operate. At the same time the PVT panels are used to generate DHW. If there is not sufficient solar energy the heat pump boiler is activated, thereby cooling the technical zone.

Around 7:30 pm the electricity grid is heavily loaded, so the passive system is activated. The buffer volume heats up slowly, while cooling the building. If the set point temperature is not reached the heat pump can support.

After sunset, around 9 pm, the night radiative cooling starts. The pump is switched on and the H_2O-PCM buffer is cooled down by thermal radiation against the night sky. This principle is applied as long as advantageous (temperature difference over the PVT panels high enough: 0,5°C).

During the passive days the principle is nearly the same, however two consecutive days must be bridged. Therefore before the start of the passive competition the buffer will be charged directly by the air-to-air pump.

However, the system is suitable for seasonal change, showing his versatile character. During cold winter days the excess solar heat will heat up the H_2O-PCM tank, which will be used to cover part of the heating load.

CONTROL STRATEGY

The control scheme of the passive installation and the connected DHW tank is given in **Figure 9**, together with 4 different operational modes of the system and corresponding activated pump and valve positions.

Temperature sensor S_2 and S_3 control the on-off behavior of pump C during the DHW production. During mode 2: night radiative cooling, the temperature difference S_7 - S_6 is the determining factor for circulating water through the PVT panels in order to cool down the buffer. These sensors are also used during the charging before the passive days. Pump B and C have a fixed mass flow rate of 900 l/h and are on-off controlled as well as the valves, while pump A has 3 operating points.

The other sensors are mainly used to keep an eye on the system during testing and operation.

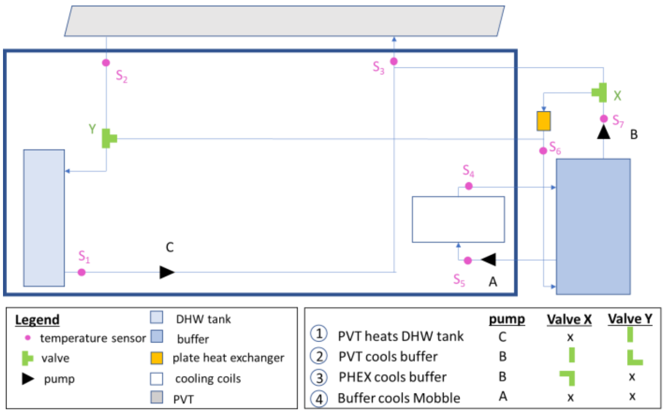


Figure 9: The implementation of the control system of the technical installations (passive system +DHW)

CONCLUSION

For comfort one needs a fast reaction time together with the smoothening effect of the thermal mass. Hence the idea came up to move away from slow systems and to bet on fast reacting systems inside a lightweight building. The relocation of thermal inertia from the building structure to a controllable thermal energy storage shows great promises for the near future. Also the use of night radiative cooling by PVT panels has shown its profit, resulting in an energy use decrease of 25% compared to a purely active cooling strategy.

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List of symbols

$\mathbf{R}_{\downarrow}$	incoming infrared radiation from the sky [W/m^2]
$\mathbf{R}_{\uparrow}$	outgoing infrared radiation from the radiating surface
$\mathbf{T}_{sky}$	effective sky temperature [K]
$\mathbf{T}_{a}$	ambient dry bulb temperature
$\mathbf{T}_{s}$	radiating surface temperature
$\mathbf{T}_{in}$	incoming temperature
$\mathbf{T}_{out}$	outgoing temperature
$\mathbf{T}_{1}$	lowest tank temperature
$\mathbf{T}_{2}$	middle tank temperature
$\mathbf{T}_{3}$	upper tank temperature
$\mathbf{T}_{start}$	start temperature buffer
$\mathbf{T}_{set}$	indoor set point temperature
$\mathbf{T}_{set,HP}$	set point temperature heat pump
$\mathbf{T}_{living}$	temperature living area
$\mathbf{T}_{bedroom}$	temperature bedroom
$\mathbf{T}_{m}$	melting temperature
$\mathbf{\Delta T}$	temperature difference
$\mathbf{M}_{t}$	mass one tank [kg]
$\dot{Q}_{cooling}$	cooling load [W]
$\dot{Q}_{nightcooling}$	total heat transfer rate from PVT panels to the sky
$\dot{Q}_{sky}$	heat transfer rate from PVT panels to the sky due to long-wave radiation
$\dot{Q}_{conv}$	convective heat transfer rate from the PVT panels to the sky
$\dot{Q}_{solar}$	heat transfer rate to the PVT panels due to solar irradiation
$\dot{Q}_{P}$	cooling load due to persons
$\dot{Q}_{B}$	cooling load due to lighting
$\dot{Q}_{M}$	cooling load due to appliances
$\dot{Q}_{R}$	cooling load due to adjacent rooms

$\dot{Q}_w$	cooling load due to transmission + radiation through walls
$\dot{Q}_T$	cooling load due to transmission through windows
$\dot{Q}_S$	cooling load due to radiation through windows
$\dot{Q}_G$	cooling load due to ventilation and infiltration
$Q_{nightcooling}$	total heat removed during night radiative cooling period [kWh]
$\mathbf{R}_{sky}$	thermal resistance to long wave radiation [K/W]
$\mathbf{R}_{as}$	thermal resistance to convective heat transfer
$\mathbf{R}_{loss}$	thermal resistance to losses
$\mathbf{h}_{sky}$	heat transfer coefficient long wave radiation [W/m^{2}K]
$\mathbf{h}_{as}$	heat transfer coefficient convective heat transfer
$\mathbf{h}_t$	heat transfer coefficient tank
$\mathbf{c}_p$	specific heat capacity [J/kgK]
$\mathbf{c}_{ps}$	specific heat solid
$\mathbf{c}_{pl}$	specific heat liquid
$\mathbf{c}_w$	specific heat capacity water
$\dot{m}$	mass flow rate [kg/s]
$\dot{m}_{pvt}$	mass flow rates through PVT panels
$\dot{m}_{coil}$	mass flow rate through cooling coil
$\dot{m}_{air}$	mass flow rate air over cooling coil
$\dot{m}_{water}$	mass flow rate through cooling coil
$\mathbf{A}$	area [m^2]
$\mathbf{A}_s$	radiating surface area
$\mathbf{A}_t$	tank surface area
$\mathbf{L}_t$	insulation thickness tank [m]
$\mathbf{M}_O$	correction factor orientation [-]
$\mathbf{M}_{cw}$	correction factor uncompensated glazed facade
$\mathbf{k}_t$	thermal conductivity tank [W/mK]
$\mathbf{U}$	overall heat transfer coefficient [W/m^{2}K]
$\mathbf{g}$	solar heat gain coefficient [-]
$\mathbf{m}$	mass [kg]
$\mathbf{E}$	energy [J]
$\mathbf{L}$	latent heat [J/kg]
$\mathbf{S}$	absorbed radiation [W/m^2]
$\mathbf{G}$	solar irradiance
$\mathbf{\Delta H}_r$	reaction enthalpy [J/mol]
$\mathbf{n}_A$	mole of reactant A [mol]

$\mathbf{z}$	zenith angle [°]
$\mathbf{p}_{a}$	partial pressure of water vapor [Pa]
$\mathbf{p}^{*}$	equilibrium vapor pressure of water
$\mathbf{\Delta p}_{tot}$	total pressure drop
$\mathbf{v}_{wind}$	wind speed [m/s]

Greek letters

$\boldsymbol{\rho}$	density [kg/m^3]
$\boldsymbol{\lambda}$	thermal conductivity [W/mK]
$\boldsymbol{\sigma}$	Stephan Boltzmann constant [W/m^{2}K^4]
$\boldsymbol{\epsilon_{sky}}$	effective sky emissivity [-]
$\boldsymbol{\epsilon_{sky,0}}$	effective sky emissivity under clear sky conditions
$\boldsymbol{\epsilon_{s}}$	effective surface emissivity
$\boldsymbol{\phi}$	relative humidity
$\boldsymbol{\phi_{n}}$	heat loss [W]
$\boldsymbol{\phi_{t}}$	heat loss due to transmission
$\boldsymbol{\phi_{v}}$	heat loss due to ventilation
$\boldsymbol{\phi_{RH}}$	heat loss due to reheating

Chapter 1

Introduction

Today, buildings are responsible for 40% of the European energy use and 36% of the CO_2 emissions. In order to achieve the European 2020 goals there is need for a substantial reduction of the 'conventional energy' use in buildings. Meanwhile, high thermal comfort and affordability must be guaranteed. The specific targets of the 2020 strategy aim to ensure that by 2020 the greenhouse gas emissions are cut by 20% compared to 1990 levels, 20% of all energy used is coming from renewable energy sources and reduce the amount of primary energy sources used, by improving the energy efficiency by 20%.[1]

These goals are in the line with The Solar Decathlon (SD) competition which is an international student-competition introduced to increase the social awareness about the energy use for residential use. Universities from all over the world meet to design, execute and operate their sustainable, energy efficient house. The main objective is to decrease the energy demand by changing the building design. However, in order to decelerate the climate change, the use of renewable energy sources will be needed. It becomes clear that energy efficiency and clean energy-use are essential if we want to achieve a reduction of greenhouse gases. Luckily in this case economic and environmental objectives can go hand in hand.

As the title of the competition suggests, solar energy will be the primary (renewable) energy source in the building. Solar systems are currently under rapid development due to their potential to reduce fossil fuel in the building sector. Participants of SD are challenged to search for new, innovative solutions and technologies with maximum energy efficiency. They have to think about current housing problems and develop a critical attitude towards living in the future. On the other hand they can immediately translate their ideas in a temporary pavilion. The competition demonstrates that a well-designed house can generate enough electricity for a household, a battery can be used. Such that the SD houses will offer possibilities to meet the European Union (EU) targets of 2020.

The major challenge for the building industry is to find solutions to improve thermal comfort, but at the lowest impact on the environment. Heating, Ventilation and Air Conditioning (HVAC) systems have an important need of energy use in buildings. Reducing this energy while maintaining a comfortable indoor temperature and air quality needs some innovations. The technical aspects and design of the HVAC system of the Mobble (the Solar Decathlon Europe 2019 (SDE19) house of Ghent University) are the main focus of this thesis. The design of the pavilion and the HVAC will be adapted to Belgian climate and regulations, while also being efficient in satisfying the rules of the Solar Decathlon competition located in Hungary.

1.1 Outline of thesis

In the first chapter, an introduction to the thesis topic and its context was given. The next chapters are organized as follows:

- Chapter 2 gives a background on global energy use, especially in buildings. The rising demand of energy use in HVAC systems and the future developments are discussed.
- In chapter 3 the origin, goals and rules of the SD competitions are investigated.
- Chapter 4 is talking about the architectural design and concept of the Mobble. By understanding the project, a suitable HVAC design could be designed.
- Chapter 5 is the main chapter of this book. It is concerned with the design, dimensioning and control strategy of the HVAC system for the Mobble, but a global HVAC concept was created. First previous SDE houses were studied in order to come up with a innovative and energy efficient design.
- Finally a conclusion is presented, ending with an addendum about typical HVAC systems.

Chapter 2

Energy use in buildings

Abstract

Sustainable development is the major challenge of the 21^{st} century, which impacts all sectors. The process of sustainable development was promoted worldwide in Rio de Janeiro in 1992 and is defined as follows: "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs".[1] How can a green world go hand in hand with economic growth? After a general overview of energy consumption, the global energy consumption in buildings is discussed, as well as the impact of HVAC systems. Finally the future challenges of the building energy use are reviewed.

2.1 Global energy use

According to the U.S. International Energy Agency (IEA) [2] , global energy use worldwide grew by 2.3% last year, its fastest pace this decade, driven by a robust economy and stronger heating and cooling needs in some regions.
Demand for all kinds of fuel rose, with natural gas posting the biggest increase, accounting for nearly half the growth in energy demand. Despite the major growth in renewables, global energy-related emissions are still rising. The CO_2 emissions rose by 1.7%, a historical 33.1Gt CO_2 was released.

Global primary energy consumption has increased steadily over the last decades, shown in figure 2.1. This increasing trend has been recently marked by dramatic growth rates in many developing countries. In 2018 China, the United States, and India together accounted for nearly 70% of the rise in energy consumption, not to mention the influence of the industrial activities in Africa and North America in the near future.[3]

Minimizing environmental impacts and guaranteeing the energy supply are the greatest challenges related to the 21^{st} century's energy policy. Urgent action is needed on all fronts. Not only the way energy is supplied must change, also the way it is consumed.

2.1.1 Emissions

Between 2013 and 2016 the CO_2 emissions stagnated, even though the continued global economy grew (see figure 2.1). Strong efficiency improvement was the biggest source of CO_2 emissions abatement in the energy sector. Nevertheless, the higher economic growth in 2017 and 2018 was not met by higher energy productivity. Low-carbon solutions did not scale up fast enough to catch up with the rising demand.

Economic growth, particularly in emerging economies, will keep on putting upward pressure on energy demand and emissions. Developing countries account for the growing share of greenhouse gas emissions, even though they have abundant renewable energy potential. Their challenge is to achieve knowledge and to simultaneously provide low-cost energy for economic development.

To achieve the internationally agreed objectives on global climate change, air emission and universal energy access, governments need to scale up the use of all policy tools at their disposal. Figure 2.1 shows two possible energy scenarios from now till 2040. Under current and planned policies, modeled in the New Policies Scenario (NPS), energy demand is set to grow by nearly 28% and CO_2 emissions will further increase. When following the Sustainable Development Scenario (SDS), which presents an energy transition where renewables and energy efficiency lead the charge, global primary energy use will stagnate. In this scenario, global energy-related CO_2 emissions peak around 2020 and then enter a lasting decline, resulting in nearly half the CO_2 emissions in 2040 when compared to 2018. It's obvious that policy choices will determine the shape of the energy system of the future.

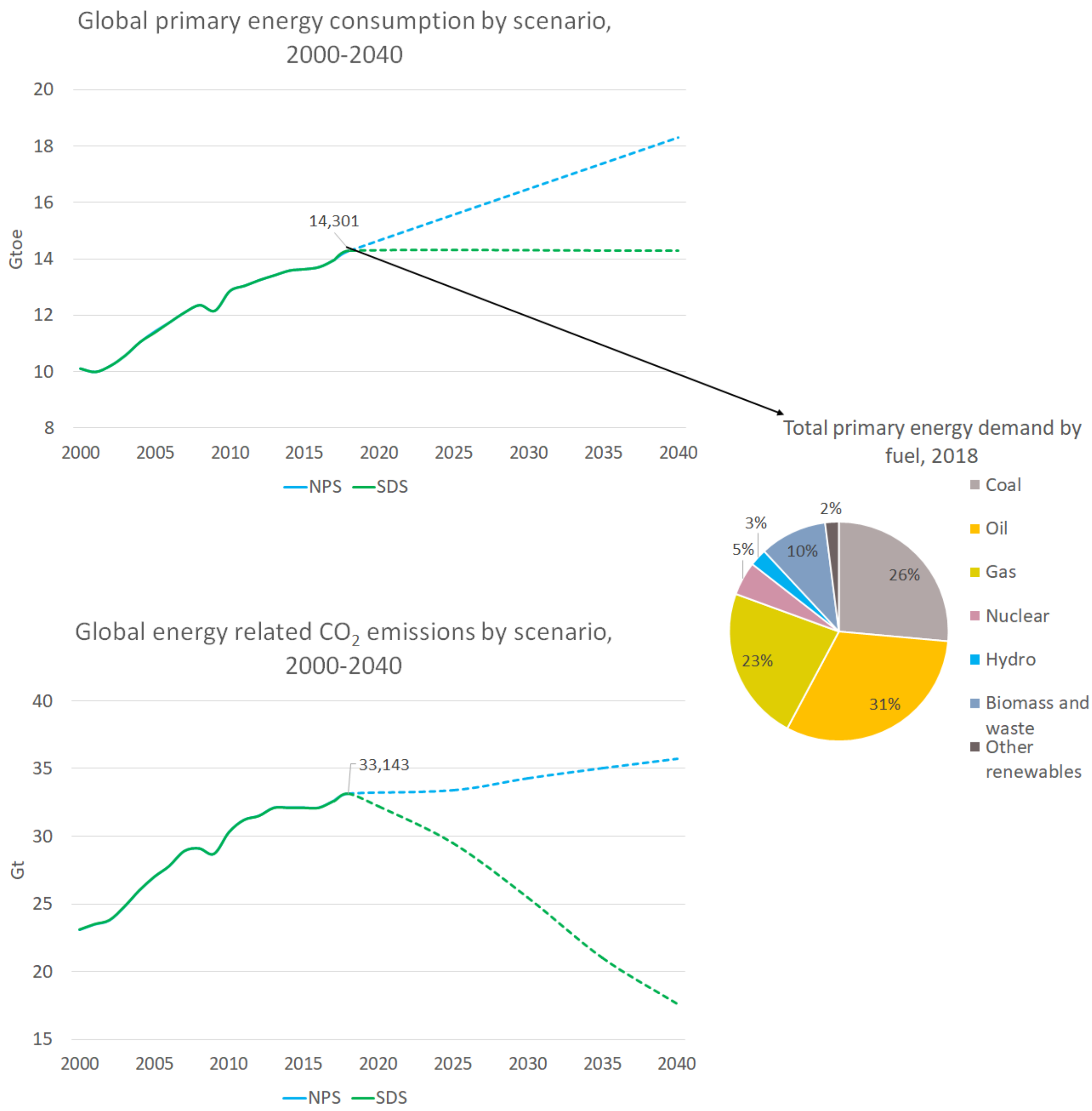


Figure 2.1: Evolution in global primary energy consumption and CO_2 emissions from 2000-2040 in the NPS and SDS scenario

2.1.2 2020 goals

Therefore in 2007 the European Union introduced the 2020 goals in a number of different sectors within the framework of climate change and energy reduction. The three key targets in the energy sector are based on the pillars leading energy policy: security of supply, competitive markets and sustainability. The energy goals are to have a 20% reduction in greenhouse gas emissions, compared to 1990 levels, 20% improvement in energy efficiency and 20% of EU energy coming from renewables.[1] The measurements show that the CO_2 emissions of the EU are declining, which shows that the effort put in the development of renewables and energy efficiency starts to pay off.[3]

2.2 The energy use of buildings

Final energy consumption is usually split into three main parts: industry, transport and 'other'. The term 'other' incorporates various sub-sectors, containing, residential, commercial, public services, fishing, agriculture.[4] As the energy consumption in buildings has dramatically increased over the past decade it should become the third main sector. Growth in population, enhancement of building services and comfort levels, and improved access to energy in developing countries, have raised the building consumption to the levels of transport and industry. Also the global climate change made the building sector the biggest single contributor to world energy consumption and greenhouse gas emissions. The data obtained from IEA [2] confirm this trend. Almost a fifth of the increase in global energy demand in 2018 came from higher energy demand as average winter and summer temperatures in some regions approached or exceeded historical records. Furthermore people currently spend 90% of their day indoors, relying on mechanical heating and air conditioning.

The world is living on a historical turning point in the field of energy and environment, as the continuation of emissions at the same pace will lead to a catastrophic situation. However, *significant energy savings can be achieved if buildings and their technical solutions are well designed, constructed and operated.*

2.2.1 Heating, ventilation and air conditioning(HVAC)

With the rise of standards in thermal comfort, HVAC systems have become the largest end user both in residential and non-residential sector, comprising heating, ventilation and air conditioning. It accounts for almost half the energy consumed in buildings.[4] In Europe, space heating comprises the largest portion of total building energy consumption, over 50% of their primary energy demand and even 66% for residential applications.[5] Also the building stock in Europe is characterized by a high number of existing architecture built under different standards. Therefore addressing space heating and cooling in a new construction and retrofitting of existing buildings creates opportunities for energy savings.

2.2.2 Zero Energy Buildings (ZEB)

Saving strategies and energy efficiency have become a priority focus for public authorities around the world. Building thermal regulations were adapted as strategy to promote energy efficiency in buildings. The European Parliament launched the European Energy Performance of Buildings Directive (EPBD). One of the strengthened requirements introduced by the last EPBD recast, Directive 2010/31/EU, is the obligation for all new buildings to be nearly zero energy by the end of 2020.[6]

The concept of ZEB's has raised growing interest during the past decade, as it can be considered the ultimate solution to limit the negative impact of the building energy consumption. The definition of a ZEB given by the EPBD is "a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources produced on-site or nearby". When energy need for heating and cooling is less than 30 kWh/m^2/y it is defined as Net Zero Energy Building (NZEB).[5] This can be achieved by applying suitable energy-efficient measures, combined with renewable energy generation systems.

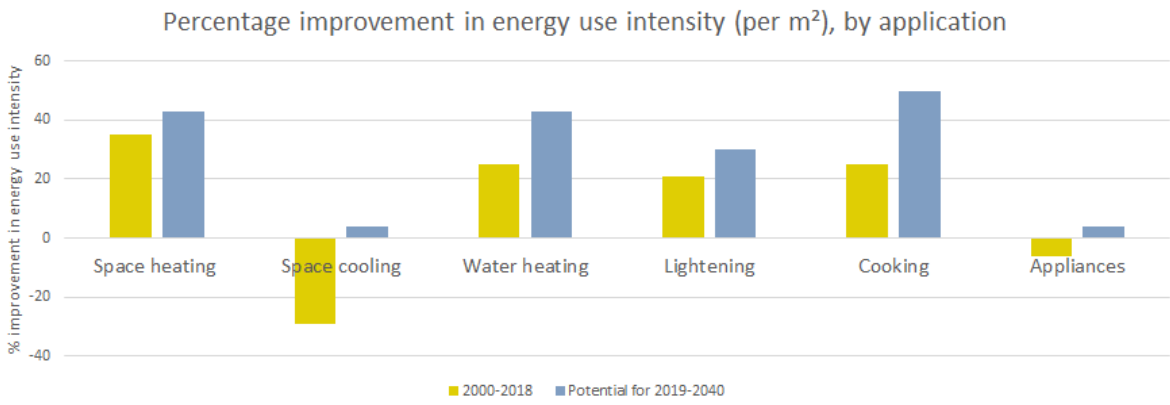


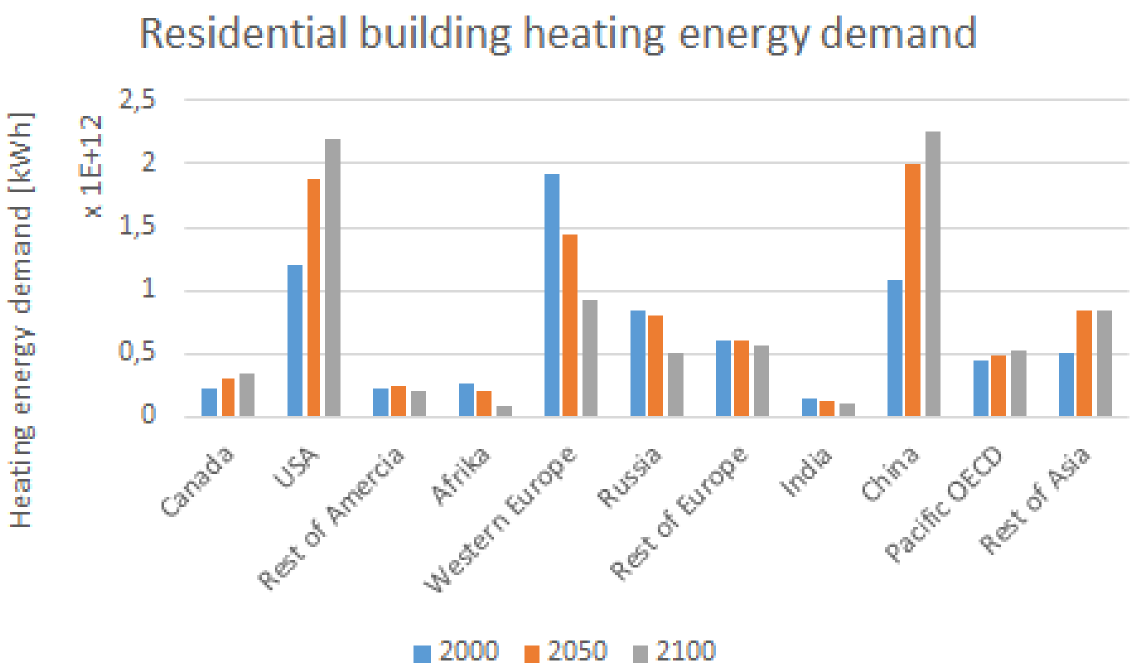
Figure 2.2: Percentage improvement in energy use intensity (per m^2), by application

2.3 Future development

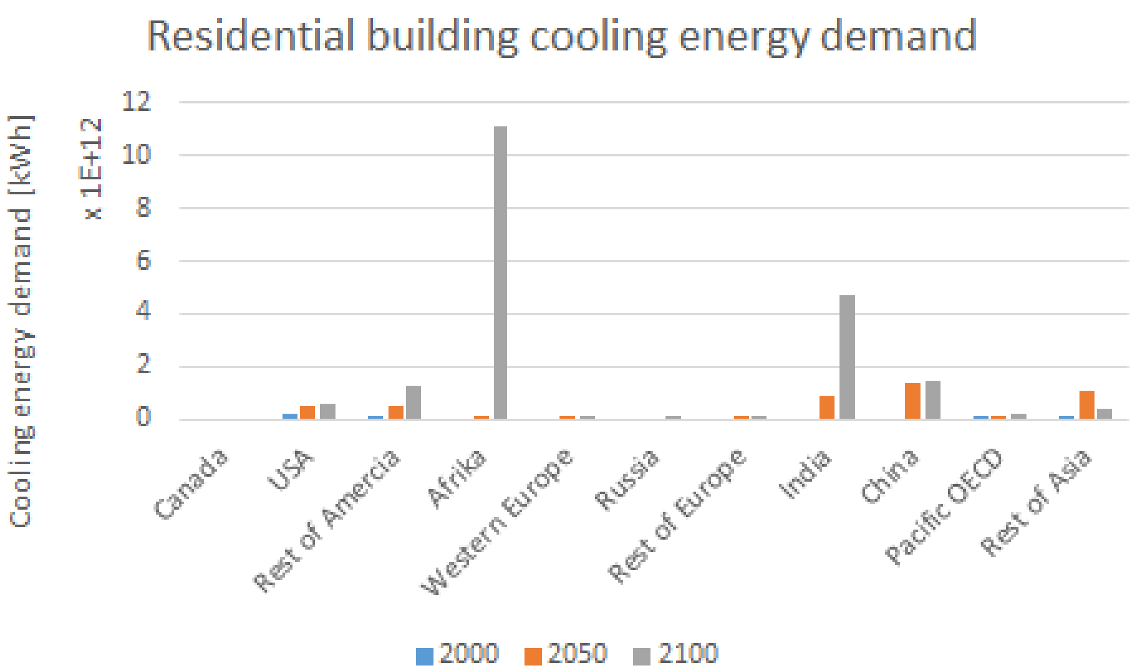
Emissions from buildings have risen again for the second year in a row, back to their 2013 peak. The emerging economies and global demand for energy services, especially air conditioning, are growing faster than decarbonised power. According to the Efficient World Scenario (EWS) of the IEA, there is potential for global building energy demand to decline between now and 2040, while total building floor area grows further 60%. Houses could be 40% more energy efficient than today. According to figure 2.2 especially for space cooling there is room for improvement. This energy saving potential is not used because of continued use of less efficient technologies, lack of effective policies and insufficient incentive to invest in sustainable buildings.

Next to these investments and policies the impact of global climate change on building energy demand must be considered. Since buildings have a long lifespan and high initial cost M.Isaac et al. [7] predicted the residential building energy demand for heating and cooling in the next century. Under the reference scenario, global residential heating demand will decrease by 34% and cooling demand will increase by 72% by 2100. The cooling demand will overtake heating by 2070. The predictions for cooling and heating are shown in figure 2.3.

Especially in Europe the heating demand will decrease because of decreasing population, lower heating intensity and a global warming climate. All these factors should be considered when designing a new building and HVAC system.



(a)



(b)

Figure 2.3: Residential building energy demand for (a) heating (b) cooling

To mitigate the climate change and the air pollution, there is a need to search for sustainable solutions. All parts of the building must be analyzed during the design: from the material choices to the details of the energy performance. Wooden constructions can be part of the solution, because houses built with bio-based material, such as timber and straw, act as CO_2 storage. Plants extract CO_2 from the surrounding air through photosynthesis. Using wood in long-life applications such as buildings (50 year and more) is the safest and cheapest form of carbon capture and storage available. Furthermore, it is the only construction material which absorbs carbon dioxide from the atmosphere when produced, rather than releasing CO_2.
Wooden solutions also have low conductivity values, working well as insulator and they certainly do not have to be inferior to stone, concrete and metal when it comes to safety and strength. If wood is burnt, a charcoal layer is formed on the surface, which considerably slows down the combustion process and thus protects the underlying wood. This ensures the stability of the building for a longer period of time.[8, 9, 10]

This all makes that a progress has been made to the ZEB, but there is still a long way to go. The Solar Decathlon competition provides an opportunity to share innovative, energy efficient solutions with the industry and public, in doing so raising awareness of energy use.

Chapter 3

Solar Decathlon

Abstract

In this chapter, the origin and goals of the Solar Decathlon competition are discussed, followed by features of the Solar Decathlon Europe edition in 2019 and lastly relevant competition rules for the design of an energy efficient HVAC system are cited.

3.1 Introduction

The Solar Decathlon (SD) is an international student competition based on the initial idea of founder Richard King from the U.S. Department of Energy (DOE) in 1999.[11] It is the biggest architectural student competition requiring interdisciplinary student teams to design, build and operate their sustainable, solar-powered house. In the end phase of the SD these houses are assembled and evaluated on the basis of 10 contests. The SD presents exciting designs and shows how solar energy and other renewables can be used to attain NZEB or energy plus buildings. The goal is to come up with new and innovative solutions to several key challenges that we face today: the need for energy saving, energy efficiency and climate change. In 2002 the first SD competition was held in Washington DC, with mainly American teams, but it became evident that these issues are global, requiring everyone in the world to work together.[1]

Owing to the active participation and commitment of the Technical University of Madrid (UPM) in the SD 2005, 2007 and 2009 an agreement was made between the Spanish and American Governments on launching the first edition outside the USA.[11] Spain would organize two editions of the competition in Madrid where participants would come mainly from European Universities. In the meantime, this competition has taken place 16 times worldwide, three times in Europe. This work is written in preparation for the next European edition: Solar Decathlon Europe 2019 (SDE19).[12]

3.2 Solar Decathlon Europe

For the SDE competitions, two main objectives were defined, in line with the 2020 goals:

- Promoting innovation and knowledge to improve energy efficiency and sustainability, and the integration of renewable energies. Translating this technologic knowledge to the industry and professionals in this way raising awareness about energy efficiency in day to day solutions for buildings.
- Taking advantage of social media to make people aware of the importance of energy consumption. Improving energy efficiency of our buildings together with the introduction of renewable energy sources can create a more sustainable world.

The competition gives the opportunity to disseminate information about public innovative technologies and design strategies for buildings, as well to promote social awareness. *The general public can be educated about responsible energy use and the technologies available to reduce their energy consumption. This all demonstrates that high performance solar households can be comfortable, attractive and affordable.* 'All electric buildings' are designed which fits perfectly in the ongoing European trend of decarbonisation of heat supply.[13]

3.2.1 The competition

Universities from all over the world meet to design their building. During the final phase each team assembles its house in a common Solar Village. This final phase includes exhibition, monitoring and evaluation in 10 separately scored contests. The so-called decathlon covers different important aspects to promote sustainable architecture. There are three different ways to earn points:

- **Jury evaluation**: A multidisciplinary jury, composed by internationally renowned experts in their various fields, will use their experience and knowledge for the evaluation of the houses. The scoring will be done following the evaluation criteria and guidelines developed by the SDE19 organisation for these contests.
- **Task completion**: Teams gain points for successfully completing several requested tasks or getting close to the goal.
- **Monitored performance**: The houses are constantly monitored during the competition, points are awarded depending on the correct performance of various tasks.

Each of these ten contests may consist of sub-contests and different assessment criteria. Every contest counts for 100 points and the team with the highest total points at the end of the competition wins the SDE. The different contests for the SDE19 are briefly explained below.[14]

In the **architecture** contest an attractive design is sought, which combines comfortable and functional spaces with bioclimatic technologies and strategies for reducing the building energy consumption. The jury of architects visits the houses, looking for a coherent and comprehensive project.

For the **engineering and construction** contest, systems used by the teams in building their houses are evaluated. Teams will have to demonstrate the higher level of functionality of the house structure, electricity, plumbing and solar system design and construction. Also the safety, viability and adequate integration in the pavilion will be analysed. This all on the basis of technical documentation and visiting the house.

Unused energy is the cleanest energy, therefore teams must demonstrate to what degree the house design and its systems contribute to enhance the **energy efficiency** of the building. Concepts such as the building's thermal envelope, passive and active systems, etc. are evaluated.

For **communication and social awareness** teams are evaluated by their ability to transmit the competition relevant topics (sustainability, innovation and energy efficiency) as well as the ideas contributed to their design to the public. This communication aspect is assessed during the period prior design and during the public visits to the pavilion. Creativity, effectivity and efficiency, adapted to each target group, is rewarded.

The **neighbourhood integration and impact** contest is arisen to accentuate the integration of the pavilion into its context. The relevance of the housing unit and its localization in the neighbourhood regarding the social and urban contexts chosen by the teams will be evaluated. The value created and added to the community by the renovation will play a particular role. Several strategies are possible: providing surplus electrical power, new balconies, increased accessibility, etc. The economic strategy and associated mode of production and transportation will be evaluated.

Innovation and viability points are gained by teams who made innovative solutions on varying fields, ranging from architectural to technical system level. Teams must demonstrate that their proposals are social, technical and economically feasible. Furthermore their innovative ideas must increase the added value or improve the building's performance.

Circularity and sustainability consider the environmental impact of the house during the lifecycle. A minimal impact during the manufacturing of the components, the construction phase, building procedures and use, to its demolition and re-cycling is rewarded. Teams have to reduce waste generation, use natural resources and maximize re-cycling possibilities. In this way circularity and sustainability effects are scored.

The capacity for providing **comfort conditions** is evaluated through measurements by installed sensors. Temperature, acoustic, lighting and air quality are scored by predetermined values.

In order to comply with the demanding standard of present day society, it is necessary to maximize the performance of the house. The **house functioning** contest tries to simulate the average energy use in a modern home. Checks are made on the possibility of performing the normal everyday tasks, so measurements will determine the score.

Past Solar Decathlon competitions focused on innovative energy saving solutions and solar energy utilization. Electrical self-sufficiency and energy efficiency will again be evaluated in the SDE19, therefore houses must reduce their consumption to a minimum and achieve a positive **energy balance**. But in future energy systems the correlation of demand and supply becomes a major issue. Energy flexible buildings which try to have their own network **for** load management will be rewarded.[12]

3.2.2 Hungary 2019

The Solar Decathlon Europe 2019 (SDE19) takes place in Szentendre, Hungary in July 2019. It maintains the key features of SD, namely 16 university teams, the 10 contests, the contest period and the exhibition and evaluation. The aim is challenging students to think critically about how people can build and live in the future and immediately translating these ideas into a pavilion. This year the focus is on the renovation of existing buildings and urban development challenges as this is a living subject in Europe. Most European countries have a large building stock of which the structure is still steady, but with outdated systems. How can these dwellings be revived? Also the densification of cities leads to some problems that need to be solved. The teams can choose between different topics:

- Renovation of the traditional Hungarian rectangular apartment buildings with brick wall either with concrete flooring or without heavy flooring solution
- Development of a roof-top apartment with other indications of the context
- A renovation project to solve typical problems in the native country or region
- Any other proposal to solve specific local challenges

This edition, a set of new rules is developed in order to meet the challenge that our societies are now facing. Thanks to these rules the houses can be fairly evaluated in the contests.

3.3 Goals and rules for HVAC system

The goal of this work is the design of an energy efficient HVAC system for The Mobble. Therefore the rules of SDE that are appropriate to accomplish this goal are discussed in more detail in this section. The objective of an HVAC system is to provide interior comfort through the control of temperature, humidity and air quality, while taking into account the energy efficiency and acoustics. Also domestic hot water must be provided. The HVAC system is scored in different contests during the competition days. For better clearness, the following part of the document has specific structure. First the comfort condition requirements and house functioning are quoted, as they contain clear boundary conditions and are evaluated by measurements. Then other relevant restrictions of the competition are discussed. All information given below comes out of the SDE19 rules.[14] The competition calendar of this SDE edition was not delivered on time so the measurement period of the indoor temperatures was based on previous competitions. The house functioning activities, like cooking, washing, bathing, will have an influence on the cooling loads.

Comfort conditions

The comfort conditions will be constantly measured and evaluated. Temperature, humidity and air quality must be kept between fixed limits. Two temperature sensors will be installed: in the bedroom and dining room. Humidity and CO_2 sensors will be located next to the temperature sensors. The measurement of the sound level produced by all HVAC and active equipment in the bedroom will be done according to the ISO 10052:2004.

The time-averaged interior dry bulb temperature has to be between 23 ℃ and 25 ℃ in order to obtain full points. One gets reduced points if the indoor temperature keeps between 21 ℃ and 23 ℃ or 25 ℃ and 27 ℃, as shown in the figure 3.1.

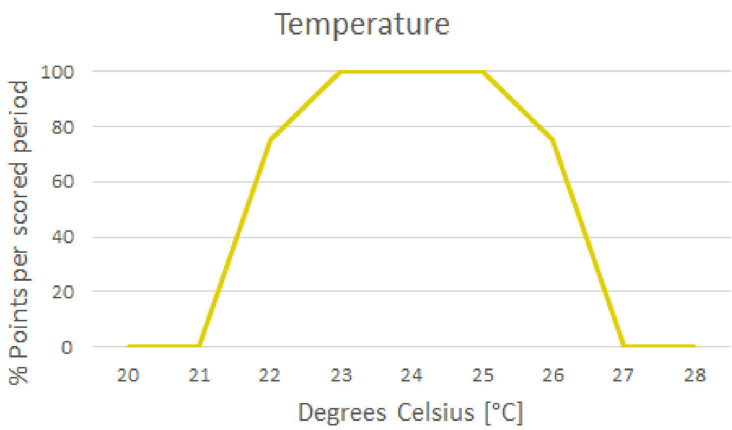


Figure 3.1: Temperature sub-contest points distribution

For humidity full points are earned when the time averaged interior relative humidity is kept between 40% and 55%. Reduced points are scaled linearly, as shown in figure 3.2.

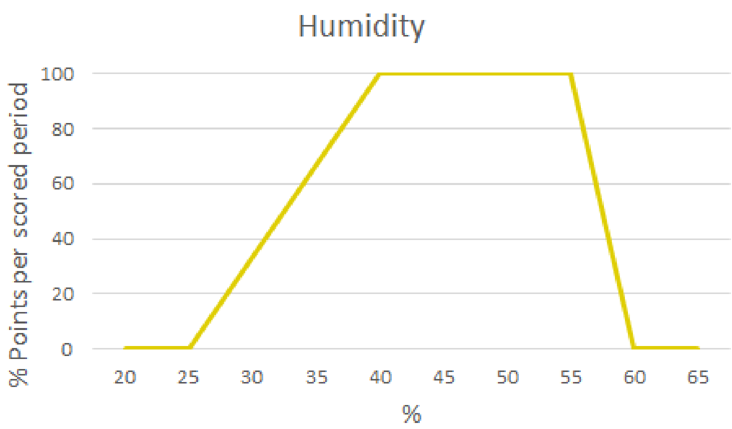


Figure 3.2: Humidity sub-contest points distribution

Also the air quality is measured. Full points can be scored by keeping the content of CO_2 below 800 ppm during the test period. Reduced points are scaled linearly, as shown in the figure 3.3.

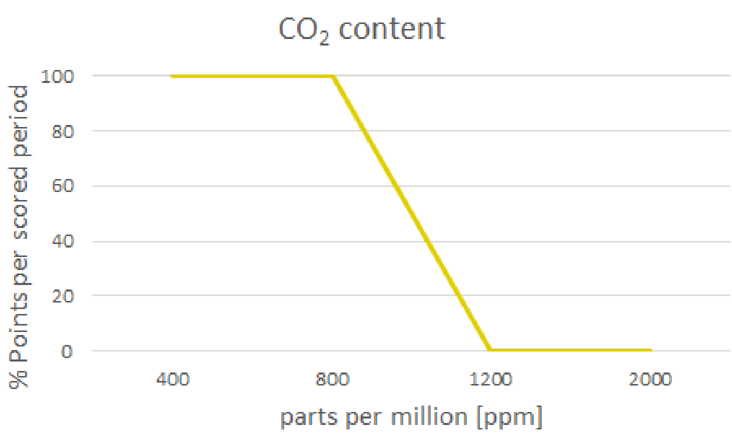


Figure 3.3: air quality sub-contest points distribution

Furthermore acoustic comfort can be obtained by reducing the sound level of HVAC and active systems to a minimum. All technical equipment will be in operation for nominal setpoint to ensure interior comfort. The point distribution is given in figure 3.4.

Lastly there is the passive evaluation period. During two consecutive days the houses can only use 'passive cooling or heating'. So, not relying on internal heat or cooling production devices or

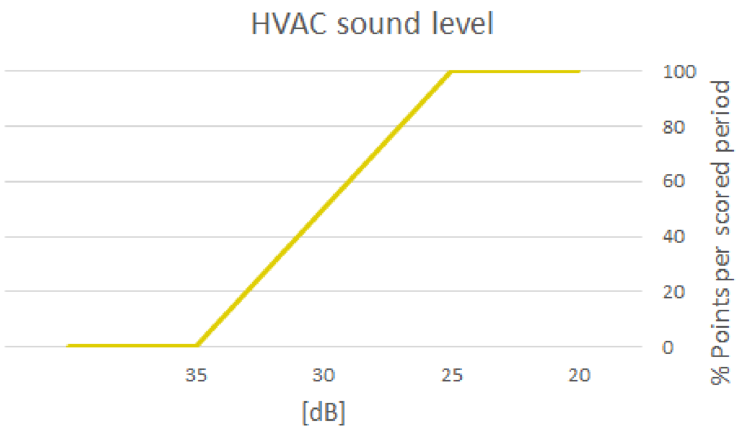


Figure 3.4: HVAC system sound level points distribution

a thermodynamic cycle (Carnot). Only the use of pumps and fans are allowed, batteries are not permitted. The teams will have to think about passive strategies for keeping the house in the comfort limits. Penalties will be applied to teams that do not follow the passive period rules. This passive period will run from 15^{th} of July, 00:01 am to 17^{th} of July, 08:00 am.

House functionalities

In order to optimise the performance of the houses, the contest tries to reproduce the average energy use in a modern home. The house functionality will be evaluated by measurements realised in the SDE19 competition week. The system must be correctly sized in order to fulfil the domestic hot water (DHW) requirements.

To simulate the use of domestic hot water, typical hot water draws of a household will take place. The schedule of the hot water draw differ from one day to the next, and the number of draws per day will not exceed three. For each draw, 50 litres of hot water shall be delivered during 10 minutes. All points are obtained by delivering water at an average temperature of 43 ℃ . When the average temperature is below 37 ℃ no points are earned (see figure 3.5).

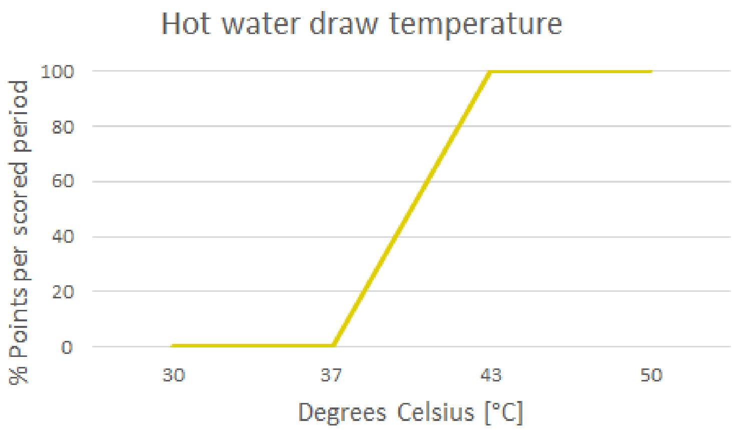


Figure 3.5: Hot water sub-contest points distribution

Other requirements

In this section other appropriate rules that have to be kept in mind when designing the HVAC system are reviewed.

There are some restrictions and prerequisites when it comes to the thermal aspect of the HVAC installation. The competition takes place in Hungary in July but the pavilions must be designed for all four seasons. Therefore heating and cooling problems should be addressed, as well as summer overheating.
Teams from all over the world must design their house for home conditions while being efficient in Hungary. This duality aims at encouraging young minds to find the most adapted solution for a specific context, while sharing the most innovative ideas with colleagues from other countries. Innovation, sustainability and efficiency of the technical concepts will be rewarded.

Thermal energy storage devices located outside the footprint shall be fully isolated from direct solar radiation. Furthermore teams may use liquids as thermal mass. These thermal storage containers shall be filled and sealed before their arrival and shall remain sealed during the stay on the competition site. These containers shall be insulated.

Geothermal energy cannot be supplied during the competition and has to be simulated by an active system. In order to attain a fair comparison between the teams, the energy consumption used to simulate the ground will be counted in the energy balance.

The utility of thermal solar systems will be evaluated regarding each project's needs. The use of solar systems other than DHW will be positively evaluated.

Furthermore there are also some electric demands. For the Energy Balance contest different concepts are evaluated. These are briefly explained below as while designing the HVAC, the focus will be on maintaining comfort with maximal energy reduction.

- Load consumption per surface area: aims at evaluating the electrical energy efficiency of the house fulfilling comfort conditions and functions. The house with the lowest energy consumption obtains all available points, passive strategies are encouraged.
- Positive electrical balance: evaluates the degree of self-sufficiency of the building
- Temporary generation-consumption correlation: In order to reduce the need for transmission lines, flexibility of energy usage and generation is encouraged.
- House adjustment to network load state: one of the challenges of the future is to reduce peak loads on the network, therefore houses must be able to manage their energy consumption according to the general state of stress. The consumption peak is shown in figure 3.6.
- Power peaks will be monitored.

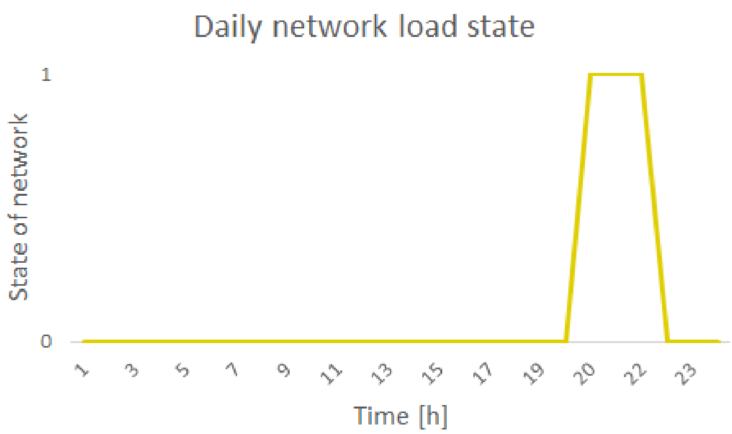


Figure 3.6: Daily network load state

Chapter 4

Pavilion: The Mobble

Abstract

The pavilion designed by Team Ghent University for SDE19 is explained in more detail.[15] The pavilion focuses on the renovation of nearly identical, large scale apartment buildings, built by the company Etrimo in the '50–'70 in Belgian suburbs. More information about Etrimo and the developed module to solve the problems of the Etrimo buildings is given. During the design of the pavilion the rules and evaluation points were used as guideline. Technological and architectural innovation is encouraged by the organisation.

4.1 Etrimo buildings

As already stated, the SDE19 contest focuses on renovation projects. Team Ghent University aspires to tackle some of the renovation problems of large-scale apartment buildings in Belgian context. During the second world war a large amount of residential and non-residential facilities were destroyed. After the war, all over the European continent, demand for housing became natural and resulted in a need for constructing quickly new dwellings available for immediate immigration. In Belgium, contractors such as Etrimo and Amelinckx started a mass production of repetitive high rise buildings in the '50–'70 in the suburban zones (see figure 4.1). The post-war apartments were build following an industrial building concept, such that the standardised

Figure 4.1: Etrimo Building in Breughelpark in Asse, Belgium [16]

houses could be realised in a very short time. All these residential buildings are built according to one principle. Four apartments are arranged around a circulation core, they have a terrace and an identical plan layout, as shown on the plan below (figure 4.2).

Collective buildings were a big improvement, in terms of hygiene and quality of living, when compared to the houses constructed before the fifties. Although these buildings have interesting urban locations, nice view and affordable housing, today these apartment buildings are outdated, energy inefficient and no longer meet the standards. Fire safety, thermal and acoustical performance don't satisfy today's needs. The majority of these buildings is in desperate need of a thorough renovation. But almost all apartments belong to different owners, making total renovation of a building block difficult. Therefore renovation is a complex process, determined by a number of practical, technical and financial obstacles.

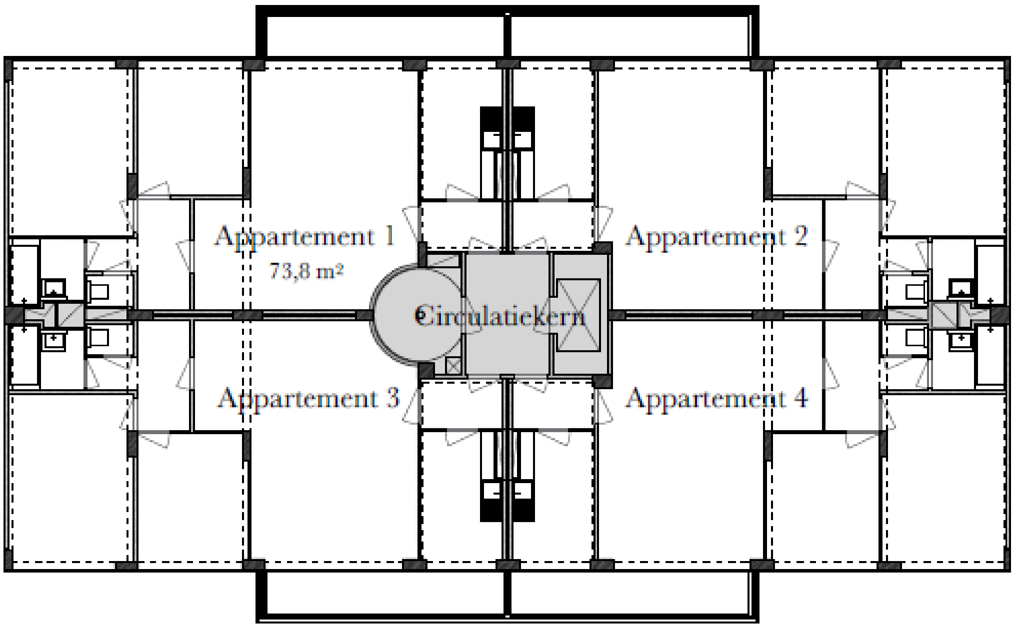
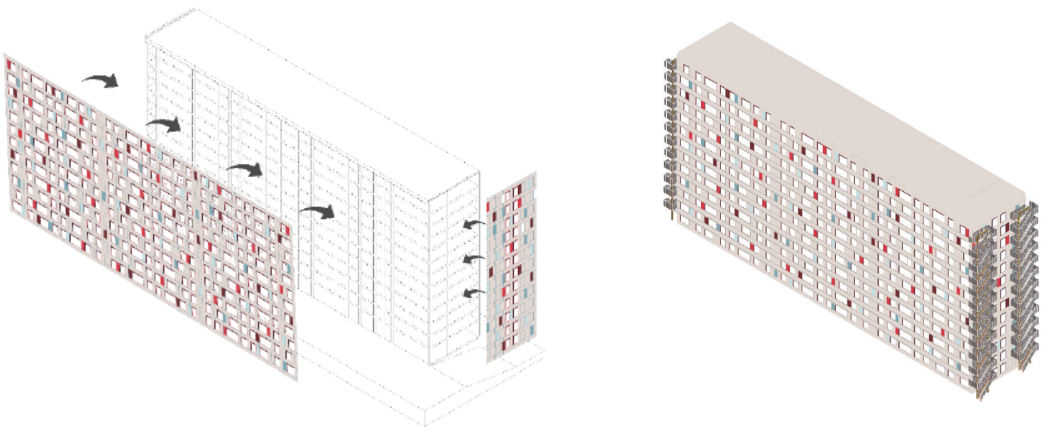


Figure 4.2: floor plan Etrimo [16]



(a)

(b)

Figure 4.3: (a) Façade renovation (b) Continuous Balconies and New Staircases [15]

4.2 Renovation strategy of Etrimo buildings

The SDE19 team of Ghent searched for a renovation strategy that is efficiently applicable and has minimal impact on the residents. Since the structure of the Etrimo buildings is still in good condition, it would be inefficient to demolish them. Therefore they ended up with a façade renovation, where the façade of the apartments will be renovated by prefabricated sandwich panels to increase the thermal and acoustic performance (see figure 4.3a). These panels are finished and filled with insulation. This could be an efficient renovation strategy without destruction of the structure, which could mean that the inhabitants can stay in their apartment during the renovation of the building. To turn this concept in a smart and efficient system, modularity will be applied. A maximum of 2 or 3 different sandwich panels will be standardized, making the renovation of the façade modular. Also some of these panels will be used as technical panels, containing the newest installations. They can contain a ventilation system, electric battery or water distribution system. Thanks to this concept, outdated panels can easily be replaced by a panel containing the most up-to-date installations. To get an individualized look of the façade, some panels will be executed in a different colour.

A second strategy tackles the problems concerning fire safety. The Etrimo buildings are lacking in legal escape and evacuation routes. By creating new balconies, continuous over the façade, leading to new staircases at the four corners, a safe evacuation route can be created, like shown on figure 4.3b.

4.3 Solar Decathlon pavilion: The Mobble

In particular, the pavilion represents a test set-up to inform the broad audience over renovation strategies for high-rise towers. This theme together with the rules of the competition had a major influence on the development of the building. The pavilion for SDE19 is a conversion from a typical type Etrimo apartment into modules (see figure 4.4). The geometry and corresponding dimensions, manner of entry, terrace and the zoning are copied. This historical model in concrete became a wooden module because of its durable character, transport reasons and ease of construction by students.

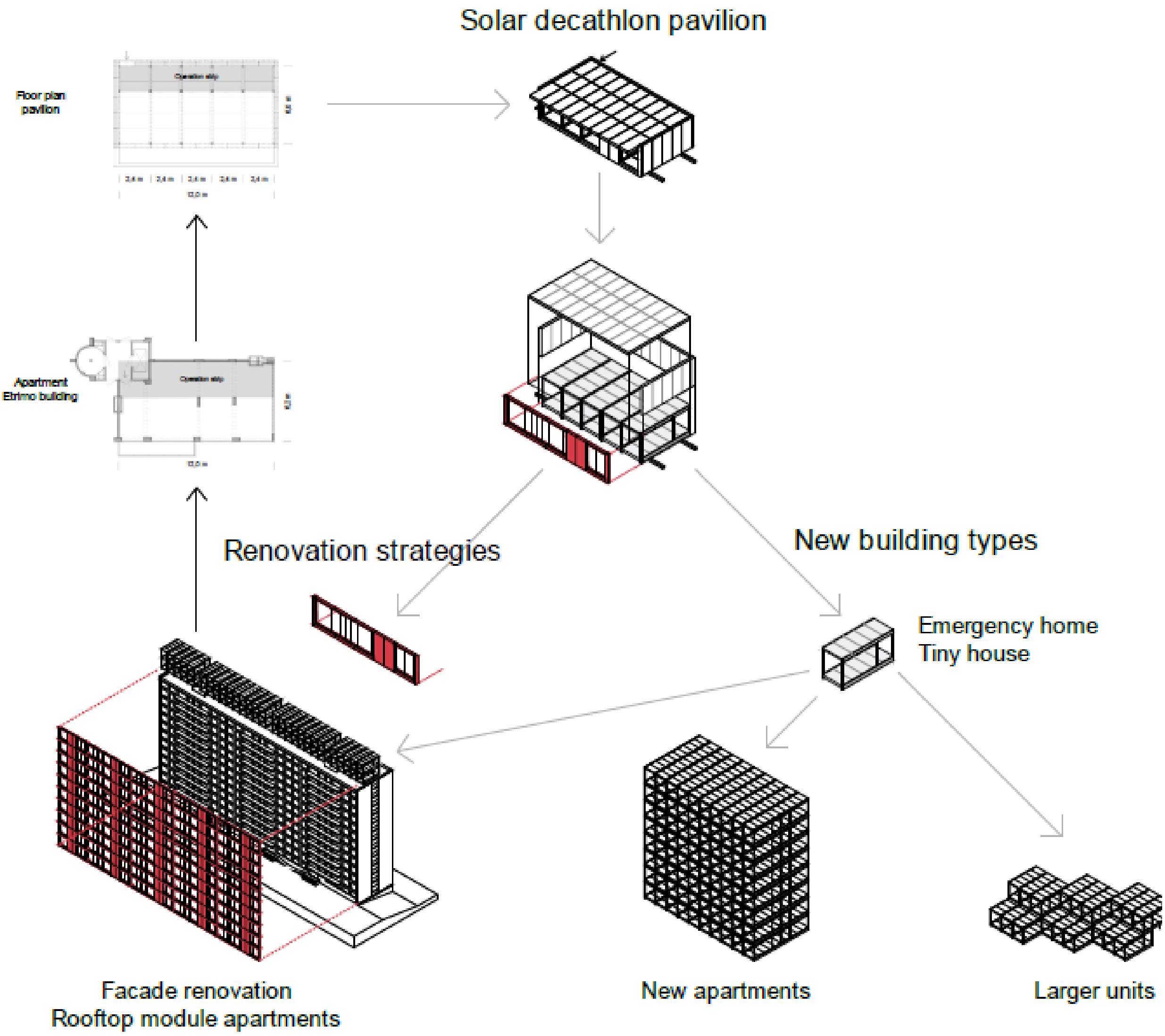


Figure 4.4: Integration possibilities of the Mobble [15]

On the other hand, the SDE19 pavilion of the University of Ghent also tries to offer solutions for the housing challenges in cities, by moving away from the static residential market. Today, there is a continuously growing housing need in cities. Co-housing, house sharing, tiny houses are projects that can balance temporary personal housing requirements with the building stock. Hence a basic modular building block, "The Mobble" was erected.

The pavilion is built out of five identical Mobbles, for reasons of standardization and transportation, like shown in figure 4.5. It will be finished on site with a shell of standardized sandwich panels and a layer of roof panels. The choice to separate the shell from the supporting structure has the advantage that different configurations are possible. Thanks to the Mobble you can adjust your house depending on your needs and changing living situations. This system is modular and circular: you can freely combine according to the demand there is, and if you need one Mobble less, it can be used elsewhere. Re-use can be done on a component scale rather than on material scale. Imagine a house that can grow with you. Which you expand when there are children coming. Which you even take with you when you move (see figure 4.6).

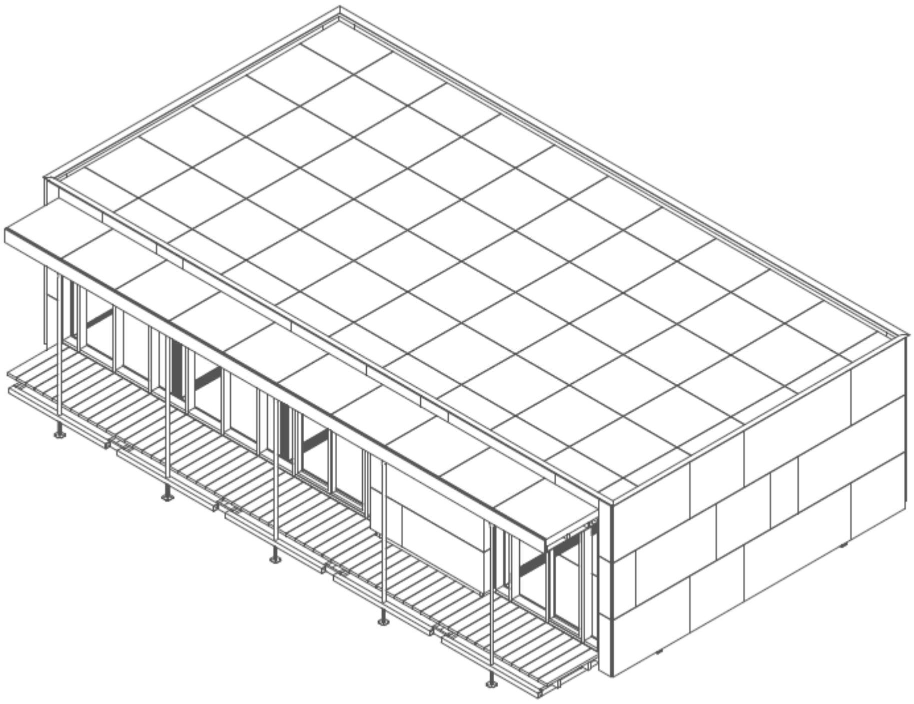


Figure 4.5: SDE19 pavilion team Ghent University [15]

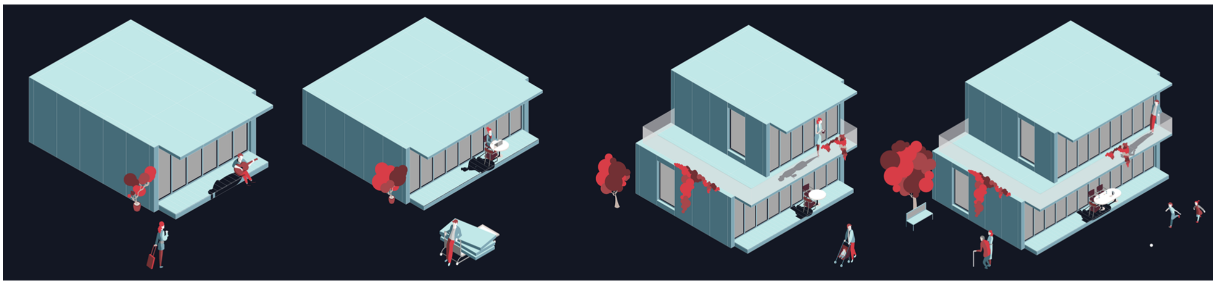


Figure 4.6: Different Mobble configurations [15]

Additionally the modules also have applications during the renovation of Etrimo apartments. The light construction makes it possible to top the Mobbles on the apartments. Families can move there during renovation of their apartment. At the end of the renovation, the modules can stay, creating extra housing units, which promotes densification in the city.

Consequently the pavilion has a two side story, going from the renovation strategy to the modularity, this all is shown in figure 4.4.

4.4 Architecture

One Mobble has following dimensions: L6,0m x W2,4m x H3,1m. The length and width are multiples of 1,2m, the standard width of typical sandwich panels and standard dimensions for transport.

The construction of the pavilion is shown in figure 4.7. One Mobble has two structural frames (1), between which floor panels (2) and the first layer of roof panels are placed (3). Five modules are made and each one gets a protective sail for transport. In Hungary first the foundation is mounted (5), followed by the placement of the Mobbles (6,7,8). After installation of the Mobbles, the façade panels are placed (9, 10), as well as the additional layer of roof panels (11, 12).

Thanks to the simple design, students and do-it-yourselfers can manufacture their own house. Structural design and calculations can be checked in the summary work on the Mobble. [15]

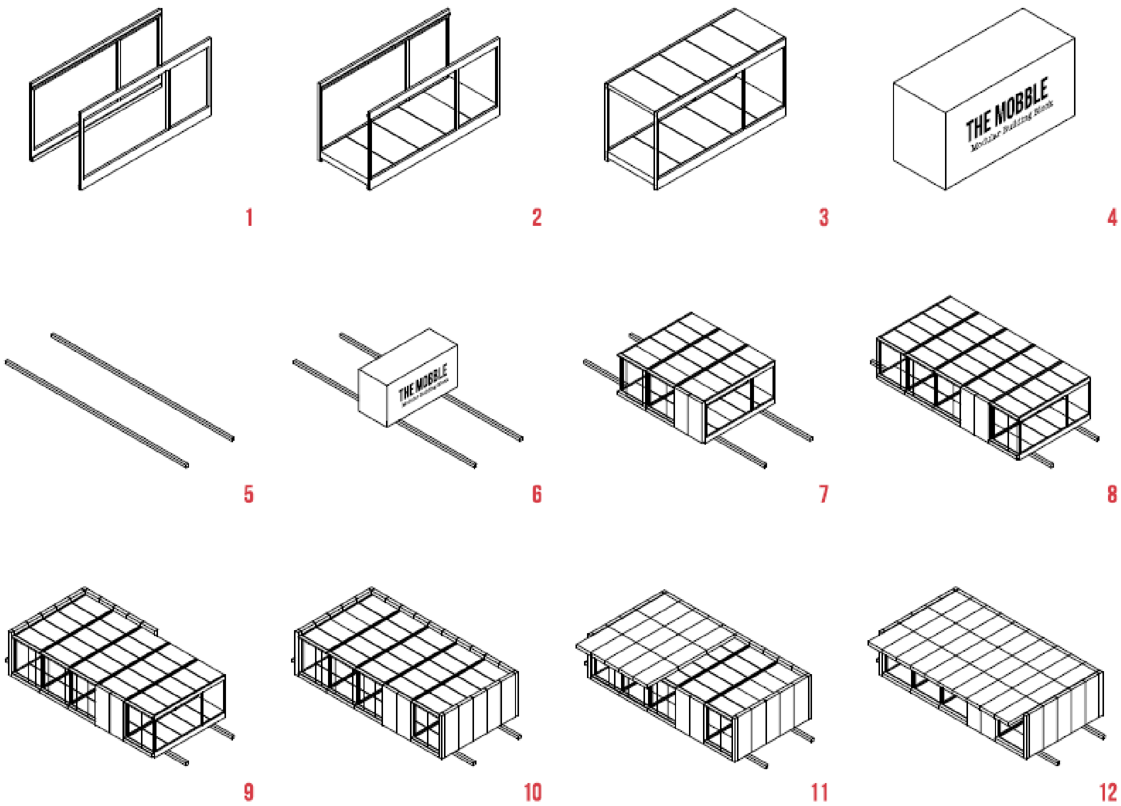


Figure 4.7: Design of the pavilion [16]

Chapter 5

HVAC in the Mobble

Abstract

The challenge for the future is to find creative solutions for a conflicting trend: to improve the quality of living for a growing world population still by reducing substantially the impact on our environment. The idea is to increase the energy efficiency and to reduce the need for fossil fuels by optimizing the use of solar energy. Our approach is combining the best of both worlds i.e. having the comfort of the traditional concept with high thermal mass build in the construction without the disadvantages linked to it (slow reaction time, high impact of energy for the construction elements and heavy building materials).

5.1 Background

The design and dimensioning of the HVAC system of the Mobble itself is discussed throughout this document. However, the Mobble concept can be used in a lot of different configurations, which makes it impossible to make calculations and dynamic simulations for every single case. Therefore the technical installations are designed according to the setup for the competition, namely 5 Mobbles placed in a line, still creating a global concept.

The traditional way of building has the advantage that you build in the construction not only the functional envelope but also a high thermal inertia. But to make concrete you need special lime kilns with very high energy input, the same counts for bricks. Adding transport costs and the equation becomes quite negative.

CO_2 neutral buildings are a hot topic. The expected energy use and cost reduction starts to convince the population to build and renovate following the most recent developments. Insulation, compactness and airtightness are of course well-known principles for energy efficient buildings.

However, recent research shows that the difference in actual energy use between poor and well-insulated buildings is smaller than expected.[17] This phenomenon is partly caused by the user behaviour but is mainly due to the HVAC system and control.
In old, non-refurbished buildings, a local heating system, that is turned on when it's needed, is applied. Currently there is an evolution towards low temperature distribution systems, such as floor heating, often in combination with a condensation boiler or heat pump. Due to the low temperature gradient of these systems, they react slowly and people leave these installations in stand-by 24/7. The energy savings due to more efficient techniques are partially offset by the transition towards uniform and continuous systems and the associated poor control.

Fast reacting systems, integrated in buildings with low thermal mass, can be the key towards lower energy use. By implementing demand-control in a lightweight building structure, HVAC systems can anticipate and be adjusted to a variable user behaviour.
Cancelling the classic thermal mass of buildings implies that other energy storage systems must be operated in order to apply peak shaving. The difference between the pavilion and the renovation of apartment buildings is striking. Etrimo buildings are constructed out of reinforced concrete, while a wooden structure was designed for the SDE pavilion. This results in a completely different building structure and energy design.

The design of the technical installations will focus on an integration in the Mobble, and thus will be an appropriate HVAC design approach in circular building applications. A translation of the technical solutions has to be made from the pavilion to the apartment.

For comfort one needs fast reaction time together with the smoothening effect of the thermal mass. This was absent in the old approach but was our headache for which we think to be able to solve. This is certainly not the first time this way of thinking has come up but still underdeveloped. In order to optimize the installed capacity and hence the specific energy consumption it seemed logic to find the possibility to store excess energy and to reuse this to do the "peak shaving".

All these reflections led us to scrutinize all possible alternatives for

energy storage with following features:

- Light
- Compact
- Cheap
- Good thermal conductivity
- Fast response

Furthermore solar energy can contribute to CO_2 neutral buildings, thermal or electric measures are possible. Different solar strategies are investigated and implemented in the pavilion.
The rising demand for space cooling is putting enormous strain on electricity systems and environment. Since the competition takes place in summer, the cooling demand will be the decisive factor for the pavilion. Hereby a perfect opportunity arises to investigate energy efficient cooling techniques.

The combination of the previous approaches, shown in figure 5.1, resulted in the energy efficient HVAC system for the Mobble. Geothermal and wind energy are excluded in the framework of our study, out of practical considerations and visual nuisance. First some research was done to previous SDE pavilions. The final HVAC concept for the Mobble is explained in the end of this chapter.

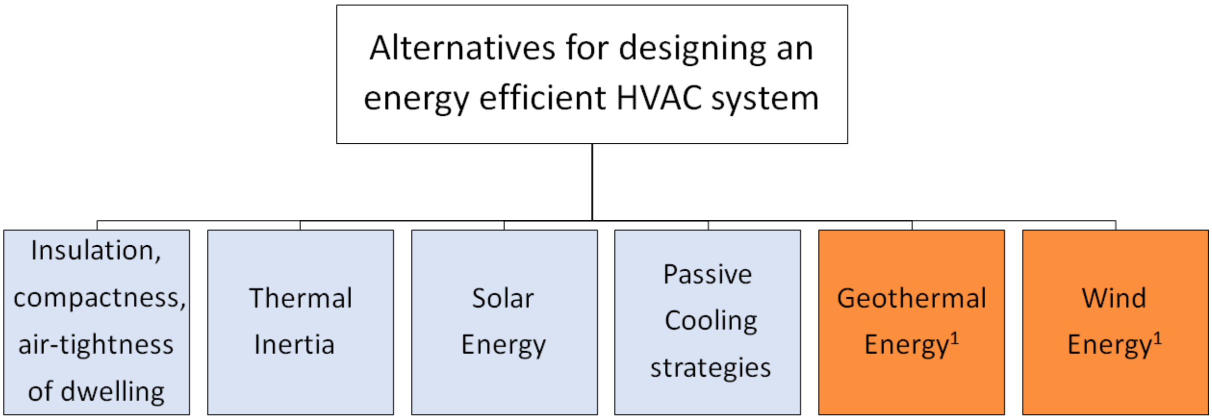


Figure 5.1: Alternatives for designing an energy efficient an energy efficient HVAC system for the Mobble

[1]excluded in our study due to the rules

5.2 HVAC in SDE

Abstract

As the Solar Decathlon competition challenges students to think about innovative ways to reduce the energy consumption, various techniques are used to increase the building performance. This section is a kind of literature review on the different architectural and technical (HVAC) solutions used in previous SD competitions.

5.2.1 Architectural solutions

First of all the **building envelope** needs to be highly energy efficient in terms of energy demand. Different types of innovative insulation are tested in the competition before they become widely used on the market. Some use environmental friendly materials, other use vacuum panels, etc. Also the airtightness of the building has to be optimized.

Solar protection devices need to be integrated to prevent the excess of gains from solar radiation on the building envelope in summer. The higher the sun shading is, the lower the cooling load will be. On the other hand, in winter, gains can be exploited to reduce the heating load. Some teams designed a building with an appropriate geometry, or used a well-designed control system based on outside conditions. Glazing selection and building orientation is important.

Next, **thermal energy storage (TES)** can improve the efficiency of the building by reducing the demand peaks of the house. TES serves as a unit to store the thermal energy that is produced in the most optimal moment in terms of costs and environmental conditions. This can be done passively by the buildings mass. As we are talking about lightweight constructions, most teams include phase change materials (PCM) to give some inertia to those buildings. PCM will be used in the Mobble, therefore a more detailed explanation follows.

Solar energy use is encouraged in the competition because it's an inexhaustible, but discontinuous renewable energy source. SDE teams make extensive use of solar/PV energy, ranging from flexible panels to concentration systems that enable generation of electricity and DHW. Some teams also used solar energy directly to heat up the DHW or water for space heating.

Finally there is a large variety of **passive heating and cooling systems** used by the different teams. Evaporative cooling by water or air reduces the air temperature. Sensible heat from the air is changed into latent heat when water evaporates. Also other systems like solar chimneys are used to reduce the thermal charge. A solar chimney is a passive solar heating and cooling system that improves the natural ventilation of buildings by convection. Air is heated in a vertical shaft by solar radiation. The resulting updraft draws warm air from the building to rise through the shaft, due to the temperature gradient. By installing an underground pipe to draw cooler air into the base of the building a cooling effect is created (see figure 5.2).

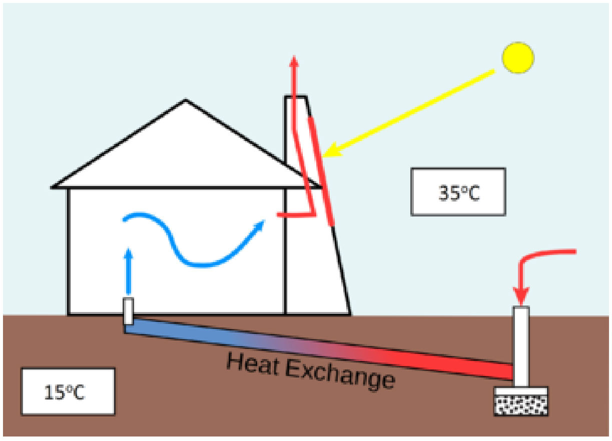


Figure 5.2: Solar Chimney principle [18]

To conclude: the comfortable indoor climate in the building is partly achieved by passive means like the thermal mass, sun shading and passive cooling/heating systems.[1, 11]

5.2.2 Technical solutions

To obtain a comfortable atmosphere in the house, the HVAC system must be well designed. Some energy efficient SD strategies are studied in more detail. This way, ideas can grow for the installation of the Mobble.

In the **North house** (SDE2009) solar energy is used for both, hot water and space heating system. PVT panels are combined with 2 variable capacity heat pumps and a three-tank system. Figure 5.3 shows the design of the HVAC system, which is a solar assisted heat pump system. A solar thermal storage tank is directly connected to evacuated tube collectors. A second space

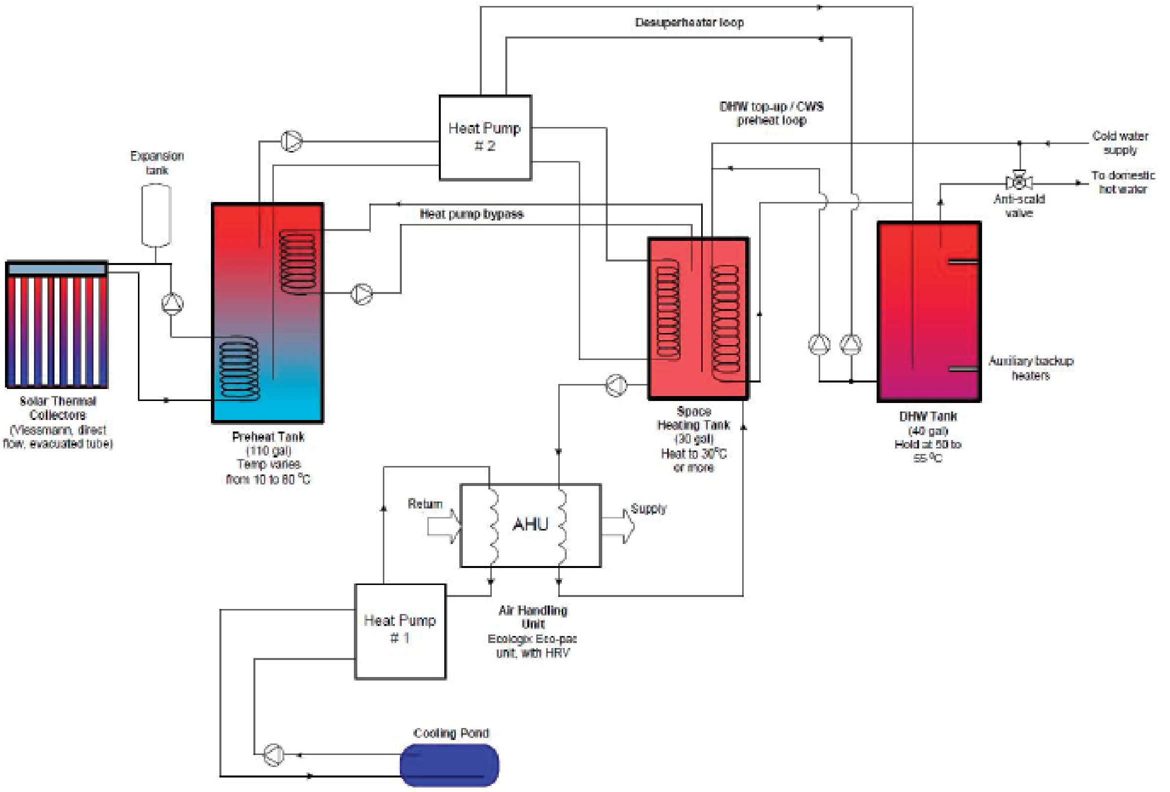


Figure 5.3: Schematic of HVAC system the North house [19]

heating (SH) tank provides heat to the fan coils of the hydronic forced air-heating system. The third DHW tank is provided with back-up electrical heaters. The solar tank and SH tank are connected with a heat pump if solar energy isn't sufficient to maintain the desired temperature, otherwise a bypass is used. A desuperheater loop is integrated such that the solar tank also delivers energy to the DHW tank. For cooling and dehumidifying the air in the AHU, a refrigerator is used, which dissipates its energy to the environment.[19]

The HVAC system in the **SML house** is a water-water heat pump based system with PCM thermal storage for heat and cold accumulation (see figure 5.4). The hot tank is operated as a heat sink for the heat pump, such that it can exchange heat at constant temperature and so granting never to reduce COP from minimum. A cold tank is used if the outside temperature is low at night while expecting a cooling demand the next day. In these circumstances the PCM tank is cooled with high Coefficient Of Performance (COP) at night and is later used to cool the building. The cold tank also delivers a more steady performance of the heat pump, because when indoor set temperature is reached while cooling, the tank can be cooled. A floor radiator is used as emission system. Ventilation is CO_2-demand based and uses heat recovery.[20]

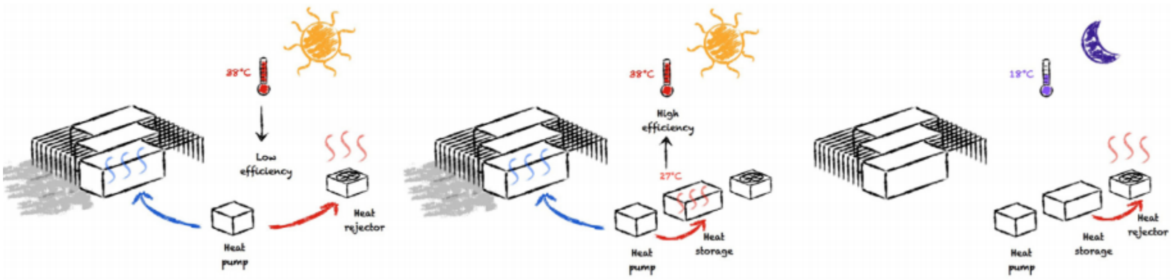


Figure 5.4: Schematic of heat storage tank for dissipation [20]

In the **Home+ design**, mechanical ventilation (AHU) with heat recovery and indirect passive cooling systems is used to reduce heat losses and provide additional cooling. During summer nights, a radiative cooling system on the roof (PVT-collectors) first regenerates the PCM ceiling and then takes up as much heat as possible, rejected from the heat pump, by cooling down the heat sink tank. If possible this cold water from the heat sink is directly used during day to activate the radiant floor, 'free cooling'. If not, the reversible heat pump removes heat from the radiant floor. In winter on sunny days, the PVT collectors feed the heat sink tank to enhance the efficiency of the heat pump. The vacuum tubes provide DHW and when low irradiance is available they supply solar heat into the heat sink tank to avoid freezing. The hydraulic scheme is added in figure 5.5. Thanks to the good passive design of the building and the new technologies a small energy consumption is achieved.[21]

For the SDE2012, Denmark designed a water based HVAC system consisting of: ground coupled heat pump, DHW tank and PVT panels on the roof for their building **Fold**. Solar energy is used for DHW heating. The radiant floor provides heating, while the ceiling is used for cooling purposes. 'Free cooling' uses the temperature of the ground to cool the house or the PVT panels. This last strategy is only possible when no space cooling is needed. The ground coupled heat pump provides the necessary supply temperature during heating season. Furthermore mechanical ventilation is applied. The AHU uses two heat recovery mechanisms: cross flow (passive) and reversible heat pump coupled with DHW tank (active).[22]

There are also teams who focus on architectural innovations for less heating/cooling load through-

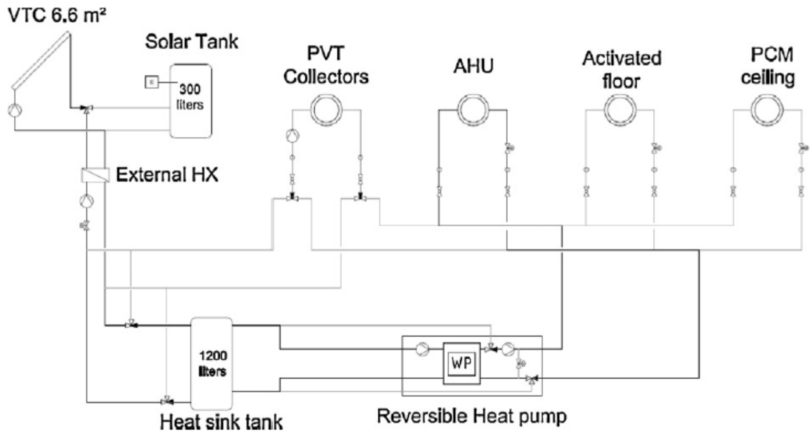


Figure 5.5: schematic of HVAC system home+ [21]

out the year. For the HVAC system they choose energy efficient installations that are more common in the building sector.

For example the **Lumenhaus**, the winner of SDE 2010, used a radiant floor for comfort considerations and combined this with ground source heat pump for heating and cooling.

Also well controlled AHU's for heating, cooling and ventilation are frequently used, because they require low heating and cooling power, as the heat recovery can be very high. This is often combined with a certain type of heat pump that conditions the air or feeds an extra emission system. (**The H.O.U.S.E., Armadillo Box**)

The figure below shows a compact unit that provides hot water, heating, cooling and ventilation, with all control included. (**Napevomo, team Wuppertal**)

The last system described, was previously used in the **Solarkit** design from the University of Sevilla. The primary task of the solar energy is to cover the demand for domestic hot water. When solar panels overproduce in winter, the excess can be used for space heating. If not enough energy is produced, the air-water heat pump is activated to fulfil the DHW demand. Cooling is provided by the heat pump. For ventilation a heat recovery system is used.

This system can also be combined with PCM in the ventilation ducts in order to reduce cooling loads and buffer temperature peaks. (**Bamboo house**)[1]

5.3 Design energy efficient HVAC system

5.3.1 Insulation, compactness and air-tightness

Energy performance regulations become stricter and the necessary insulation is likely to increase significantly. Therefore, attention is being paid to the performance of the building envelope, both in new construction as in the renovation.

The wooden structure of the Mobble offers a number of advantages in terms of energy performance. The pavilion is a building with a surface area of 72 m^2, consisting of two main zones: the living area and the bedroom. The exterior layer of the pavilion is constructed using sandwich panels and envelopes three out of four sides. The panels are made out of several layers plywood, insulated with mineral wool. Since plywood is a relatively weak thermal conductor (λ=0,13 W/mK) and the space between the upright panels is completely filled with the insulating material, this construction technique is ideally suited for the construction of high-quality thermally insulated buildings with low wall thickness. The exact values for the heat transfer coefficient of the different structures used in the Mobble are listed in table 5.1.

Furthermore the air-tightness between the Mobbles must be insured, because the flow of fresh air entering a building through leaks and cracks in the building envelope is uncontrollable and varies greatly according to the weather conditions. Poor air-tightness has unpleasant consequences: increased energy consumption, unpleasant air currents (thermal discomfort), condensation on the inside of the walls, a poorly functioning ventilation system and acoustic discomfort. Therefore swelling bands are placed onto the rigid structural frames. This way the energy demands diminish and become controllable.

5.3.2 Thermal inertia

Besides the U-value (thermal transmittance) of the envelope, thermal mass should also be considered. Thermal mass of a building enables to absorb, store and progressively release energy depending on the temperature difference with the immediate surroundings, providing "inertia" against temperature fluctuations.

The amount of energy stored depends on the density (ρ) and specific heat capacity (c) of the material, while the rate of exchange is influenced by the thermal conductivity (λ) of the material. A high thermal mass within the building envelope, will display a reduced and delayed reaction to an initial excitation or internal gain. This transient behaviour is called the thermal inertia of a building.[23, 24, 25] As shown in figure 5.6 next to the uncontrollable thermal mass also a controllable thermal energy storage can include thermal inertia in a building system, by the use of a buffer volume, electrical, thermochemical or mechanical storage.

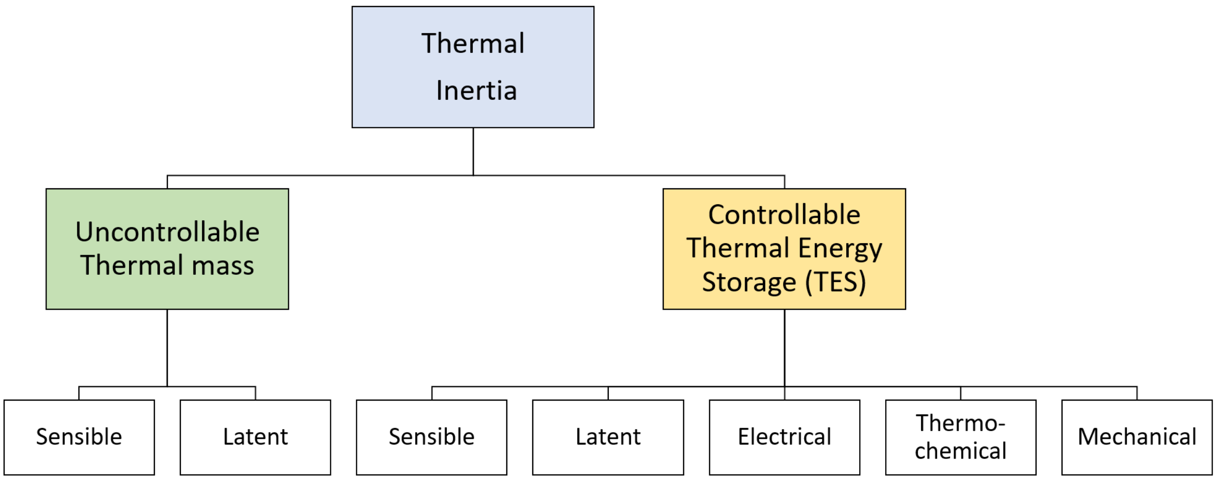


Figure 5.6: Different methods to incorporate thermal inertia in a building system

Despite the importance of thermal inertia it remains an underdeveloped field of research. The effect is more substantial than the effects of thermal resistance, and depends on a wider range of factors. A fully dynamic thermal analysis, including geometrical properties, user patterns and temperature distribution, must be done in order to retrieve detailed information about the exact contribution of building thermal inertia. The subject has been studied widely by different authors, but as a consequence of the wide range in research methods and parameters, the research outcomes differ greatly.[26]

As a general tendency it can be concluded that additional thermal inertia can have significant positive impact on the thermodynamic behaviour of a building. Firstly, it increases the building thermal comfort by giving more stable indoor temperatures by slowing down the dynamical fast change of the indoor temperature.

Secondly, the power needs may be shifted to off peak periods. Many of the renewable energy sources do not provide a stable output of electrical power, by time-shifting the energy demand, it can be aligned to the available renewable energy. Peak shaving is one of the effective ways to reduce distribution losses, by shaving the peak load and filling the load valley. Both phenomenons are shown in figure 5.7.

Thirdly, the amount of thermal inertia can lower total cooling and heating energy needs, however this characteristic must be nuanced. A lot of authors state that no substantial energy savings are offered by uncontrollable (standard) high thermal inertia. However, it is possible to combine the advantage of thermal mass without the drawbacks (slow reaction time) by storing the energy in a separate device and releasing it when needed. With a proper control strategy, additional thermal inertia will reduce the energy demand and peak loads when combined with passive solar heating or night ventilation strategies.[23, 24, 27, 28, 29]

Uncontrollable thermal mass

The classical approach to obtain thermal inertia in a building is by the integration of 'passive', uncontrollable thermal mass in the structure. Sensible heat storage can be applied but lately also phase change materials (PCM) are studied as materials for buildings of the future, leading to greater heat storage capacity per unit. In figure 5.8 different building materials are distinguished with their volumetric heat capacity, giving an indication of their thermal mass by sensible heat storage. For the paraffine, higher values can be obtained in the phase change range, thanks to the latent heat storage. Nevertheless the whole pavilion structure is build out of plywood, which results in a light weighted construction. In the Mobble low thermal mass allows a very

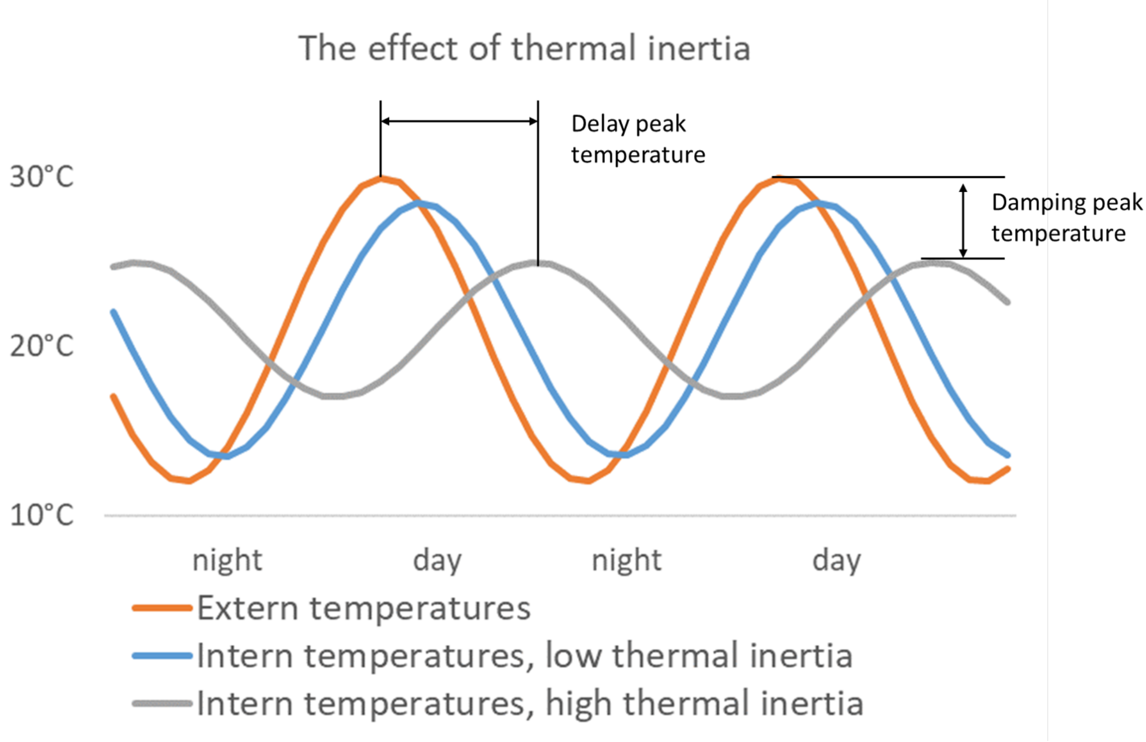


Figure 5.7: The effect of thermal inertia

fast reacting building, which is ideal to assent the instant demand from the user. Research also pointed out that in buildings with intermittent use, thermal inertia could be detrimental. It takes more time to reach the desired indoor temperature, which results in an increased energy consumption. Also from a life cycle analysis point of view, the benefits of thermally heavy buildings in terms of energy consumption are not better than thermally light buildings. For example the production of concrete is more energy intensive than wood.[27, 30, 31]

However due to the low thermal mass of the pavilion, oversized systems are necessary to totally cover the peak loads, thereby negatively influencing the energy level of the dwelling. Also thermal instability e.g. overheating can occur as the dynamic properties of the wall do not achieve adequate damping for high solar and internal gains. During the competition comfortable indoor climate should be provided and temperature fluctuations prevented. A narrow temperature range is given by 23-25 ℃, therefore the building must be able to buffer sudden fluctuations. Otherwise on-off behaviour of the heat pump could arise, which is negative for the lifetime of components and for the energy efficiency. Therefore an active, controllable thermal energy storage (TES) must be provided in order to buffer temperature fluctuations.

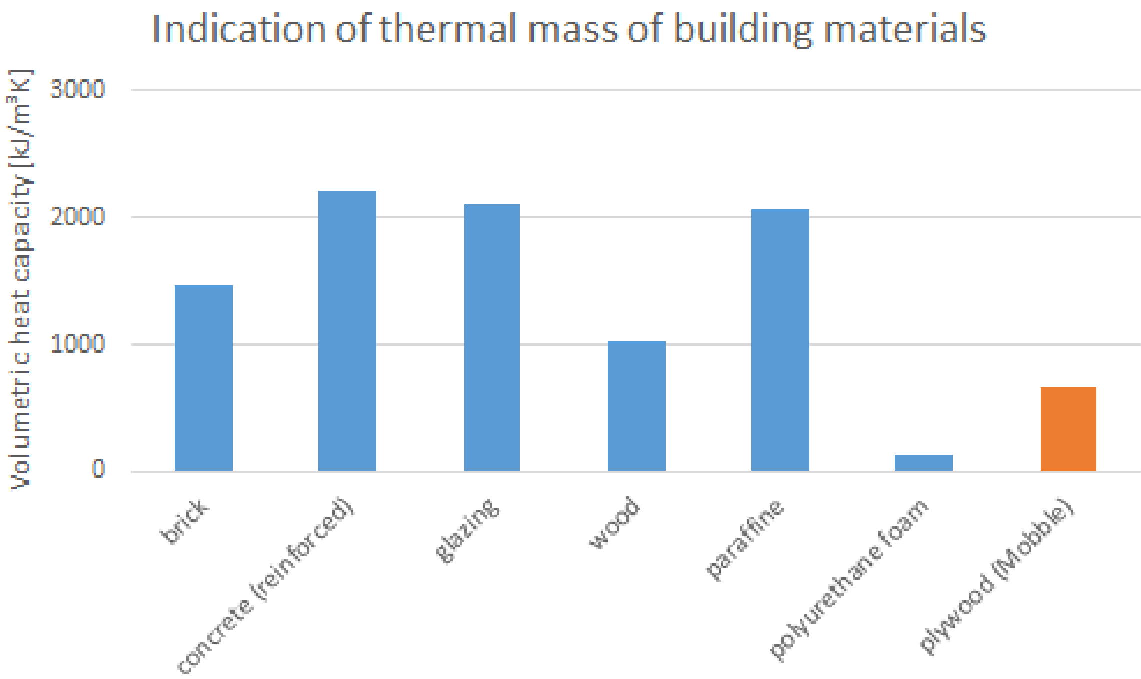


Figure 5.8: Indication of thermal mass of building materials

Controllable thermal energy storage

Active thermal energy storage systems provide a high degree of control and improve the way of storing and using available energy. They can overcome the lack of coincidence between energy supply and its demand by peak shaving (figure 5.9). It is the most cost effective method for demand side management and can lead to energy reductions by making the mechanical equipment run at higher efficiency. Overdimensioning of the system can be avoided by the use of thermal energy storage, as shown in figure 5.9. The advantage of activated thermal energy storage over the implementation of passive thermal mass in building is that it results in a fast response of the building.
There are different energy storage mechanisms: sensible heat storage, latent heat storage, electrical storage, thermochemical heat storage and mechanical storage, presented in figure 5.10. These were examined in order to look for a sustainable HVAC system for the Mobble. [23, 27, 32, 33]

<u>Sensible thermal energy storage</u> apply a temperature gradient to a medium in order to store

heat. The storage medium, solid or liquid, does not change its phase (see figure 5.11). The amount of energy stored is proportional to the temperature change of the material and is shown as:

$$E = m \int_{T_1}^{T_2} c_p dT \tag{5.1}$$

with m the mass of the storage material, c_p the specific heat, T_1 and T_2 the temperature limits between which the storage system works. Water is the most common available medium to store sensible heat, especially for low-temperature applications, because it is cheap, easily available and stable. But several materials with proper thermophysical properties, like ceramics, oils, and polymers are suitable candidates, like shown in figure 5.12. The selection is dominated by the temperature level by which heat is to be stored. The materials used for sensible energy storage have excellent thermal conductivity and are not toxic. The main drawback of sensible heat is the high volume requirement depending on the desired amount of heat to be stored. But also the incompetence to deliver energy at constant temperature is unfavourable.

In the case of latent heat storage the energy storage density increases and hence the volume is reduced. The materials, so called phase change materials (PCM), used are capable to release or store a significant quantity of energy while undergoing a phase change (see figure 5.11). The amount of energy stored is expressed as follows:

$$E = m \cdot (L) \tag{5.2}$$

where m is the mass and L the latent heat of the storage material. In the above case the storage is expected to work in an isothermal way, while storing or releasing energy at close proximity to the melting point. If the system works within a range T_1 and T_2, the energy stored is part sensible heat and part latent heat, given by:

$$E = m \int_{T_1}^{T_m} c_{ps} dT + m \cdot (L) + m \int_{T_m}^{T_2} c_{pl} dT \tag{5.3}$$

with T_m representing the melting temperature and c_{ps} and c_{pl} specific heat of solid and liquid. The energy storage during phase change gives higher energy values than the specific heat capacity during sensible heating of a given material. Different groups of PCM exist depending on the material nature (paraffin, fatty acids, salt hydrates, etc.). There is a wide range of thermal properties of PCM's with eutectic temperatures ranging from 100 to 897 ℃, and latent heat ranging from 100 to 560 kJ/kg, where the selection must be made based on the application requirements. Mostly, for technical reasons, the solid-to-liquid phase change is used. The main disadvantage is the low thermal conductivity of PCM. Therefore the heat transport Q=f(A, ΔT,$\dot{m}$) must be enhanced. Furthermore firesafety and toxity must be regarded while designing.

In times where renewables are involved with their inherent intermittency, storage is essential. Electrical energy storage can be implemented on large scale using technologies such as pumped hydro, compressed air and megawatt-hours batteries. But this leads to distribution level constraints. Therefore battery storage systems for residential electricity peak demand saving can provide a solution. This strategy is implemented in The Mobble in order to adjust the house to the network load and to reduce power peaks. However the capacity of batteries is finite. The maximal allowed electrical storage capacity of 6 kWh will be installed by use of the Varta Pulse 6. Solar energy will be the major energy source, producing electricity, during the competition. As such heat is first converted into electricity, then stored and finally converted back into thermal energy. Every conversion from thermal to electrical energy brings some losses, therefore electrical storage for the heating HVAC system will be avoided. [34]

In thermochemical storage (figure 5.11), heat is exchanged by reversible endothermic/exothermic chemical reaction processes. During the charging, reactant A dissociates into B and C at the expense of thermal energy. During heat release process, the products B and C are mixed again, whereby heat energy is liberated.

$$\begin{gathered} A + \Delta H_r \Leftrightarrow B + C \\ Q = n_A \cdot \Delta H_r \end{gathered} \tag{5.4}$$

Thermochemical materials (TCM) have a high energy density and lack heat gains or losses during the storage period, which makes them attractive for seasonal energy storage. During summer, solar energy can be stored for winter heating applications. The drawbacks of TCM's are poor durability, corrosion and chemical instability, limiting its application. Ammonia-based thermochemical storage offers opportunities for the future, because the reaction runs at temperatures favorable to solar collectors and is easy controllable. However, the use of H_2 is forbidden by the SDE organisation.

$$NH_3 + \Delta H_r \Leftrightarrow 1/2N_2 + 3/2H_2 \tag{5.5}$$

Different types of mechanical storage are possible, a brief overview is given.

Firstly mechanical storage may be done by the use of gravitational potential energy. Changing the altitude of a mass can release or store energy via an electric driven elevating system. It is also possible to envision storage of energy in kinetic form by inertia flywheels. Flywheel energy storage works by accelerating a rotor, called the flywheel in vacuum, to a very high speed, holding energy as rotational energy. Adding energy results in an increase in the speed of the flywheel, while the wheel decelerates when energy is extracted.

Compressed air energy storage is another way to obtain mechanical energy storage. A piston is used to compress a gas with a surplus energy, this energy is stored and can be released by reversing the movement of the piston.

The last option is pumped-storage hydroelectricity, which is the largest capacity form of grid energy storage available. The storage is charged by pumping water from a lower source into a higher reservoir. When energy is needed, water is released back into the lower reservoir through a turbine, generating electricity. Hydroelectric plants work following the same principle but use natural stream flow.

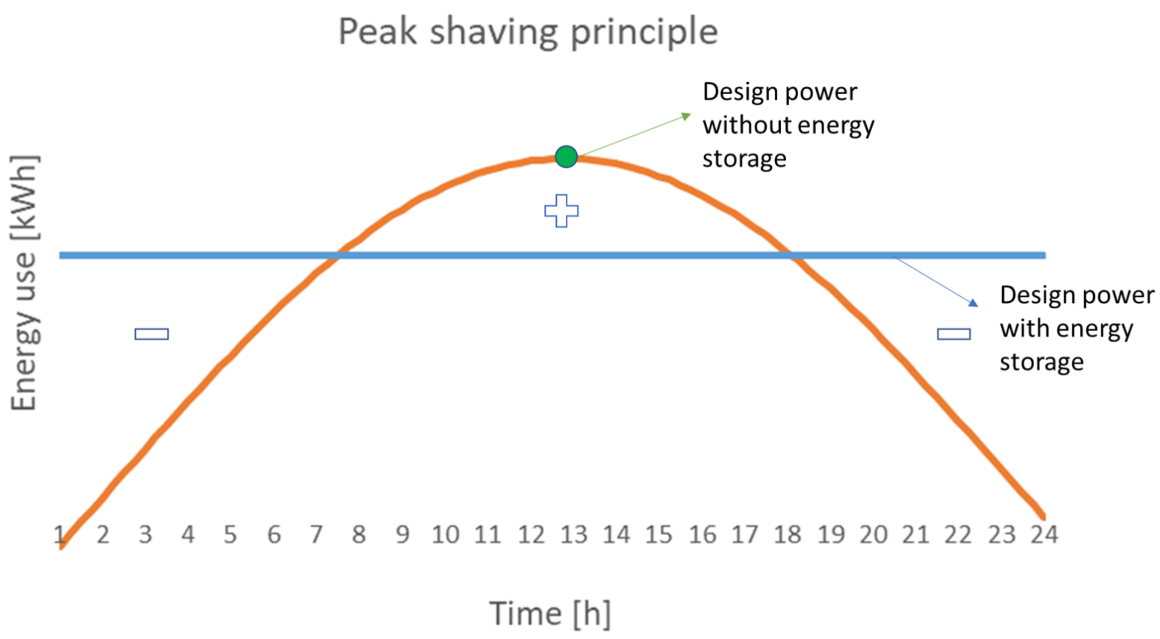


Figure 5.9: Peak shaving principle, thereby making maximal use of available energy

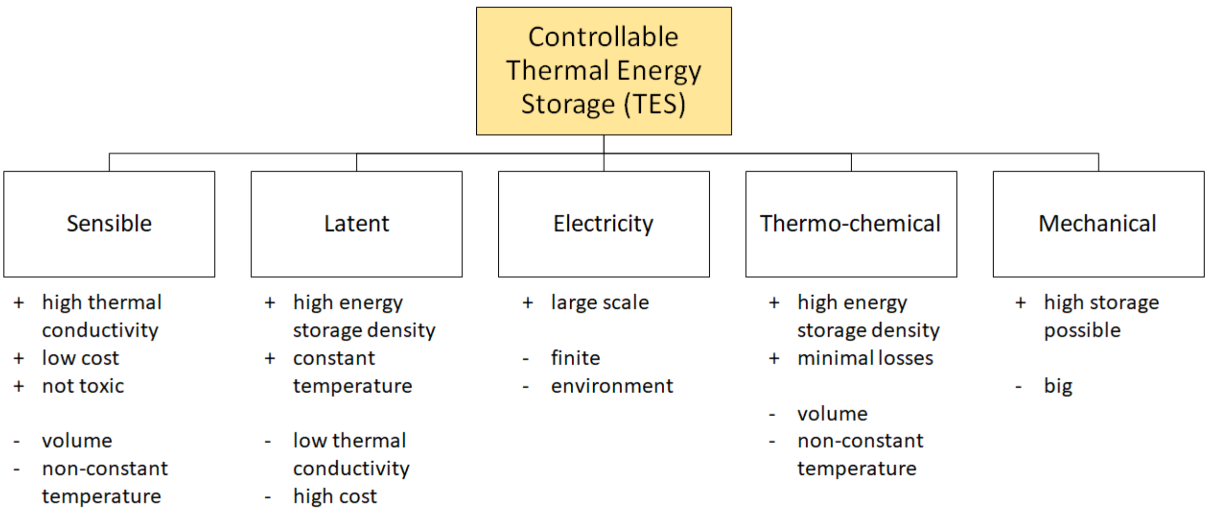


Figure 5.10: Different types of controllable thermal mass with pro's and con's

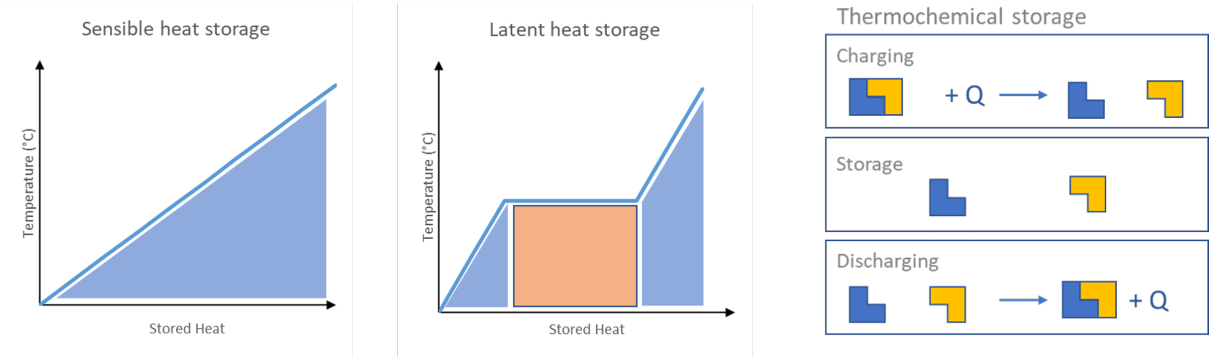


Figure 5.11: Different TES methods

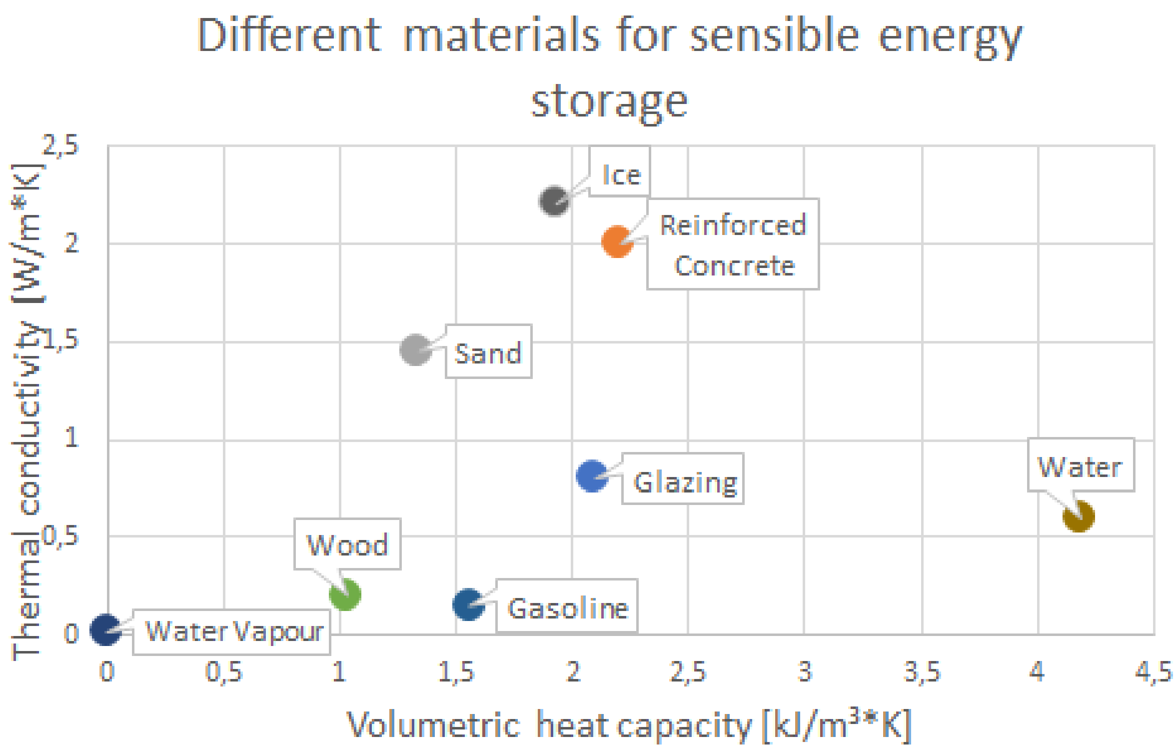


Figure 5.12: Different materials for sensible energy storage

5.3.3 Solar energy

The global energy use shows a rising trend, therefore future energy sources should be cheap, abundant and environmentally friendly. Renewable energy is gaining much interest in recent years, starting to replace conventional energy. Renewable energy is energy obtained from naturally repetitive and persistent flows of energy occurring in the local environment, these energy flows are freely and abundantly available in nature, i.e. solar radiation, rain, ocean waves, tides, wind, rivers (hydro power) and geothermal heat. [35] Geothermal energy is widely available in Hungary. However due to the short character of the competition, this strategy cannot be implemented in the Mobble. The competition is called the “Solar” Decathlon, so the main focus is on the exploitation of solar energy. It’s a zero-carbon source and is continuously available, reducing the overall price of transportation. Solar energy coming from the Sun is an inexhaustible energy source that can be very useful in the future for the building sector. The challenge exists in finding solutions for the intermittent nature of solar energy and the fact that it cannot be supplied during night time, therefore sufficient solar energy storage must be provided.

The average amount of energy that reaches the Earth is given by the solar constant which is 1350 W/m^2. A part of solar radiation is reflected, scattered and absorbed by different atmospheric gasses, therefore the irradiance that reaches the Earth after passing through the atmosphere is reduced to approximately 1000 W/m^2. Peak solar intensity depends on sky conditions, air pollution and time of the year. The amount of power from the sun that strikes the Earth in an hour, is more than the entire world consumes in a year. The distribution of the average annual sum of global horizontal irradiation in Europe is shown in figure 5.14. If this energy is able to be converted into various energy forms, the potential is huge. Solar energy is free, but the high cost of its collection, conversion and storage still limits the exploitation in many places. The structure of this chapter is given in figure 5.13. First possible passive building design measures to exploit the sun are reviewed, followed by the general utilizations of solar energy, being thermal, electrical and chemical. In the end of this section the passive and active solar strategies installed in The Mobble are discussed. [36, 32, 37]

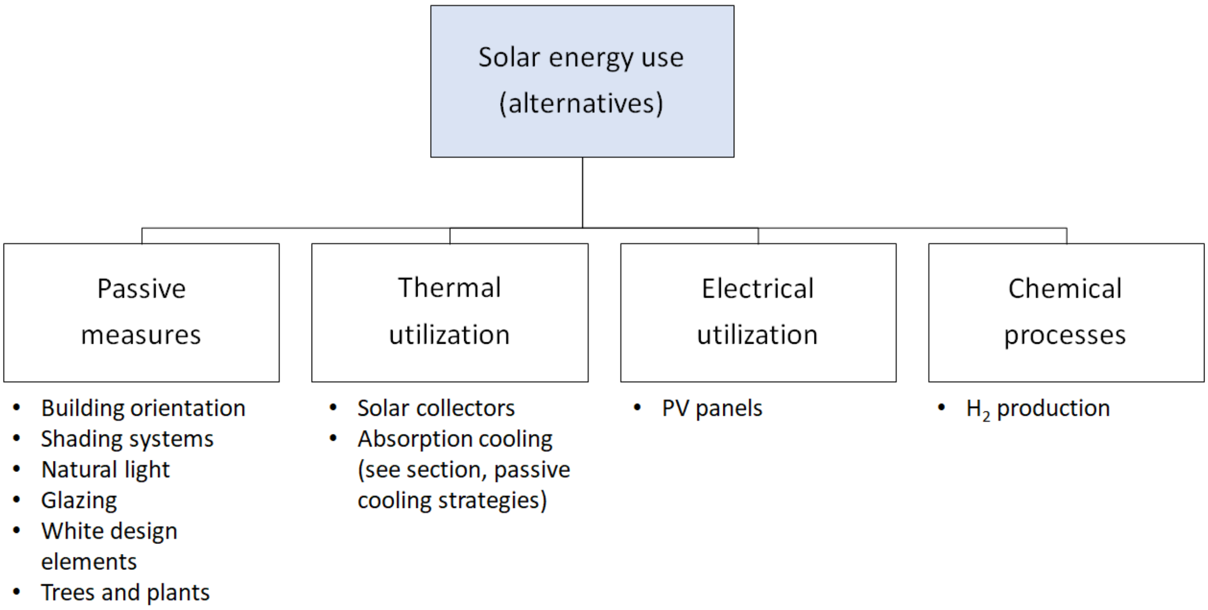


Figure 5.13: Different solar strategies

Passive building design

Integration of passive solar energy structure gives the opportunity to exploit all benefits of the sun without any extra costs. In the building design, measures are taken to make the best possible use of solar energy for passive heating and, if possible, for cooling. This can be optimized by using natural energy flows through air and materials by radiation, conduction, absorption, evaporation and natural convection by a temperature gradient.

Building orientation is one of the key aspects for solar building design. The building energy consumption can be lower or even fully compensated by the use of solar energy, which can reduce heating and cooling costs by 85%. The southern side of the building will potentially receive sunlight throughout the day, therefore most passive solar buildings will feature glass dominating the southern side. Figure 5.29 shows the solar path, where it becomes obvious that in summer the sun travels high in the sky. A proper overhang or shading system keeps the heat and energy from being absorbed into the house, and thermal mass helps to cool the building. But too much solar gains can increase the risk of overheating in summer, reducing thermal comfort. In winter, the lower sun shines through windows allowing heat energy to be absorbed into the building's thermal mass.

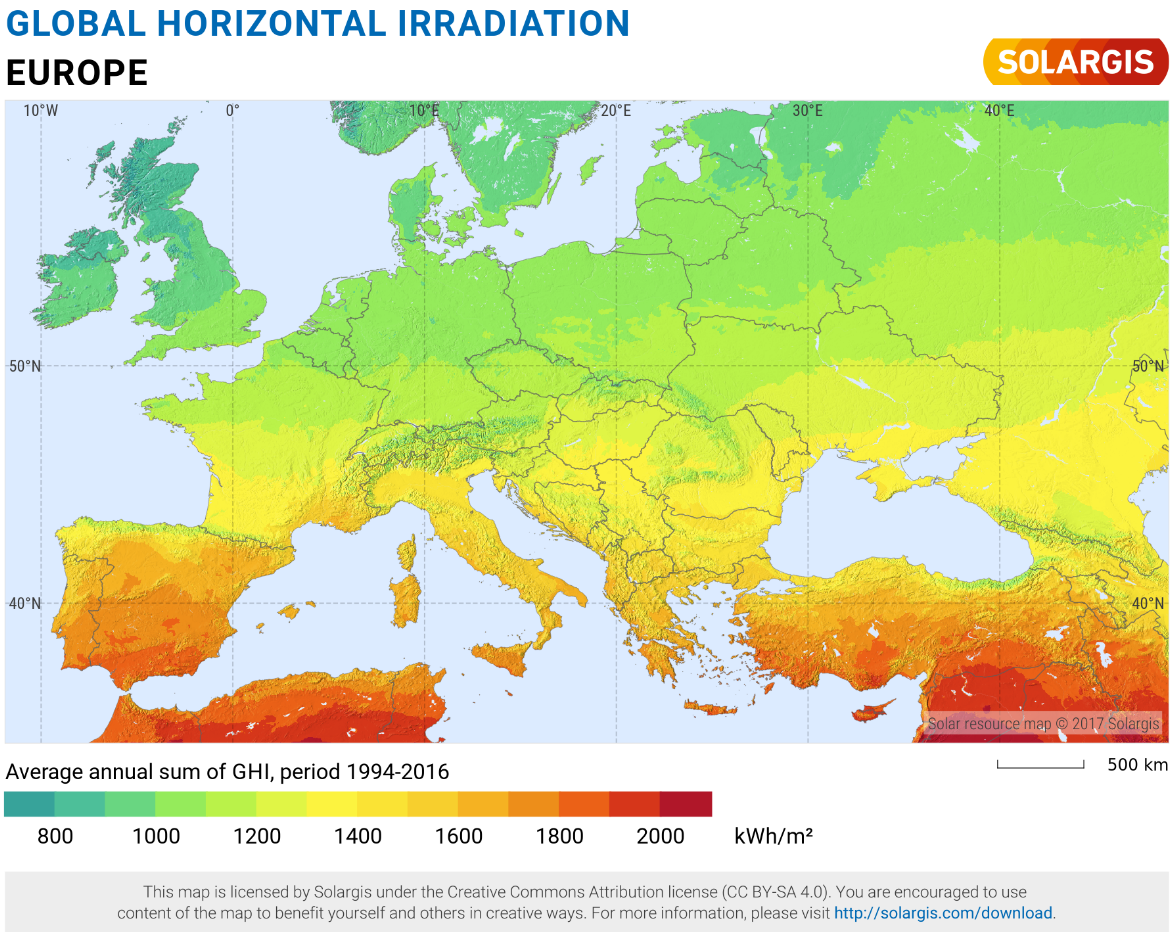


Figure 5.14: Global horizontal irradiation in Europe [38]

Southern oriented glazing is a vital component for a passive solar design. They also provide natural light to the house throughout the day, which is important for our health and well being. Thereby reducing the reliance on artificial lighting and hence saving energy.

Also the performance of the glazing is determining. While admitting high solar gains through the windows, their thin and transparent nature also allows heat to escape a building. High performance windows, double or even triple glazing, can increase the thermal resistance to thermal loss. North-facing glazing is not recommended, as it only loses heat.

White design elements can reduce overheating as it will reflect much of the sun's energy back into space, while a black roof absorbs most of the sunlight and turns it into heat. White has a very high reflection factor, so the absorption factor must be very low, and with black it is the reverse.

By a clever positioning of deciduous trees and plants they provide shade in the summer, but because of their loss of leaves they let the low sun into the house in autumn and winter.

Using the laws of physics, the solar air heater collects solar radiation and exchanges heat with the moving air to indoor living spaces, see figure 5.15. It creates a natural vacuum that allows cool air to be sucked into the lower section of the solar heater where it immediately starts to warm up. The solar air heater is recently gaining interest for the building design, and is also referred to as a thermosiphon.[36, 32, 37]

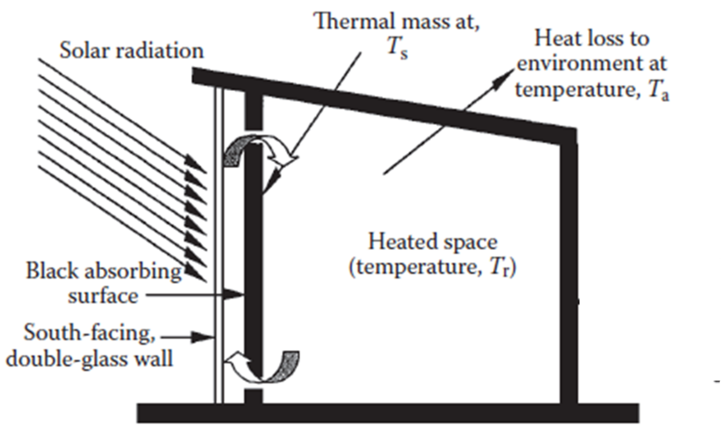


Figure 5.15: The principle of solar air heaters [36]

Thermal utilization

The basic principle of the direct thermal utilization is converting the solar radiation into thermal energy, by utilizing solar collectors. Direct thermal utilization is cost effective, simple and the most efficient way of using solar energy. Furthermore solar collectors are not angular critical. Capturing sunlight and converting it into useful energy is difficult because the intensity of solar radiation at Earth's surface is low. Therefore these collectors have a large area, but still their kW/m^2 output is high compared to electrical utilization. There are different types of solar collectors but in general, they collect and concentrate solar radiation to heat up water. Heat may be supplied at different temperature levels, depending on the application e.g. space heating or daily hot water consumption. Collectors are generally mounted on the roof, south faced in the northern hemisphere, and must be rugged as they are exposed to a variety of different weather conditions.

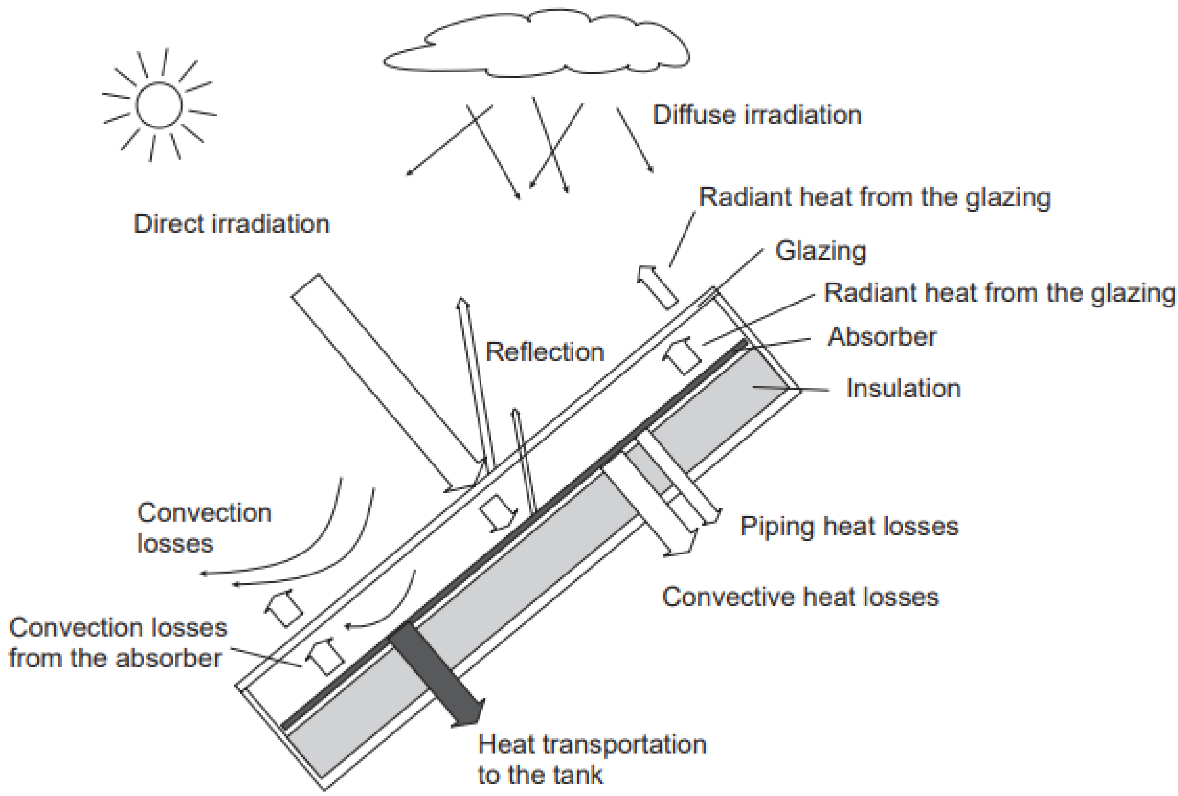


Figure 5.16: The heat transfer processes in a solar collector [39]

The thermal performance is determined by optical properties and its insulating capacity. When irradiation falls on the collector, a part is lost through optical losses, being reflection and absorption in the glazing and also reflection in the absorber. The remaining irradiation is absorbed, from where the heat is transported, mainly through conduction and convection. The principle is shown in figure 5.16. To get the remaining power per unit area, q, from the collector, the heat losses must be substracted from the absorbed irradiation. Therefore the insulation of both the collector and the piping is important. This is described by:

$$q = S - U \cdot (T_s - T_a) \tag{5.6}$$

where S is the absorbed radiation [W/m^2], T_s the temperature of the surface, T_a the temperature of the ambient air [K] and U the heattransfer coefficient [W/m^2K].

The flat-plate collector consists of a blackened metal plate absorber with insulated cover. The heat transfer liquid is circulating through copper or silicon tubes contained within the flat surface plate, while the black material absorbs the solar radiation and heats up the heat transfer fluid, thereby converting radiation heat to sensible heat. Flooded absorbers increase the surface area by having two sheets of metal and allowing the liquid to flow between them, this way boosting the efficiency. Flat-plate collectors typically operate in the lower temperature range, up to 100 ℃. The efficiency ranges from 20 to 80 percent, depending on the collector design. Flat-plate collectors are commonly used for space heating, or daily hot water. The heat may be used directly, or it may be stored for use at night or on cloudy days.

Evacuated tube collectors can operate at higher temperatures with only very small heat losses. The high efficiency is achieved through excellent insulation, created by a vacuum container, thereby reducing the convection and conduction heat loss. Evacuated tube collectors can deliver heat at very low irradiance levels and are unaffected by the air temperature.

Concentrating collectors also use solar radiation for thermal purposes, though such systems are not commercially available for residential buildings. It is a proven efficient technology for various applications with medium- and high-temperature demand in climatic regions with high direct solar irradiation potential. The high energy output of concentrating collectors is used on large scale in many power plants, from France to the Sahara. These collectors use highly reflective materials to concentrate the energy from solar radiation. An example is given in figure 5.17 where a pipe that carries water is placed in the center of a parabolic reflective material so that sunlight is focused onto the pipe. [36, 39, 32]

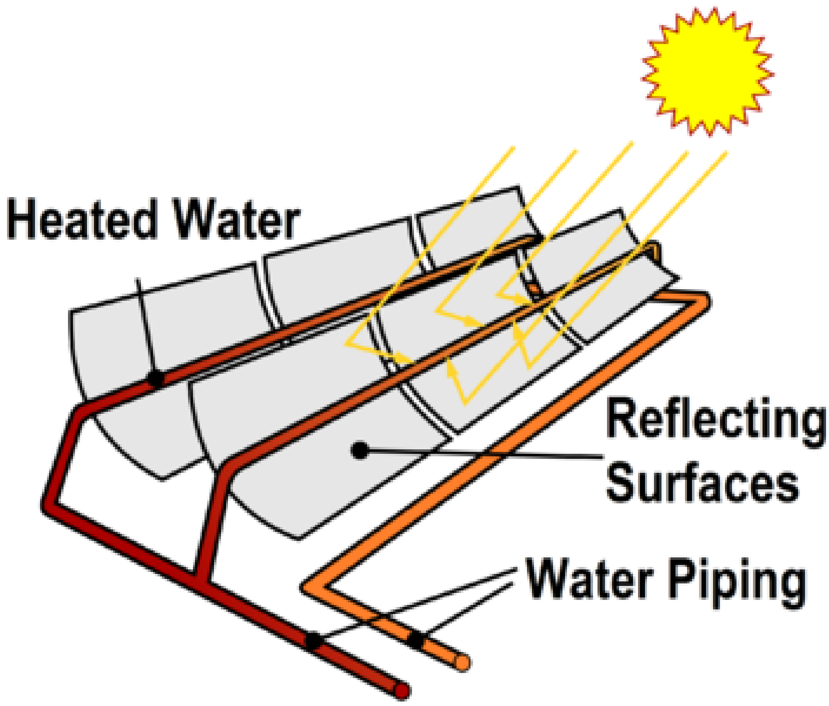


Figure 5.17: Example of a solar concentrating collector [40]

Electrical utilization

Besides heating, solar energy also can be used to produce electricity by photovoltaic (PV) cells. Different types of PV cells exist, which all use semiconductors to interact with incoming photons from the sun in order to generate an electric current. A PV cell is comprised of many layers of material, shown in figure 5.18. The layer determining the photovoltaic process is the treated semiconductor layer. It contains two distinct layers (p-type and n-type) and when the sunlight strikes the PV cell, electrons in the semiconductor material are freed from their atomic orbits and flow in a single direction. This creates direct current electricity. On both sides of the semiconductor, a conducting material is applied which collects the produced electricity. The final layer of the cell is the anti-reflection coating, placed on the illuminating side in order to reduce the reflection of solar radiation.

The power generated by a single PV cell is typically about two watts, so connecting large numbers of individual cells together, creating a PV panel, results in hundreds kW of electric power. PV panels are static making them simple in design and they require little maintenance.

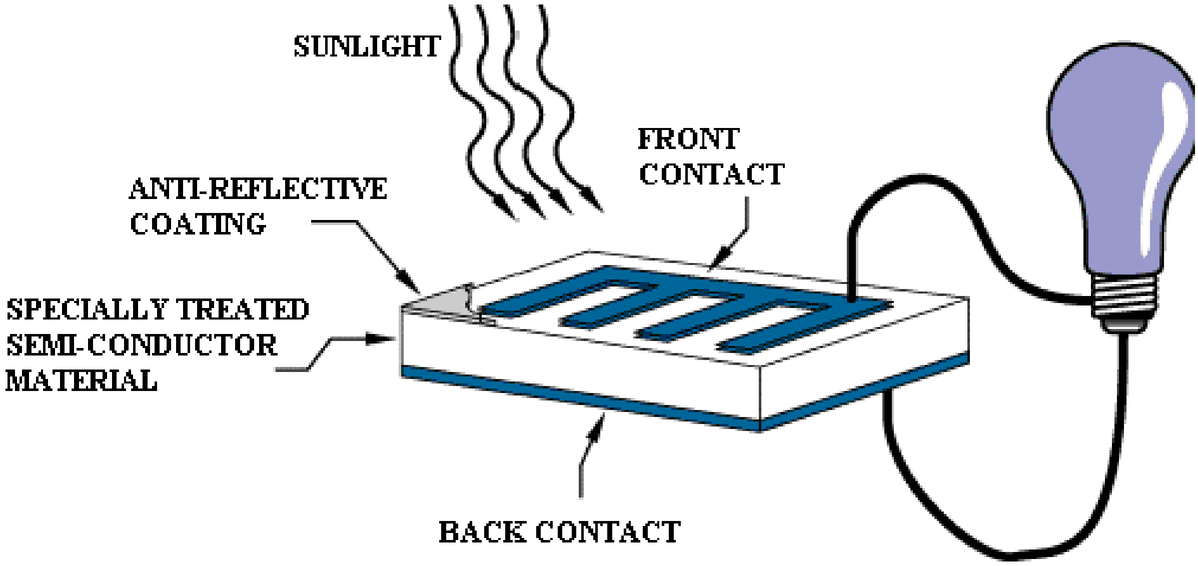


Figure 5.18: The basic photovoltaic principle [41]

[36, 32, 37]

Chemical processes

To be complete, the use of solar energy in chemical processes is mentioned. For example trees can produce their food and reduce CO_2 by converting carbon dioxide into oxygen. Mimicking the process of photosynthesis, solar energy can be used for the clean and renewable production of hydrogen as an alternative energy source. Silicon-based devices use solar energy to split water into hydrogen and oxygen, leaving no pollutants. Hydrogen can be the future energy source, having the largest energy content of any fuel. However the energy content per volume is low and the storage of H_2 is not obvious. [32]

5.3.4 Passive Cooling strategies

The rising demand for cooling is putting enormous strain on the electricity systems in many countries. Without efficiency improvements, cooling energy use could more than double between now and 2040. Obviously, the basic driver is climate, namely the temperature of the air and the humidity level. But also economic growth, income and wealth determine the increasing cooling demand. And the consumer expectations of thermal comfort are still growing. Lastly, population growth is another important cause of the rise as the most rapid grow is in regions with the hottest and most humid climates. Thanks to the newest technologies living in inhospitable climates becomes possible. [42]

There are different cooling strategies for buildings. The most basic principle is to limit the cooling requirements. Reducing the internal (lighting, appliances, human use) and external (solar gains) loads is therefore a crucial step in achieving high-quality cooling.[43] Also the use of an electrical fan can create a cooling effect. The most advanced active measure is the air conditioner, which is effective in reducing temperatures to provide thermal comfort. Most Air Conditioners (AC) are based on vapour compression refrigeration cycle technology, which is the reverse cycle of a heat pump. A fan moves warm air over a cold, low pressure coil. The liquid refrigerant in the coil absorbs heat and is converted into a gas. Afterwards a compressor is used to increase the pressure and temperature of the refrigerant. Once it has passed through the compressor, the refrigerant is at a higher pressure which allows its heat to be rejected from the chiller. The refrigerant condenses to the liquid state and the cycle, called Carnot cycle, starts over again.

The amount of energy needed to meet the cooling demand depends on the type and efficiency of the equipment, how it is used and how often. As currently most cooling strategies operate on electricity, the share of space cooling in total electricity use in buildings grew to 30%.[42] Therefore meeting the peak electricity demand is becoming the major challenge for cooling purposes. Passive cooling strategies, energy efficient design principles that takes advantage of the climate to maintain a comfortable temperature range in the home, could offer a solution (no vapour compression refrigeration cycle = no Carnot cycle). They provide the opportunity to produce produce buildings with low energy costs, reduced maintenance, and superior comfort, by exploiting free, renewable energy sources such as the sun and wind to provide cooling.

As the Mobble is operated for the competition in the summer, an innovative passive cooling strategy must be implemented. Different passive strategies, see figure 5.19, are explained below to end this chapter with the concept chosen for the pavilion, being night radiative cooling.

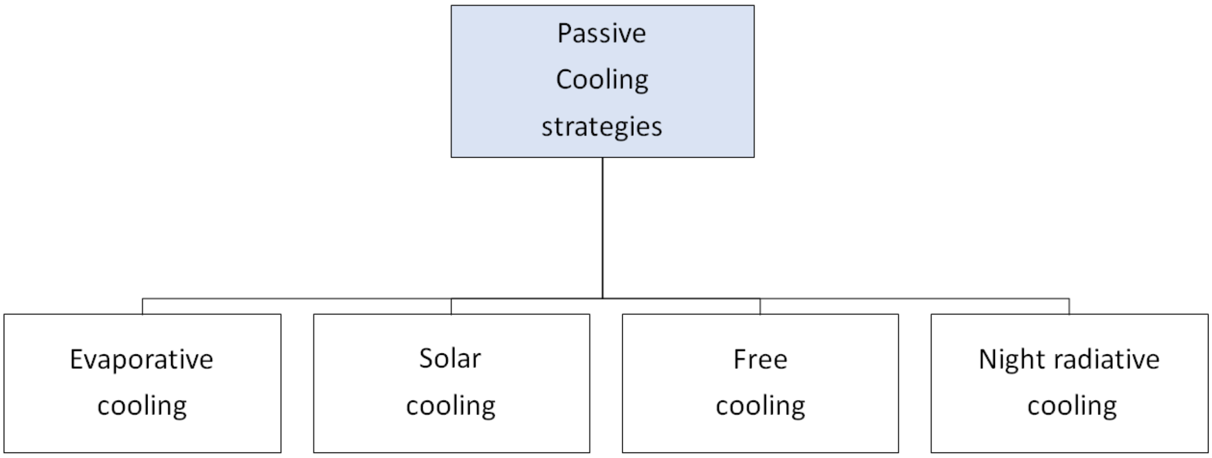


Figure 5.19: Different passive cooling strategies

Evaporative cooling

Evaporative air cooling is not done with a compressor and refrigerant. The principle is based on water evaporation, water needs heat in order to change from liquid to vapour state. So when evaporation occurs, an amount of heat (known as the latent heat of vaporization) from the air is absorbed by the water, resulting in cooled air or surroundings. This cooling strategy can be classified into direct and indirect evaporating cooling, and is also called adiabatic cooling. The difference between both is shown in figure 5.20 and explained below. It has been found that among some passive cooling systems, evaporative cooling gave the best cooling effect. However not all water can be used for evaporative cooling as for example rain water would lead to calcification.[44]

For the direct evaporative cooling process air is drawn into the unit through the moistened path and is cooled by the evaporation process. The cooling potential depends on the difference in wet and dry bulb temperatures of the air. Sensible heat of the air is transferred to the water and becomes latent heat by evaporating the water, forming water vapour. The moisture of the cooled air may be excessively increased after the process. Water evaporation only occurs when

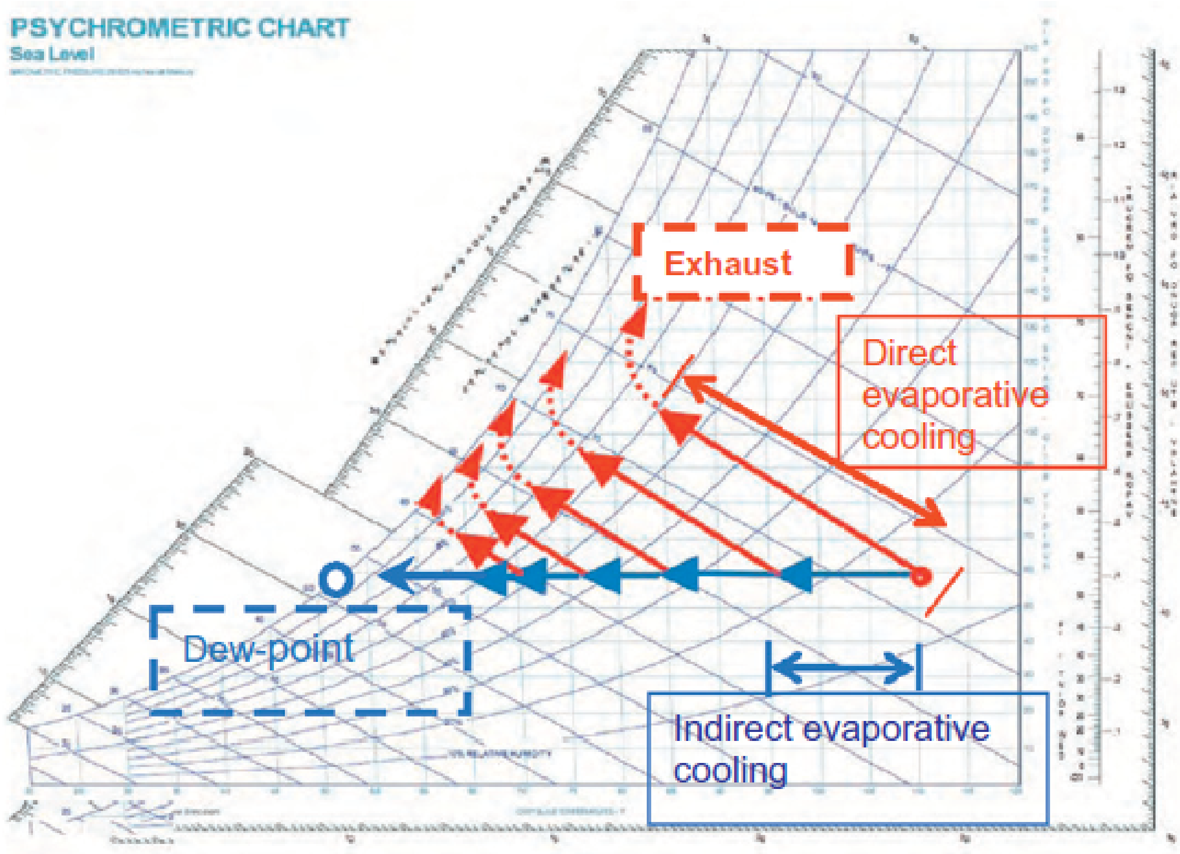


Figure 5.20: Indirect and direct evaporative cooling on psychrometric chart [45]

the humidity of the air is under 100%. As the relative humidity $\phi = p_a/p^*$ of the air increases, the performance of the system decreases, because the water holding capacity of the air declines. Therefore direct evaporative cooling is most effective and applied in climates where average relative humidity is less than 30% (very dry and hot climates). The humidity distribution over a year in Hungary is shown in figure 5.21. Consequently this cooling strategy is not useful for the hungarian climate as evaporative cooling does require a climate that is hot and dry.

An indirect evaporative cooler caries a secondary heat exchanger. Two air streams, separated by a heat exchanging wall. Water is sprayed and evaporated on cooling fins on the wet side, while the supply air passes on the dry side, involving sensible heat removal. No moisture is added to the air, making it suitable for different climates. Water can be supplied throughout the heat exchanger, thereby increasing the cooling capacity.

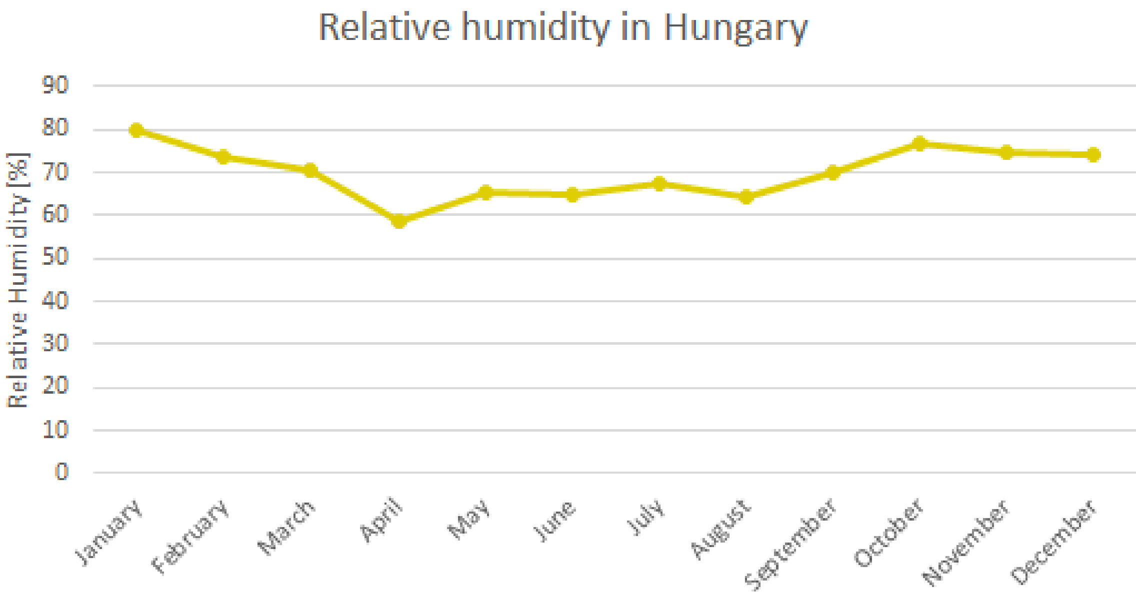


Figure 5.21: Relative humidity in Hungary

Solar cooling

Solar cooling uses the thermal energy from the sun to cool and dehumidify the space. Hereby a renewable energy source replaces the existing electrical power input required in a vapour compression refrigeration cycle. *The benefit of solar cooling is that the availability of solar radiation coincides with the cooling energy demands.* This way allowing for the greatest cooling potential during the summer months, when the demand is highest.

But the daily pattern of solar power supply does not always match the demand, with high cooling demand lasting after sunset. Thermal energy storage will be needed in these systems. Two solar cooling methods are commonly implemented, being the desiccant system and the thermally driven chiller. Of course, solar irradiation can be used to generate electricity with PV panels, thereby driving a conventional vapour compression AC system. This method however is inefficient due to the transition losses from solar heat into electricity and back to heat.[46]

Desiccant cooling uses evaporative cooling to cool the air, but first the air passes over a desiccant, thereby dehumidifying the incoming air. The desiccant (i.e. silicagel) is regenerated (water removed) using solar energy.

Absorption heat pumps use heat to cool down buildings, by combining solar thermal energy and the modern absorption process. This strategy is not purely passive, as it still uses a Carnot cycle, but is worth mentioning as it offers great perspectives for the future. Such chillers can be described as a modified version of the vapour refrigeration cycle, where the compression of the refrigerant is done by an absorption process. The energy required for the compression is heat, which is widely available by the sun.

The mechanical compressor is replaced by two substances, where one must be readily soluble in another, respectively called the refrigerant and the absorbent. The refrigerant passes through the four major components of the cooler, being the evaporator, absorber, generator and condenser. The principle is shown in figure 5.22. First the liquid refrigerant evaporates in the evaporator, thereby cooling the ambient air. Then the refrigerant is absorbed, forming a concentrated solution that is pumped to the generator. The higher temperature generator adds heat, coming from the sun, causing the refrigerant to escape from the solution as vapour. Afterwards the cycle works following the same principle as a vapour compression chiller. The vapour changes to the liquid phase by passing over the condenser, thereby releasing heat to the outside. In order to complete the cycle the liquid passes through the expansion valve to a lower pressure level, returning to the evaporator.

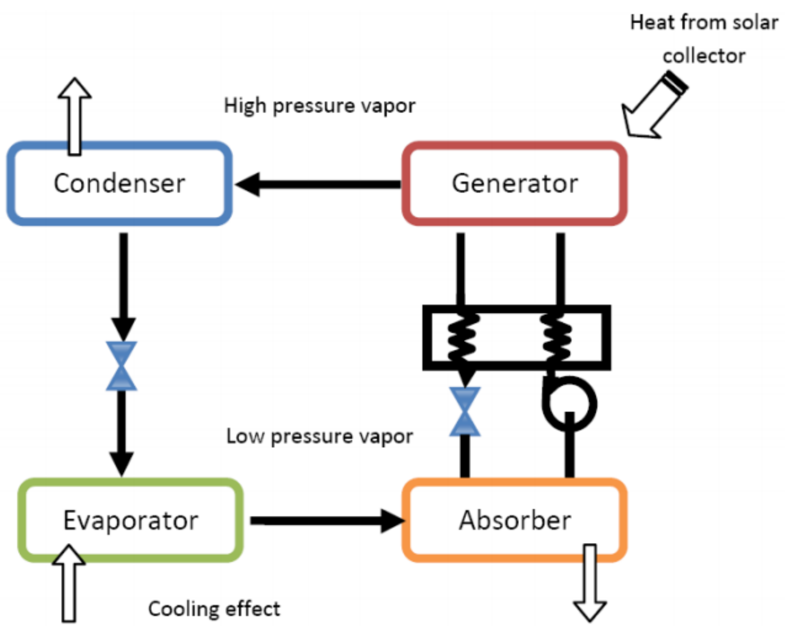


Figure 5.22: Absorption cooling [47]

Typical combinations are ammonia-water(NH_3-H_2O), where ammonia is the refrigerant, and water-lithium bromide (LiBr-H_2O), where water vapour is the refrigerant. As water can be used as refrigerant, no environmentally harmful substances are needed to produce the coldness. In the absorption compression cycle the major power consuming device is the pump, which only requires a small amount of energy. Furthermore this system is silent and maintenance costs are low thanks to the absence of the compressor. However the efficiency of the absorption chiller, which is determined by the coefficient of performance (COP), is very low compared to the vapor compression systems. For a single stage absorption chiller the COP is about 1, while that of the vapor compression is about 4 to 7. The absorption refrigeration system becomes competitive only if the ratio of the electricity to heat costs becomes more than four.[46, 48, 49, 50]

Free cooling

Free cooling is a passive cooling technology for buildings and offers significant energy savings. It can be activated when the outside air temperature is lower than the return temperature. The low external air temperatures can be used to cool down the thermal mass of the building by natural or forced ventilation. Also a source of cold water can be used for building cooling purposes such as a cooling ceiling. Basically a free cooling module extracts heat from the cooling medium, being water or air, via the ambient air. It is not entirely free, because mechanical equipment can be needed.

Furthermore a geothermal heat exchanger can provide free cooling. It allows fresh air or water to circulate through underground pipes before entering the building. This way natural cooling is obtained in summer and heating in winter.

Night radiative cooling

For space cooling most buildings use reversible heat pumps which can be seen as renewable source of energy. Still they consume a large amount of electricity, therefore night radiative cooling was studied to reduce the use of heat pumps. For the Mobble this promising cooling method was chosen as passive cooling strategy.

The technique is based on thermal radiation against night sky. Radiating panels, with a heat carrier flowing through, are placed on the roof facing the sky and cool down the fluid by convection and radiation. The surface temperature of the radiator is determined by the thermal balance between the body and its surroundings. The cooling performance can be optimized, by taking advantage of the infrared atmospheric window. The nocturnal sky is then exploited as a natural heat sink, since its effective temperature can be 20-30 ℃ below the ambient air temperature under suitable atmospheric conditions.[51]

By passive radiative cooling via the Atmospheric Window an efficient cooling strategy is achieved. A body can lose heat by emitting long-wave radiation to another body at lower temperature. Thermal radiation cools down a body when facing a colder surface. Night radiative cooling is based on this principle with the cold sky acting as a heat sink. The effective outgoing infrared radiation from a terrestrial surface (R) can be defined as the difference between the radiative power emitted by the surface ($R_{\uparrow}$) and the amount of incident atmospheric radiation, absorbed by the surface ($R_{\downarrow}$).

$$R = R_{\uparrow} - R_{\downarrow} \tag{5.7}$$

The earth atmosphere has a highly transparent window in its spectral wavelength region between 8-13 µm. Outside this window, which is called the infrared atmospheric window, the atmosphere is highly emissive. Since the window falls within the peak thermal radiation of a blackbody at the ambient temperature (300K), the atmosphere is an interesting heat sink. A terrestrial body can be cooled to below the ambient temperature, because thanks to the atmospheric window the outgoing radiative emission can exceed the absorbed incoming radiation. But also other factors determine the cooling performance, such as, the conductive and convective heat gain from the surroundings, and the incoming solar radiation. Furthermore also the emission profile of the radiator is determining. The steady state energy balance for the radiator is shown in figure 5.23 and specified as:

$$\dot{Q}_{nightcooling} = \dot{Q}_{sky} - \dot{Q}_{conv} - \dot{Q}_{cond} - \dot{Q}_{solar} \tag{5.8}$$

$$\dot{Q}_{sky} = A_s \cdot (\epsilon_s \cdot \sigma \cdot {T_s}^4 - R_{\downarrow}) \tag{5.9}$$

$\dot{Q}_{\text{sky}}$ is the total long wave radiative cooling power, being the difference between the radiative power emitted by the radiating panel (with temperature T_s and radiative power received from

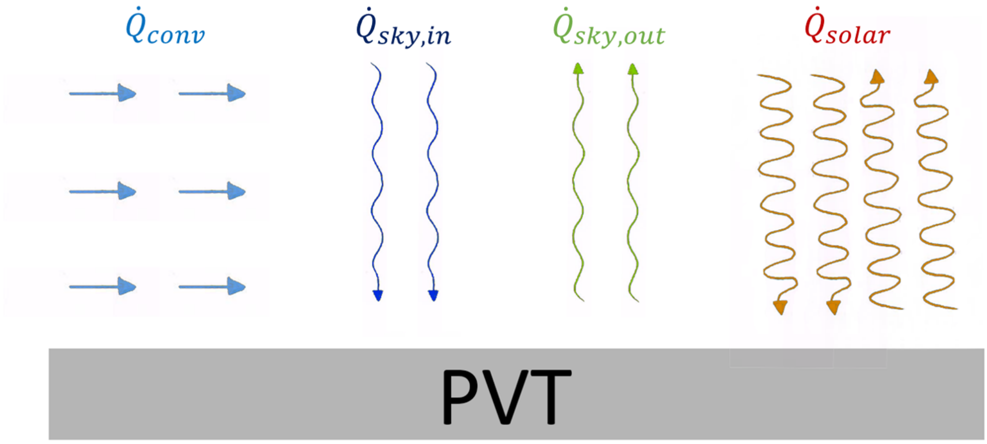


Figure 5.23: Steady state energy balance PVT panel

the atmosphere. The first factor of equation 5.9 is determined by the black body temperature and the emissivity, or via Kirchhoff's law by its absorptivity $e_s(\lambda,)$. Following the Stefan Boltzmann law, the total radiant heat energy emitted from a surface is proportional to the fourth power of its absolute temperature. This factor is dimished by the atmopheric radiative power, depending on the absorptivity of the radiator and the transmittance in the zenith direction. In equation 5.8 it is shown that the total radiative cooling power is diminished by convection and conduction (nonradiative heat gain), where the conductive heat transfer to the surroundings can be neglected. Insulation must minimize these gains, since they limit the power radiation. The last term takes the absorbed solar power $\dot{Q}_{solar}$ into account and counteracts the cooling effect of the radiator. During night radiative cooling this term is not taken into account.

It follows that cooling only occurs when the radiated output exceeds the net absorbed power. In order to maximize the cooling, and to allow the radiator temperature to drop below the ambient temperature, the radiative emission within the 8-13 µm wavelength band must be maximized, while minimizing the absorbed power coming from the atmospheric radiation, nonradiative factors and solar power.[52, 53, 54]

Selective radiators with high emissivity in the atmospheric window wavelength band and high reflection elsewhere are ideal 5.24. These properties make it possible to cool significantly below the ambient temperature and to achieve a cooling power of 100 W/m^2. No naturally occurring material has suitable selective properties, so research has been done to create new materials.

Commonly used surfaces are polymer foils on metal surfaces, silicon-based coating on metal surfaces and ceramic oxide layers. Another approach is using a selective screen, which can block the conductive heat transfer between the cold surface and the ambient, as well as reflect unwanted radiation.

Recent research on radiative cooling with the use of nanophotonic devices offered a new perspective. Peak cooling demand occurs during daytime, but daytime radiative cooling was not yet achieved because of the solar irradiation. However by using a thermal photonic approach, it is possible to use radiative cooling under direct sunlight. Photonic structures can be highly emissive within the infrared atmospheric window, while reflecting 97% of the solar radiation. The researchers introduced a photonic device consisting of seven alternating layers of HfO_2 and SiO_2, thereby achieving a temperature reduction of 5 degrees below the ambient air. This cooling potential is promising, however the practical realization is still challenging.[55, 56]

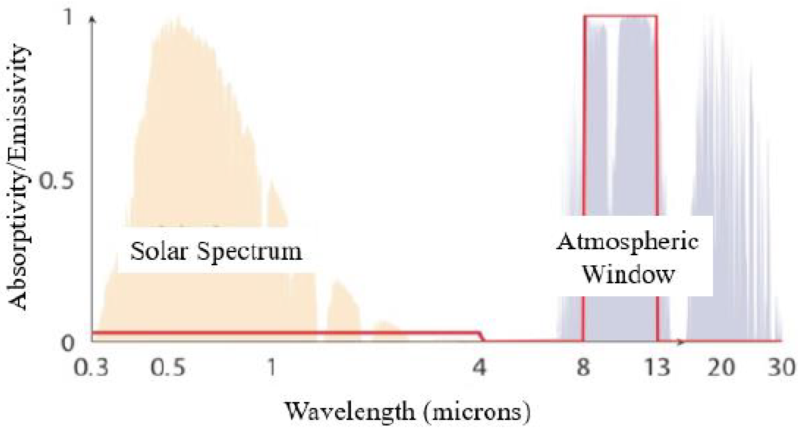


Figure 5.24: Ideal selective radiators with low absorptivity over solar spectrum and high absorptivity in the atmospheric window wavelengths [55]

The potential of this cooling technology depends also depends on other parameters, being the geographic location and the weather conditions. The transmission within the atmospheric window is mainly determined by the H_2O within the atmosphere, which can be associated with the dew point temperature of the location. In humid conditions the cooling efficiency decreases. Furthermore, for a cloudy sky, the atmosphere will be opaque for radiation, preventing effective cooling.

From research, some interesting conclusions can be taken. Water has a higher heat capacity, compared to air, so water based systems are better controllable and require a lower energy input.[57, 58] Open water systems attain a higher cooling output thanks to the high emissivity of water and the absence of an additional thermal resistance. However this system brings some difficulties due to the possibility of evaporation and pollution.[58] Lastly it is recommended to use cold storage instead of direct cooling to reach higher cooling power densities.

5.3.5 The Mobble system design approach

Thermal inertia in the Mobble: H_2O-PCM storage

Domestic hot water will be provided by a heat pump boiler connected to PVT panels. As the amount of solar energy available depends on the daytime, heat storage is useful. With the right control mechanism, a maximum energy efficiency of the heat pump boiler can be obtained. A water storage of 260 liter will be provided, thereby satisfying the Solar Decathlon rules about domestic hot water.

Also a passive HVAC system tank will be provided. For the Solar Decathlon competition the pavilion has to reach comfort conditions without the use of a heat pump during two consecutive "passive days". During Hungarian summers, a cooling problem will arise, therefore the design focused primarily on fulfilling the cooling demands. Almost no thermal mass is present in the building structure, so night ventilation or free cooling doesn't offer perspectives. A big thermal buffer is needed, which can be seen as controllable thermal mass. It brings the opportunity to diminish temperature fluctuations and to buffer peak loads. This without influencing the reaction time of the building as the storage is activated when required.

Besides the function of the thermal energy storage on the passive days of the competition, the buffer volume gives the opportunity to apply peak shaving. Figure 5.25 shows that the peak demands occur during the evening, when the grid is overloaded. By storing energy in the buffer during nighttime, it is possible to shift the peak electricity demand of the building, this way bridging the gap between energy supply and demand. It must be stated that this system can also be used in winter to store heat instead of cold.

The discussed TES methods were examined and checked if feasible for the Mobble design. Mechanical storage is a powerful storage mechanism, but not practically applicable in the Mobble. Also the use of thermochemical materials was not an option for safety reasons. As stated before an electrical battery was chosen to buffer the energy demand on network peak hours, but mainly for other applications than the HVAC system. Therefore thermal heat storage systems are applied.

The main principle applied in the Mobble in order to obtain thermal energy storage is described in this section. However a more detailed and theoretical approach of the research, design process and practical installation is given in paragraph 5.4.3.

When selecting a thermal heat storage system, it is important to find a trade off between high heat capacity and high conductivity. The load calculations, discussed in section 5.4.1, obtained the daily cooling load profile (fig 5.25) of the Mobble on a day in July. On an average summer

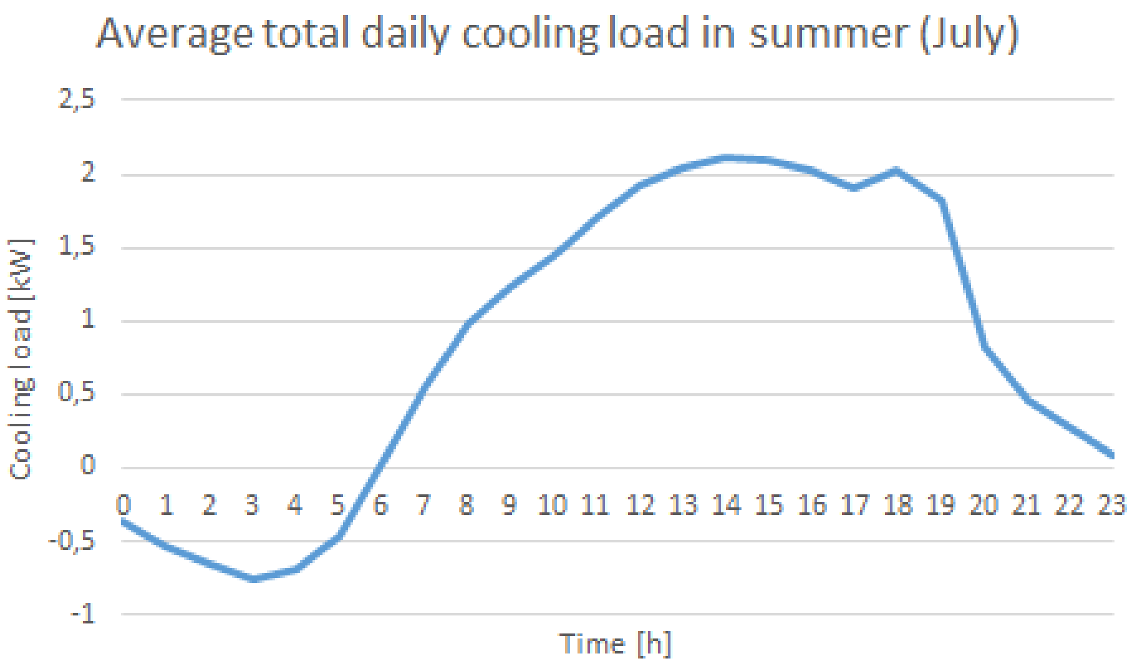


Figure 5.25: Average total daily cooling load in summer (July)

day 23,5 kWh of energy is needed to cool the building to 24 ℃, as presented in table 5.3.

The most evident and cost-effective method to store energy is by the storage of sensible heat by water. Water has a relatively high thermal capacity and conductivity, as shown in figure 5.12. But following from the cooling load data, for two consecutive days, this would result in a buffer volume of 5000 liter of water, when a power of 2 kW must be preserved by holding the water between 10 and 18 ℃. As 5000 liter is a very high volume compared to the small and compact Mobble, another approach was needed.

Latent heat storage can offer a solution thanks to the high storage density in small temperature intervals. Heat is absorbed or discharged when the storage material changes its phase as such materials used for phase change thermal energy storage must have a large latent heat. The required volume to cover the cooling load of the two passive days (T=[10-18 ℃]) is given in figure 5.26 for different sensible storage materials in comparison to the latent storage of a PCM with phase change temperature around 15 ℃. It is confirmed that the profit of PCM is mainly in the modularity and compactness of the installation, which fits perfectly within the Mobble concept.

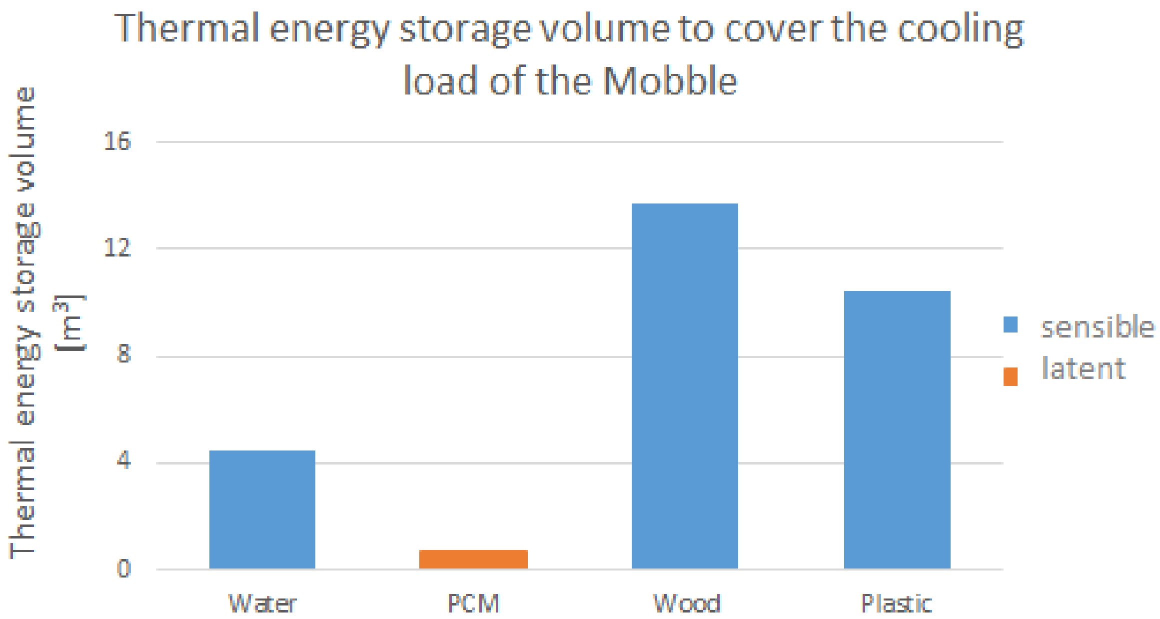


Figure 5.26: Thermal energy storage volume to cover the cooling load of the Mobble

There are a large number of PCM's with a wide range of melting temperatures. In figure 5.27 an overview is given with the classes of materials that can be used as PCM with regard to their typical melting temperature range and melting enthalpy. It becomes clear that commercial paraffin waxes are cheap and have a wide range of melting temperatures. Water can be an effective PCM as well, with a melting enthalpy of 334 kJ/kg, however its phase change temperature is around 0 ℃ so the thermal losses to the atmosphere in summer would be too high. When selecting a PCM to be used in a thermal storage system, it should have desirable thermophysical properties.[59]

- The melting temperature must match the application
- High latent heat of fusion
- High specific heat capacity c, to have additional sensible storage

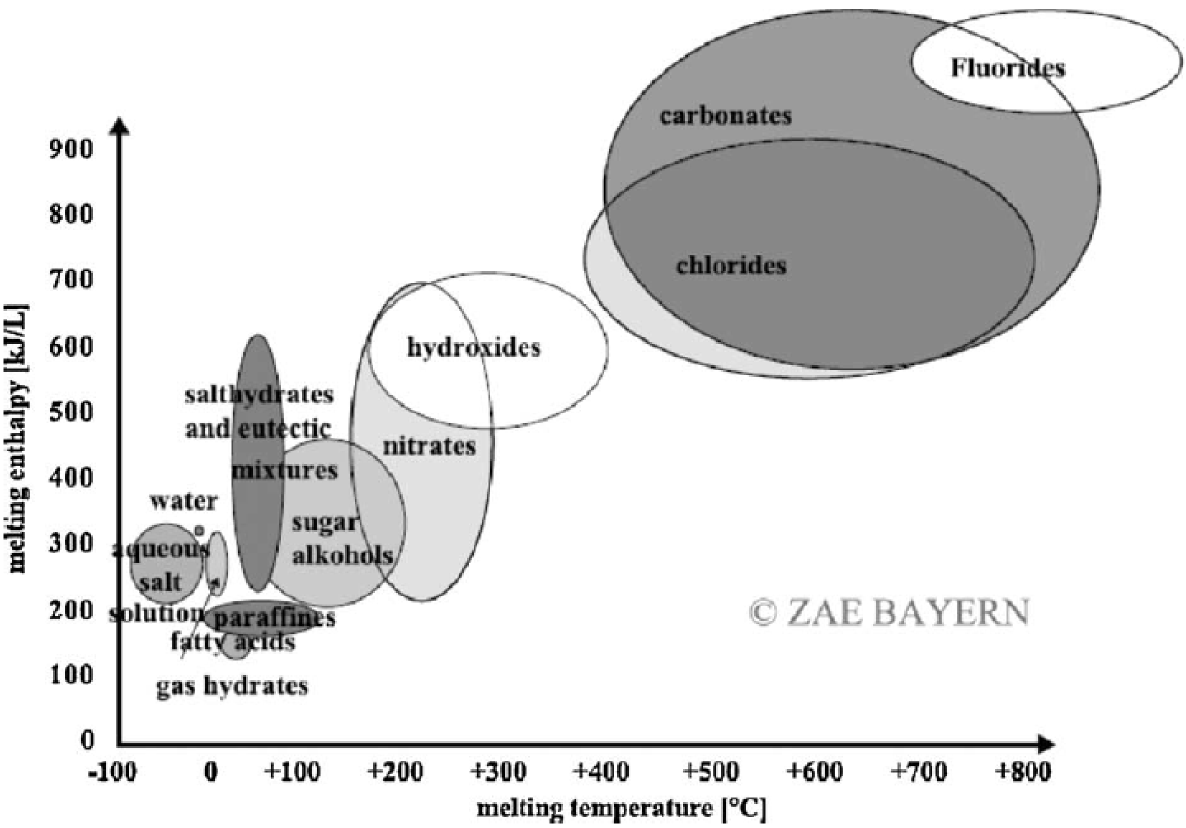


Figure 5.27: Melting enthalpy and temperature of different materials suitable for latent heat storage

- high thermal conductivity of solid and liquid phase, as it determines the charging and discharging rates
- small volume change on phase transformation

Furthermore, in the building sector the material must be non-corrosive, non-toxic and non-flammable. The Mobble is also scored on affordability, therefore the solution must be commercially available and cost effective. These prerequisites resulted in the choice for Rubitherm PCM's, being phase change materials based on paraffins and waxes. The melting enthalpy of the selected paraffin is around 180 kJ/kg, which was used in figure 5.26.

But the thermal conductivity of the storage material is important as well. This was taken into account while selecting the suitable PCM. However from calculations follows that paraffins are not able to deliver the required cooling power when used in a simple heat exchanger design configuration.

Another idea showed up, being a water tank incorporating PCM's, thereby combining the advantages of both. The PCM will increase the energy storage capacity of the water buffer, while the water guarantees a high thermal power transfer to the building. For the Mobble, this resulted in three cubic containers of water, one filled with PCM plates. Enlarging the heat transfer area between both materials is crucial for the performance of the thermal energy storage system. The design and dimensioning of this H_2O-PCM storage is described in section 5.4.3.

Solar energy use in the Mobble: PVT panels

As solar energy has a huge potential for reducing energy supply, it is exploited as much as possible in the Mobble design. The different solar strategies implemented in the Mobble are discussed in this section.

Firstly the orientation of the pavilion was chosen. This choice was based on having satisfactory natural heating in winter, but no unacceptable overheating in summer. A south-east orientation is the best regarding heating and daylight, and so the Mobble faces with its glass façade in this direction, see figure 5.28. This introduces overheating exceedance hours, but these can stay within the limits by choosing the right glazing type, with a low solar heat gain coefficient (SHGC). A double glazing, type SGG Climaplus Eclaz One, was selected with a SHGC factor of 0.53. Switchable glazing that can vary their optical or solar properties would give even better results.

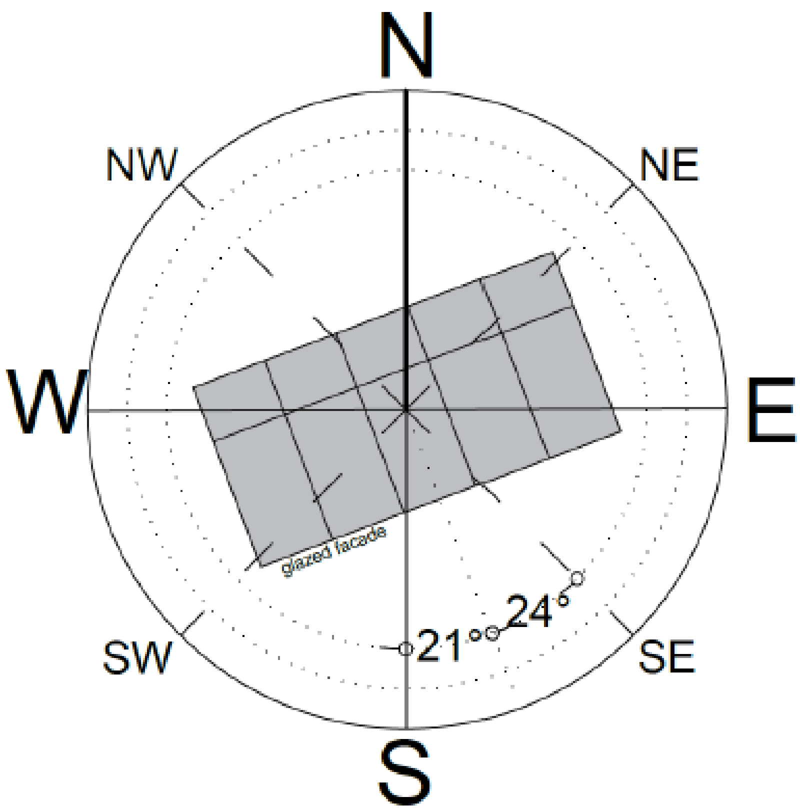


Figure 5.28: Orientation of the Mobble [15]

Furthermore the canopy of the Mobble is used as a passive method to lower the cooling load. Thanks to the high solar position in summer solar radiation will be blocked. In winter time, when the position of the sun is much lower, these solar gains can be used to lower the heating demand. The solar path in summer and winter conditions is given in figure 5.29. Also a sunscreen is integrated, reducing the SHGC to 0.08.

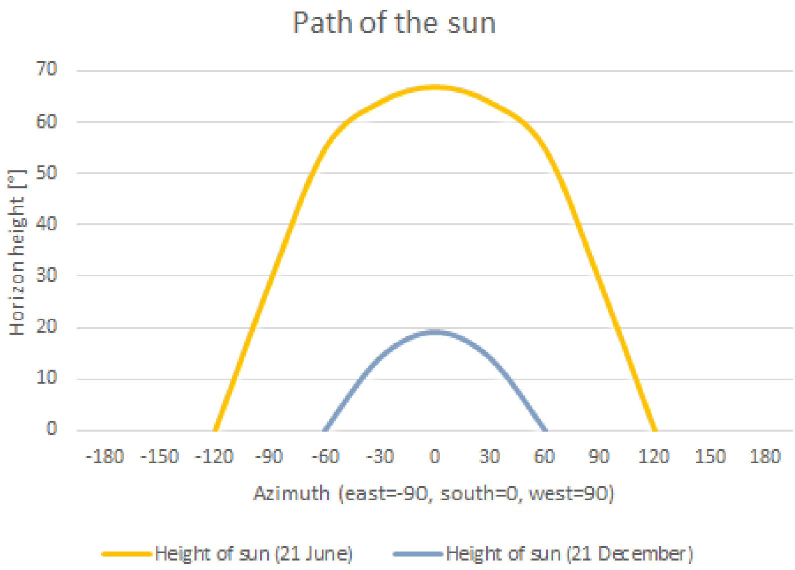


Figure 5.29: Path of the sun

For the active solar system PVT panels of Climapac were selected. These hybrid photovoltaic and thermal (PVT) panels combine the two solar use approaches, heat and electricity generation, in one panel. There are a couple of potential advantages over independent solar arrays. The first is of course the compactness in space, because in order to maintain a low investment of solar energy generation, not only the collectors must be low cost but also the energy being generated per m^2 must be maximized. As both electricity and thermal energy are generated from the same panel (see figure 5.35), it is possible to make efficient use of the small available roof area of the Mobble (and the Etrimo appartments).

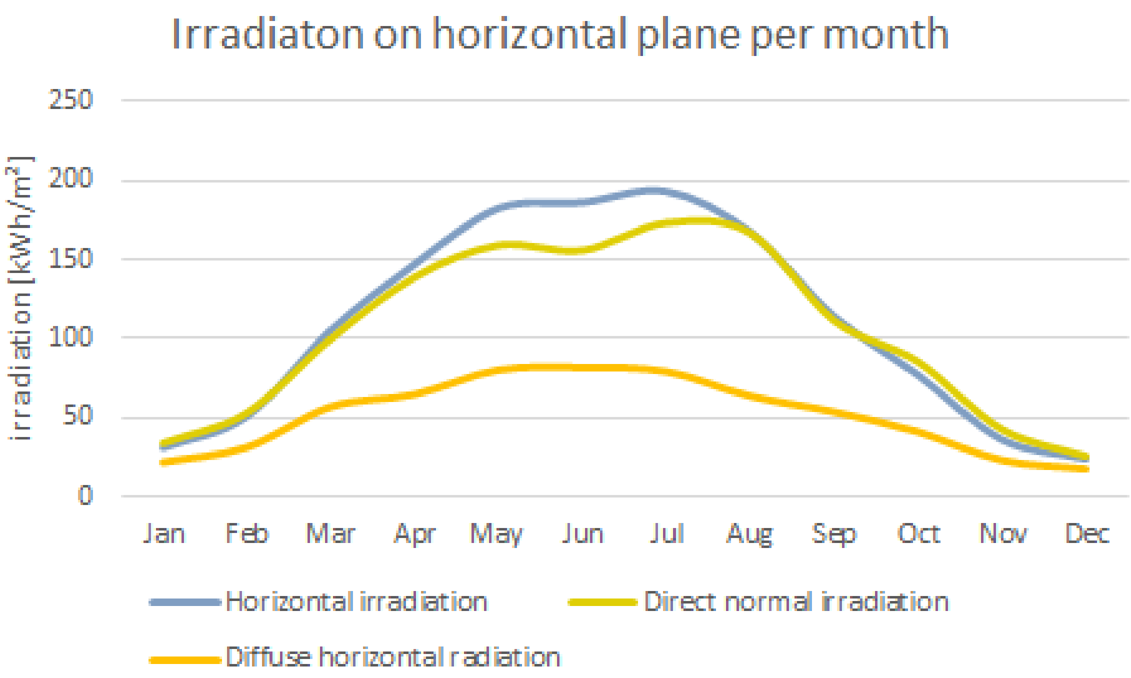
Furthermore PV panels heat up during operation, thereby reducing the efficiency and thus electricity output. When using PVT panels, the thermal collectors serve as a cooling system for the solar PV, increasing the electrical performance of the system. Overall PVT efficiencies of 70% or higher have been reported, with electrical and thermal efficiencies in the range 15-20% and

50% or higher, respectively.[60]

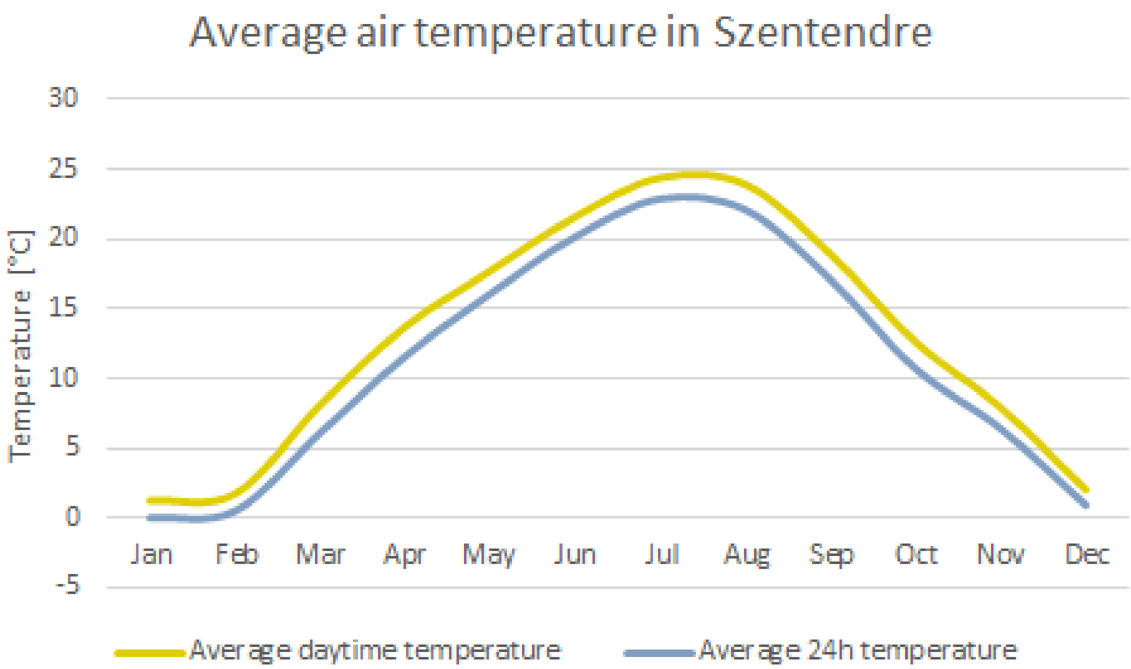
In most applications the electrical output of a hybrid PVT system is the priority function, therefore the PV system determines the optimal angle and number of panels. To design an active solar energy system, detailed information about solar radiation availability in Hungary is essential. In PV system simulations, the Global Horizontal Irradiance (GHI) and the ambient temperature, given in figure 5.30, are the two most important inputs in order to determine the electricity output. The Global Horizontal Irradiance, total solar radiation, is the sum of the Direct Normal Irradiance (DNI), Diffuse Horizontal Irradiance (DHI), and the ground-reflected radiation. However the ground-reflected radiation is mostly insignificant compared to direct and diffuse, therefore the global horizontal radiation is given by:

$$GHI = DNI \cdot cos(z) + DHI \tag{5.10}$$

in which z is the zenith angle, being the angle between the direction of the sun and the zenith (directly overhead). If the panel orientation differs from the horizontal plane the global irradiance on the tilted module is calculated from its direct and diffuse components. The whole principle is shown in figure 5.31. Therefore there is an optimal angle for the exposed PV surface, depending on the solar height. The optimal panel inclination for the different months is given in figure 5.32, which shows clearly that in the winter months the sun position is lower, resulting in a higher optimal panel inclination. The overal optimal angle is 35°.[32]



(a)



(b)

Figure 5.30: Weather information Szentendre (a) Irradiation on horizontal plane (b) Average air temperature

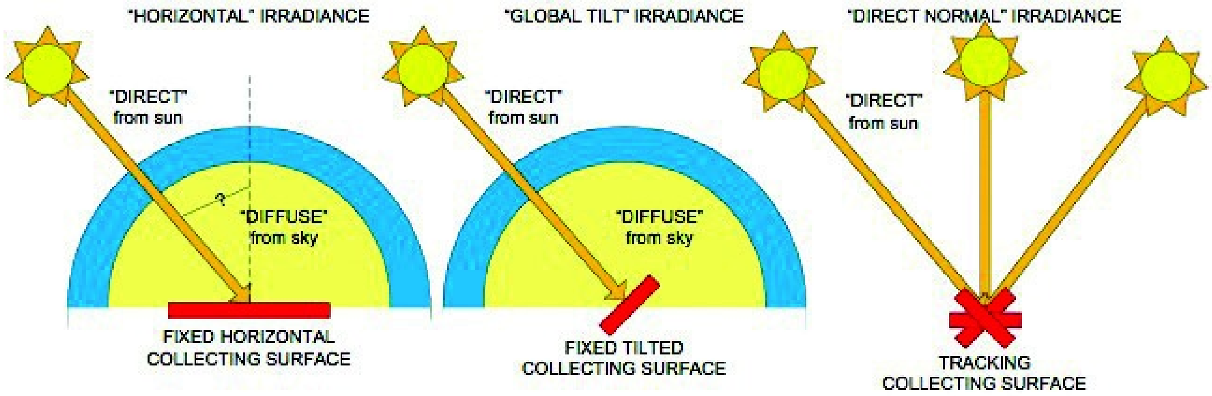


Figure 5.31: Principle of irradiation [61]

A maximum of 5 kWp of photovoltaic installation size connected to the building was enforced by the competition. Based on the datasheet of the PVT panels of Climapac, the electrical peak power is 280 Wp and maximum 6 panels can be combined on one collector. Therefore 18 panels were selected, the roof arrangement is given in figure 5.33. The monthly in-plane irradiation for 35° and the resulting monthly energy output are given in figure 5.34.

The panels consist of 60 high efficiency monocrystalline cells cooled by water circulation on the rear side and a good heat transfer between PV and the thermal part is promised. The thermal heat of the panels will be stored in a buffer volume, providing domestic hot water in combination with a heat pump boiler, shown in figure 5.35.

A general disadvantage of the PVT panels is the production of surplus warm water in the peak summer season. Therefore you need a large thermal storage system, like a swimming pool, to preserve heat. Otherwise you keep circulating hot water to the PVT, thereby reducing the efficiency. The selected panels from Climapac are not insulated, such that the stagnation temperature is 70 ℃, thereby not too much impacting the PV efficiency.

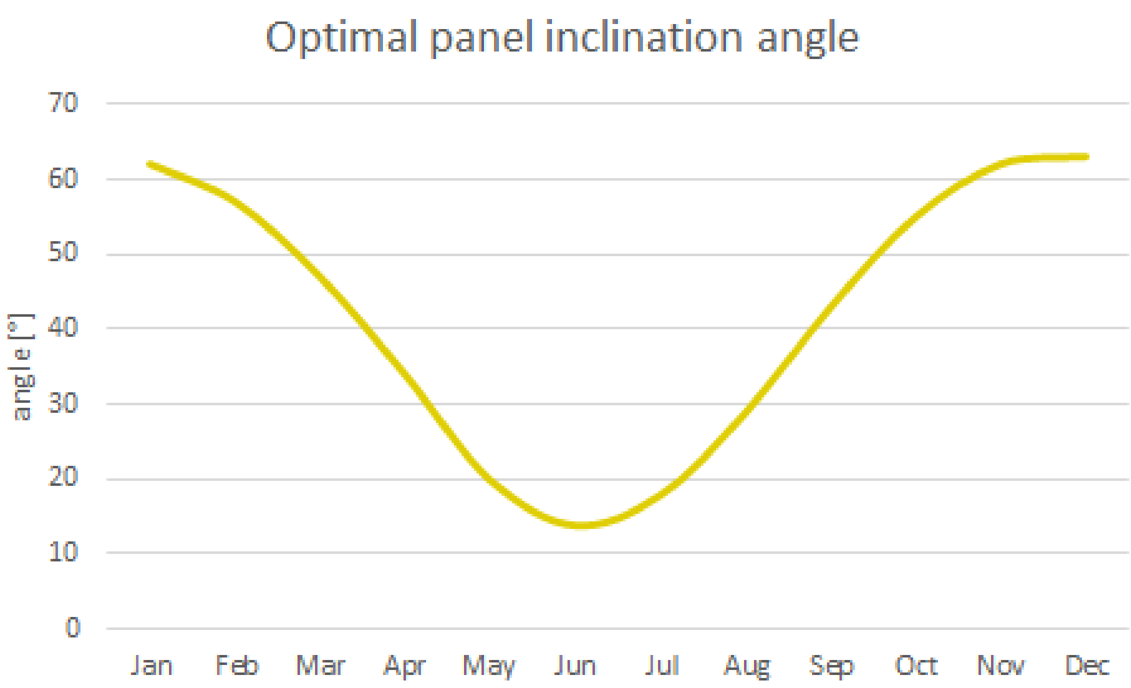


Figure 5.32: Optimal panel inclination angle in degrees

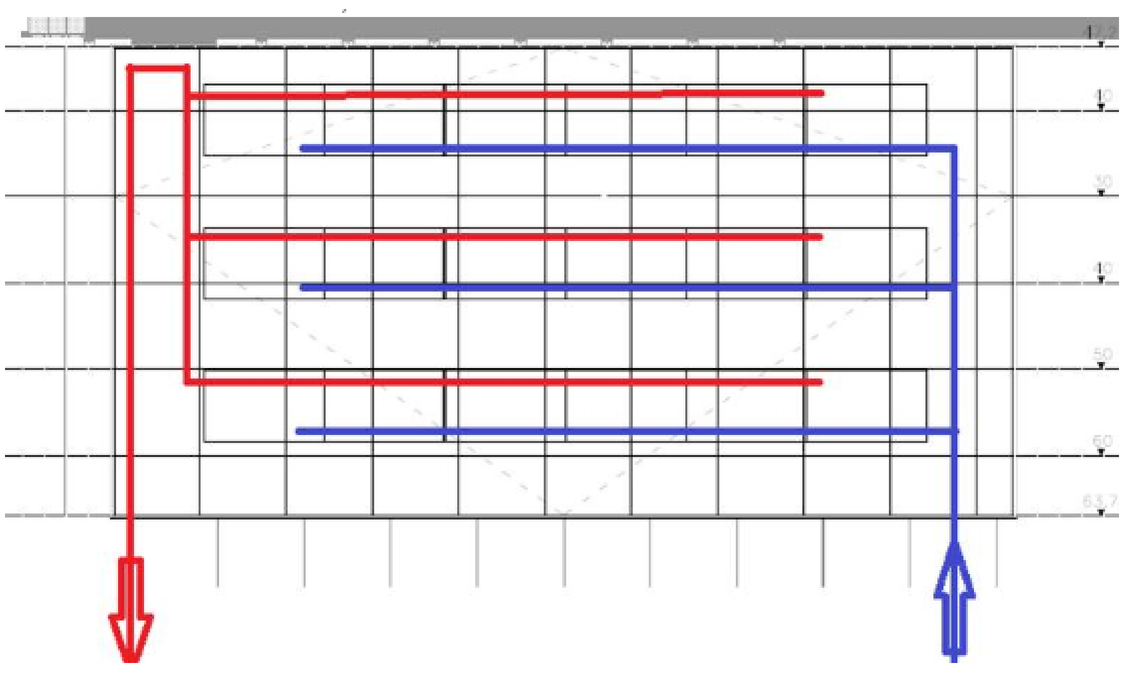
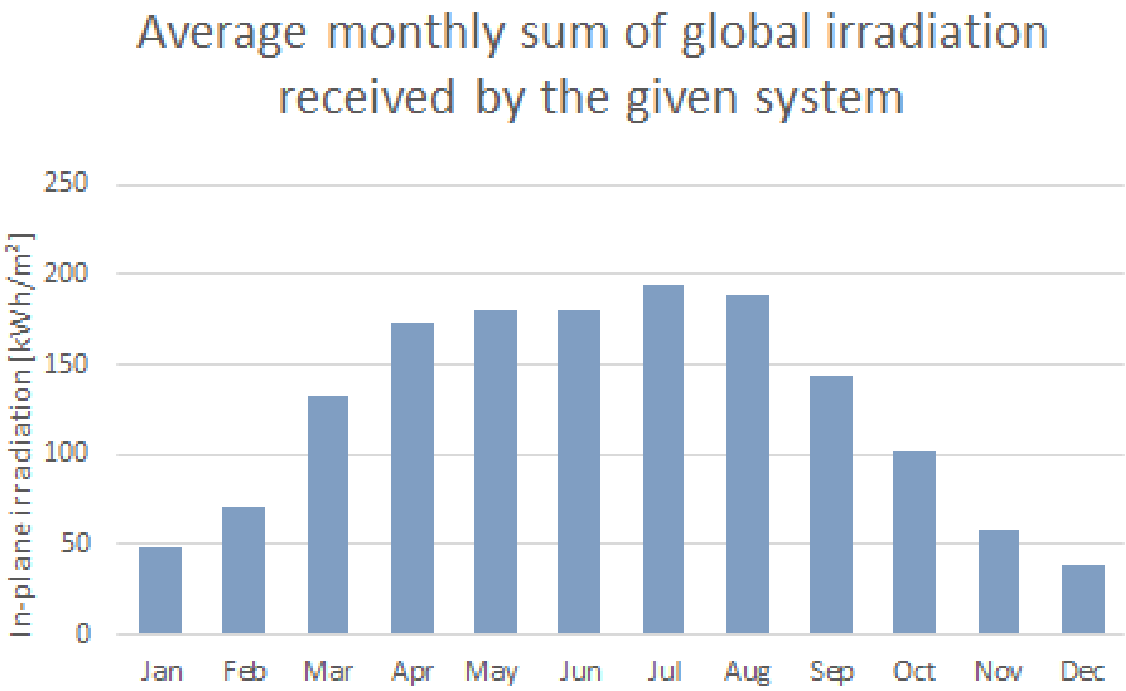
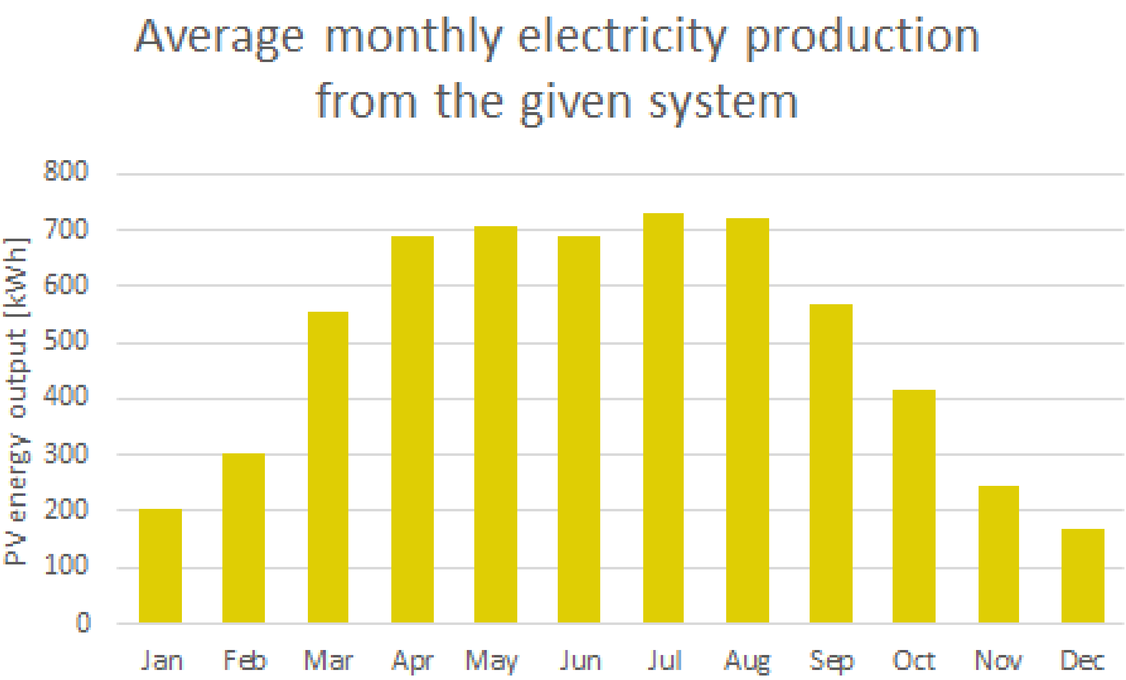


Figure 5.33: Roof arrangement of the PVT panels



(a)



(b)

Figure 5.34: (a) The monthly in-plane irradiation for 35° and (b) the resulting monthly energy output of the PV system

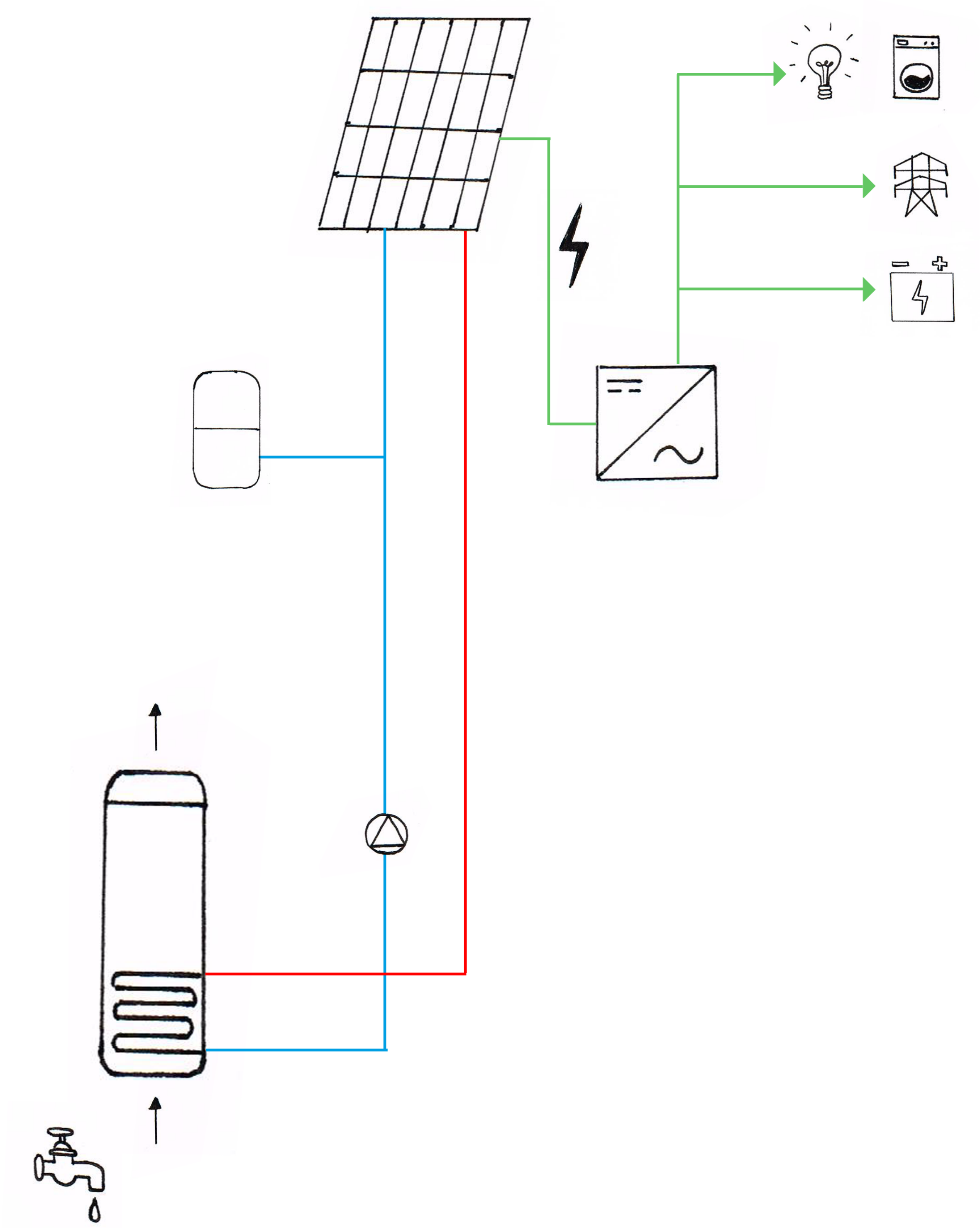


Figure 5.35: PVT panels for both electrical and thermal energy, in combination with a heat pump boiler for the DHW

Passive cooling in the Mobble: PVT for night radiative cooling

Due to the specific material properties needed for night radiative cooling, it is not often applied in today's buildings. Also the lack of commercially available components, costs and the need for large roof surface areas impedes its application. However, nowadays buildings are covered by PV panels for electricity production or with PVT panels (Mobble) in order to cover the energy needs. Such PVT systems are normally used to produce water during the day and stay untapped during night time. Using these panels for night radiative cooling could provide a versatile and cost-effective solution. The use of uncovered PVT collectors was carried out in Stuttgart, measuring cooling power levels between 60-65 W/m^2 when used to cool a storage tank and 40-45 W/m^2 when the energy was directly used by applying free cooling.

This resulted in the application for the Mobble. The 18 PVT panels will be used to produce cold water, by circulating it through the panels during nighttime. Hereby drawing away the heat accumulated in the storage tank during the day to the sky.

The simulations of the tank temperature during night time and the theoretical cooling power are discussed in section 5.4.3.

5.4 Dimensioning

Abstract

When dimensioning the HVAC system, the first step is to predict the heating and cooling loads by stationary calculations. Therefore the building design is needed. Even though the competition takes place in summer an all year round approach is used. This to ensure that the house and the system can work as close as possible to the optimum all year round. Weather data from Belgium and Hungary have been utilized. The climate is similar with the only exception that the temperatures are more extreme in the Hungarian climate. The energy loads will be in the same order, such that the installation will be a little overdimensioned for a Belgian situation.

5.4.1 Load Calculations

In this chapter the load calculations for the Mobble pavilion in Hungary are explained and analyzed. The heating demand and ventilation flows are calculated using the standard NBN B 62-003 and NBN D 50-001, respectively. The cooling load is calculated using a German standard VDI 2078. The ventilation flows are fully considered in the stationary calculation without control mechanisms resulting in a worst case scenario demand calculation. For residential buildings 3.6 $m^3/h/m^2$ fresh air needs to be provided to guarantee a good indoor air quality. More detailed information is found in the work of ir-arch. L.Landuyt and F.Lanckmans. [62]

Heat transfer coefficient

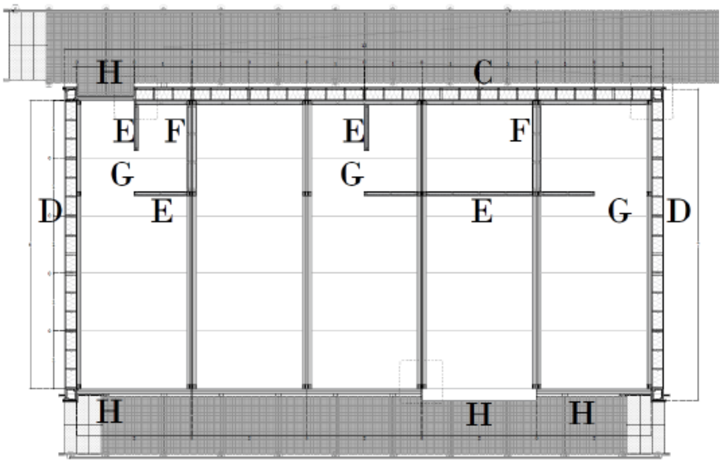
First of all the heat transfer coefficient of all the construction components has to be calculated. The calculation method is described in the 'transmissie referentie document' (=transmission reference document), a Belgian document containing all the relevant information out of different NBN EN (ISO) regulations. It provides a total overview of the formulas, standard values (e.g. Rsi, Rse) and methods to calculate heat transport due to transmission. The U-value can be calculated according to following formula:

$$U[\frac{W}{m^2K}] = \frac{1}{(1/\alpha_e + \sum R + 1/\alpha_i)} \tag{5.11}$$

With R[m^2K/W] being the thermal resistance and α_i, α_e[W/m^2K] the internal respectively external heat transmission coefficient. The building is build up out of different prefab panels and glazing, from which the manufacturer provided an overall U-value. The U-value was calculated for these building envelope elements and the glazing. The result can be seen in table 5.1, the associated location in the pavilion is shown in figure 5.36

Table 5.1: U-values of the different structural elements

Structural elements		U-value[W/m^{2}K]
A	Roof	0,123
B	Floor	0,192
C	Backside Wall	0,147
D	Side Wall	0,19
E	Interior Wall	0,57
F	Double Interior Wall	0,34
G	Door	1,38
H	Glazing	1



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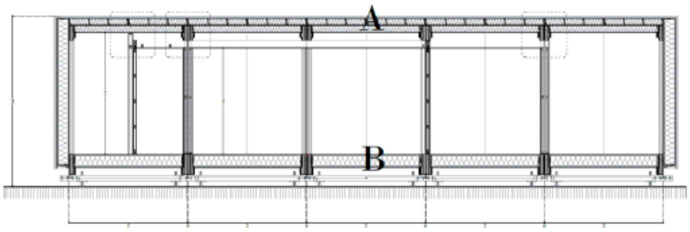


(b)

Figure 5.36: Different structural elements (a) floor plan (b) side view [62]

Heatloss calculation

With the known building design, dimensions and U-values, a stationary heat loss calculation is executed.
A general formula calculates the normalised heat losses:

$$\Phi_n = [(\Phi_t + \Phi_v) \cdot (1 + M_O + M_{cw})] + \Phi_{RH} \tag{5.12}$$

1. Transmission: $\Phi_t = \sum U_j \cdot A_j \cdot \Delta T_j$
2. Ventilation: $\Phi_v = H_v \cdot (T_i - T_e)$ Where H_v is split up in two components
    (a) the intentional infiltration: $H_v = 0,34 \cdot (V_{v,sup} \cdot (1 - \epsilon) \cdot b)$
    (b) infiltration: $H_v = 0,34 \cdot (0,15 \cdot \dot{v}_{50} \cdot A_t)$
3. Reheating: $\Phi_{RH} = A_f \cdot f_{RH}$

Where:

- M_O and M_{cw} respectively the correction factor for the orientation and uncompensated glazed facade
- ϵ is the effectiveness of the heat exchanger, when using a ventilation system with heat recovery
- $\dot{v_{50}} = \dot{V_{50}}/A_t$ with $\dot{V_{50}}$ the air leakage at 50 Pa for each m^2 building envelope. $\dot{v_{50}}$=1 as the pavilion has a high air-tightness, resulting in a specific leakage area of 1 $m^3/h/m^2$.
- The 0,15 in the formula comes from the translation between the Blowerdoor test and the real situation.
- The reheating factor f_{RH} is taken 2 according to the WTCB rapport

This calculation has been done for the D_{flow} ventilation system, without heat recovery, so $\epsilon = 0$. The temperature in the bedroom is set on 20 ℃, while in the living area a standard temperature of 24 ℃ is presumed. The difference between Belgian and Hungarian heatloss calculations is the outside design temperature, which is respectively -8 ℃ and -15 ℃. The results of the Hungarian heat loss calculation is given in table 5.2. However it must be stated that this calculation is very conservative regarding the temperatures of the weather file from the competition. In figure 5.37 it becomes clear that the extreme case of -15 ℃ is not likely to occur. Furthermore the solar gains are not included in this calculation, as The Mobble has a big glazing façade, these will have a significant positive impact on the heating capacity needed.

Table 5.2: Heat losses for the Hungarian context with a ventilation system D without heat recovery and a specific leakage area 1 $m^3/h/m^2$ according to NBN B 62-003

Space	T_j [°C]	A_t [m^2]	Φ_t [W]	$\Phi_{v,sys}$ [W]	$\Phi_{v,inf}$ [W]	Φ_{RH} [W]	Φ_{tot} [W]	Φ_{tot} [W/m^2]
Living Room	22	34	1955	750	223	68	3024	90
Bedroom	22	14	573	326	102	29	1040	72
Bathroom	24	4	202	29	51	8	304	73
Technical space	16	6	73	-29	42	0	90	14
Kitchen	22	6	168	0	47	13	239	38
Hall/Toilet	16	4	164	-14	41	0	200	48
Total heat loss							4897	71

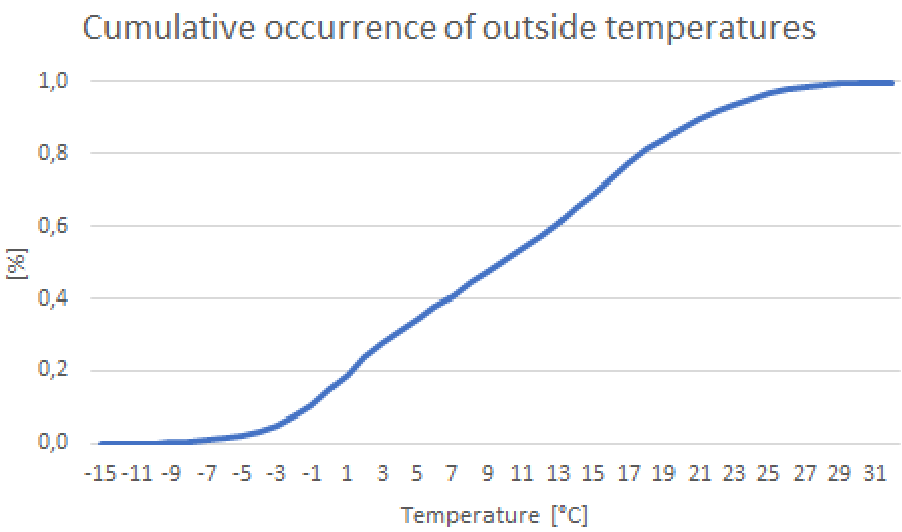


Figure 5.37: Cumulative occurrence of outside temperatures

-11 ℃ is the coldest temperature occurring during winter nights in Hungary. However following the calculations the living room stays on 24 ℃ during the night which is not necessary in reality when its freezing. From the weather files follows that December is the coldest month in Hungary, therefore a typical daily distribution of the heat losses during an average winter day in the month December is given by figure 5.38, representing the likely occuring heat losses.

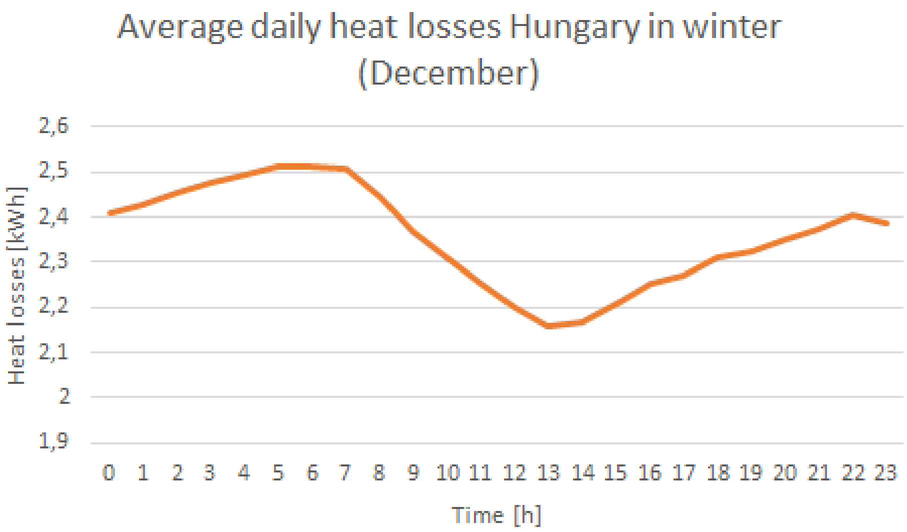


Figure 5.38: Average daily heat losses Hungary in winter (December)

Cooling load calculation

The cooling load calculation was performed for the bedroom, living room and kitchen, since there occupancy will be present for a longer time. The other rooms are less occupied and don't have glazing, therefore no cooling emission system will be installed in these zones. Still they will experience a cooling effect via the other rooms. The calculation was done according the German VDI 2078 standard and is semi stationary. A split up was made between the internal and external gains (figure 5.39). The formulas used to calculate the different contributions are given in table 5.4.

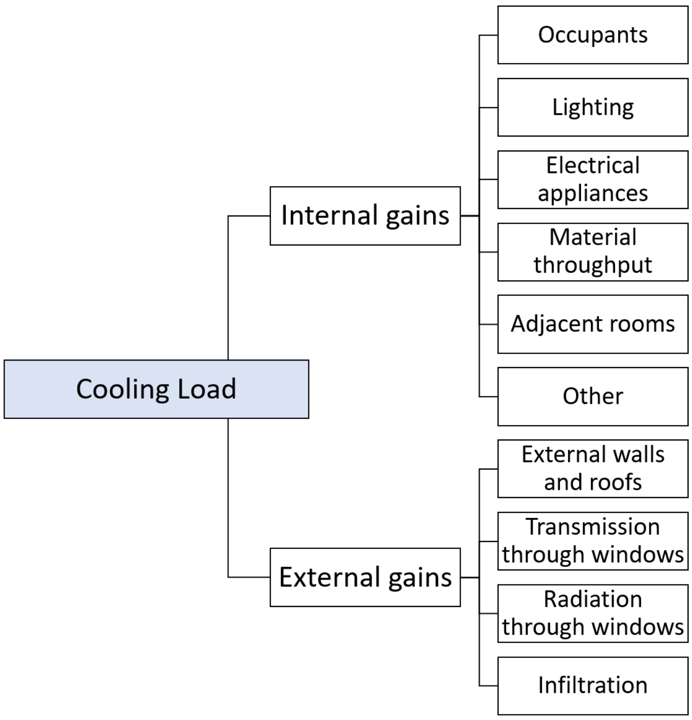


Figure 5.39: External and internal gains

Internal gains

The cooling load due to *occupants* $\dot{Q}_p$ is based on the occupancy of 2 people working during daytime, resulting from a research done at Ghent University. S_i depends on the thermal inertia of a building, as this property shifts the cooling load partly. Since the Mobble is a lightweight structure this factor is set on 1 out of safety reasons.

For the *lighting* influence $\dot{Q}_B$ following powers were used: P=100 W for the living room and

P=30 W for other zones.

The *appliances* $\dot{Q}_M$ included in the calculations are the ones stated in the rules. The radiative and convective fraction of the power determine the influence on the cooling load.

The average daily distribution of the internal gains due to occupancy, lighting and appliances in July is shown in figure 5.40a. It becomes clear that during the evening a peak value occurs, as the occupants come home, put on the lights, oven and other appliances.

The *adjacent rooms* $\dot{Q}_R$, technical room, bathroom and toilet, will affect the temperature in the conditioned rooms. ΔT was assumed 6 ℃ following from VDI 2078.

No other *heat supply* is active in the Mobble, neither any *material throughput.*

External gains

For the cooling load through *walls, roof and floor* $\dot{Q}_w$ radiation and transmission gains are taken into account. The equivalent temperature difference depends on the construction elements, the orientation and the time of the day. These values are provided by the VDI 2078 standard.

The *transmission through windows* $\dot{Q}_T$ depends on the surface, temperature difference and heat transmission coefficient of the window, depending on the frame and the glazing.
The cooling load due to transmissions is given in figure 5.40b.

Probably the most influencing parameter is the *radiation through the windows* $\dot{Q}_S$. It depends on the orientation, glazing properties and sun exposed glass area. In order to minimize the cooling load, a low g-value glazing was selected. Also the canopy helps, mainly for a south orientation. Furthermore solar shading was implemented to further reduce the cooling load due to radiation, which is clearly visible in figure 5.40c

Lastly the cooling load due to *ventilation and infiltration* $\dot{Q}_G$ was calculated. In summer months these factors have a negative effect, bringing outdoor hot air inside.

The total daily cooling load is the sum of the external and internal gains, shown in figure 5.41, for an average day in July. Furthermore it followed that the maximum cooling load occurs on the 28^{th} of July, being 3,6 kW (see table 5.3). The 13^{th} of July is the hottest and most sunny day, resulting in the highest cooling energy demand.

Table 5.3: Cooling load

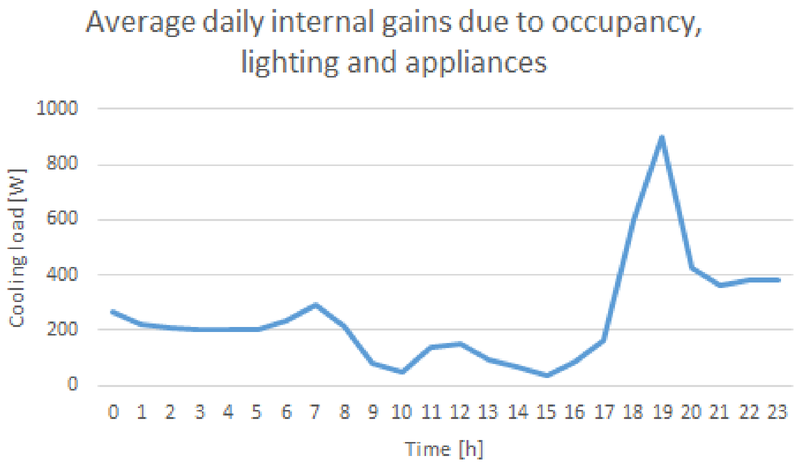
Maximal cooling load [kW]	3,6
Maximum total daily energy demand [kWh]	28,0
Average total daily energy demand [kWh]	23,5

Load distribution

For the HVAC system air will be distributed starting from the concealed ceiling unit by different pipes. The Mobble has two main rooms, being the living room and bedroom. Conditioned air is blown in, but the areas have different loads. It is helpful to calculate the fraction of the total cooling load both areas need. All maximum internal and external gains occurring in July were collected and split up according to the room they originate from. Therefrom it follows that the living area clearly needs the largest conditioning. As a result 15% of the conditioned air must go to the bedroom, the other 85% to the living area.

Table 5.4: Formulas for the calculation of the cooling load due to internal and external gains

Internal gains	**External gains**
Occupants:	Walls, roof, floor:
$\dot{Q_p} = n \cdot q_p \cdot S_i$	$\dot{Q_w} = k \cdot A \cdot \Delta T_{eq}$
Lighting:	Transmission through windows:
$\dot{Q_B} = P \cdot l \cdot \mu_B \cdot S_i$	$\dot{Q_T} = k_w \cdot A_w \cdot \Delta T$
Appliances:	Radiation through windows:
$\dot{Q_M}$=l $\cdot$ S_i $\cdot$ $\sum(P_j \cdot \mu_{aj})$	$\dot{Q_S}$=[A_I $\cdot$ I_{max} + (A-A_I) $\cdot$ $I_{diff,max}$] $\cdot$ b $\cdot$ S_a
Adjacent rooms:	Ventilation and infiltration:
$\dot{Q_R} = k \cdot A \cdot \Delta T$	$\dot{Q_G} = \dot{m} \cdot c \cdot \Delta T \cdot S_i$
Material throughput	
Others	
n[-]=number of persons	k[W/(m^{2}K)]= heat transmission coefficient
q_p[W]=heat emission from the human, depending on the activity	A[m^2]=area
S_i[-]=cooling load factor	ΔT[°C]=temperature difference
P[W]=power	k_w[W/(m^{2}K)]= heat transmission coefficient of the window
l[-]=simultaneity factor	A_w[m^2]=window area
μ_B[-]=room load factor	
P_j[W]= amount of power converted into heat output	A_I[m^2]=sun exposed area
μ_{aj}[-]=load factor of machine j	I_{max}[W/m^2]=maximum total radiation
	$I_{diff,max}$[W/m^2]=maximum diffuse radiation
	b[-]=radiation transmission coefficient of window
	$\dot{m}$[kg/s]=mass flow rate
	c[J/(kgK)]=mean specific heat capacity



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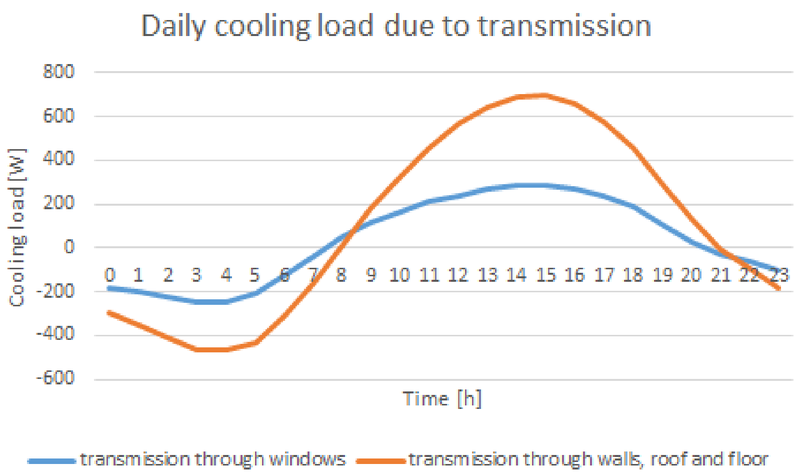

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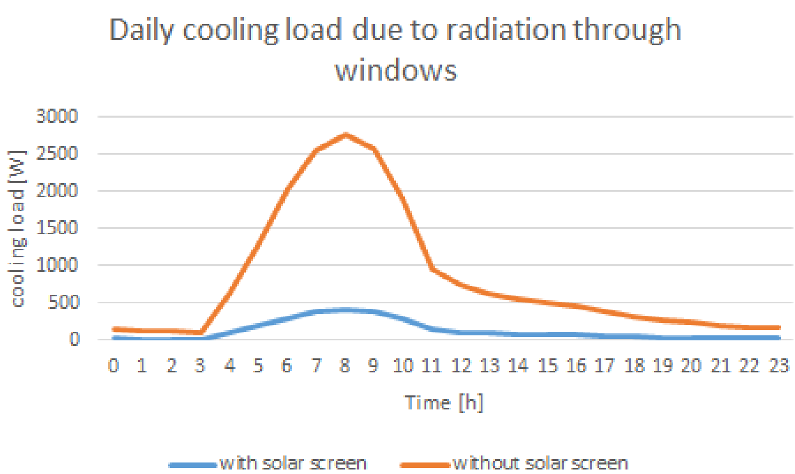


(c)

Figure 5.40: (a) Average daily internal gains due to occupancy, lighting and appliances (b) Daily cooling load due to transmission (c) Daily cooling load due to radiation through windows

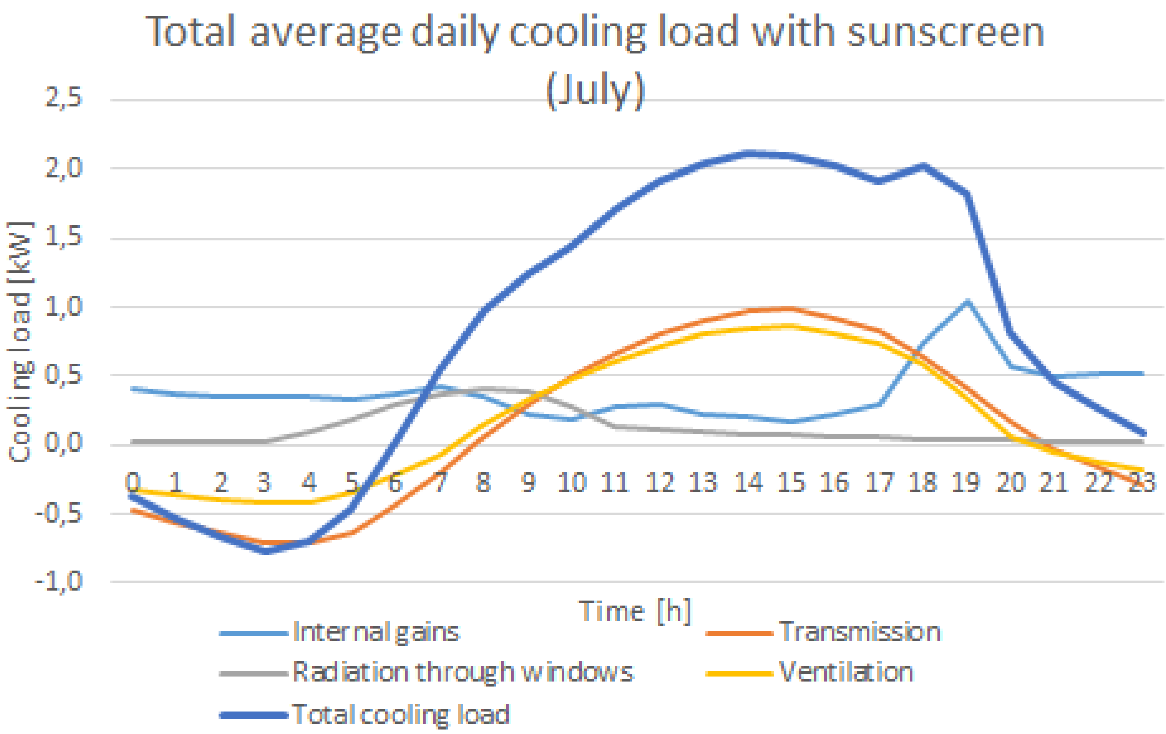


Figure 5.41: Total average daily cooling load with sunscreen (July)

5.4.2 Active system

As stated in the previous section DHW will be provided by a heat pump boiler combined with PVT panels. For heating and air conditioning an air-to-air heat pump was chosen because of its fast reaction time. The selection process of both heat pumps is described in this section.

Domestic hot water

A Monobloc domestic hot water heat pump from Daikin was selected for DHW, which is the ideal combination of heat pump technology and a high performance hot water storage tank that increases energy efficiency and creates substantial savings. The system promises a high performance and guaranteed comfort and is one of the quietest products of its kind (53 dB sound power indoors). During the two passive days hot water must be provided, so thermal collectors are necessary. As such the selected heat pump boiler is the EKHH2E-PAV3, which can easily be connected to a thermal solar system and PV system for even greater electricity savings, see figure 5.42. The boiler can be used to cool down the building, by using air from the technical room (see 5.6). A cooling capacity up to 1,3 kW is possible. The technical datasheet can be found in Appendix B.

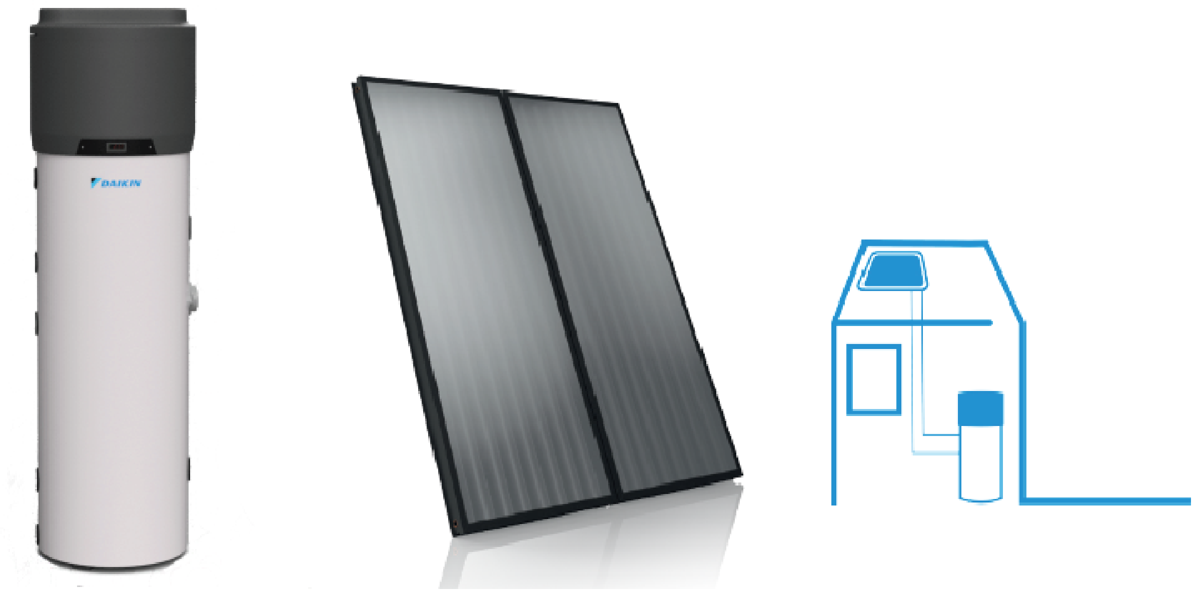


Figure 5.42: Monobloc unit connected with PVT panels [63]

The PVT panels of Climapac were dimensioned according to the electricity needs. This resulted in 18 PVT panels from which the technical datasheet is given in Appendix B.

However according to the WTCB report on average 1 m^2 corresponds with 50 liter buffer volume, resulting in nearly 4 panels. Based on the calculation method applied inside Climapac, 1 m^2 corresponds to 20-40 liters, resulting in 4 to 8 panels for the connection with the heat pump boiler.

Based on the weather data of Hungary 2 panels are needed in summer and 8 in winter.

The overdimensioning of the PVT panels according to the DHW needs is not a problem, because the main advantage of these PVT panels is that we do not get steam formation. The stagnation temperature of the panels is 70 ℃. As soon as the solar pump stops, there is no more heat supply and the temperature in the solar panels will rise. When you need heat, the panels are cooled down to the DHW temperature.

Air-to-air heat pump

Outdoor unit: 3MXM52M The maximum cooling load is about 3,6 kW, while the maximum heating demand is 4,8 kW. The outdoor unit must be connected to an indoor concealed ceiling unit and a water-refrigerant heat exchanger, leading to a multisplit system. Consequently the 3MXM52M unit from Daikin was selected. All indoor units are individually controllable and different types of indoor units can be connected. They operate simultaneously within the same mode, but do not need to be installed in the same room. By choosing for an R-32 product, a unit that emits fewer CO_2, the environmental impact is reduced with 68% compared to R-410A.

This heat pump in combination with a 5,0 kW indoor unit (see cooling and heating capacity tables of the outdoor unit, datasheet in Appendix B) is overdimensioned for cooling, however for heating at -15 ℃ this unit is still to small. During the competition points are received when it can be shown that the installation is suitable for extreme summer and winter conditions in Hungary. Therefore the heat pump is assisted by electrical batteries in the ventilation ducts. Also the passive system can cover part of the loads in both heating and cooling mode.

However, from the weather data follows that 4,36 kW heating load is never asked throughout the year. So a smaller heat pump can be selected for cost-efficiency reasons (see figure 5.38). The smaller model has the same compressor with a smaller heat exchanging area of the outdoor unit. Therefore the 3MXM52M leads directly to a lower energy consumption.

Indoor Unit: FDXM50F9 The air-to-air heat pump 3MXM52M can be coupled to 2 or 3 different indoor units. For the active system we use a concealed ceiling unit to cover the loads. The compact unit will be placed on top of the technical zone. Based on the load calculations and the space constraints the FDXM50F9 was selected (see figure 5.43). This unit has a dry programme, thereby providing an ideal humidity in Hungary.

The conditioned air will be distributed to the main rooms of the Mobble, living area and bedroom, by a multizoning system. An accessory, see figure 5.44, at the point of air discharge of the indoor unit, allows the various zones to be managed. This equipment, called multi-zoning kit, is fitted with motorized dampers, which can be driven each individually. A compact ceiling void with 5 dampers was selected, AZEZ6DAISL01L5, to condition the living area (4 dampers) and the bedroom (1 damper). Insulated ducts will guide to the rooms where the inflow first passes

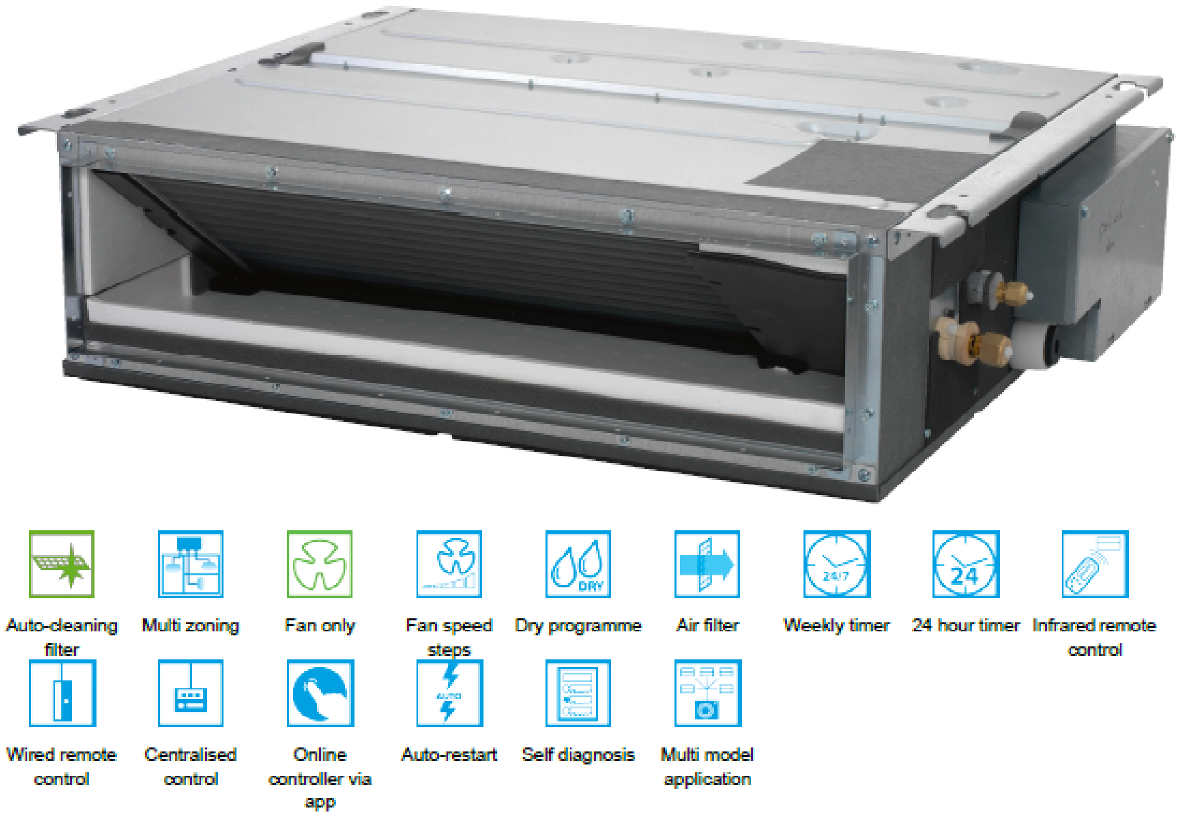


Figure 5.43: Indoor Unit: FDXM50F9

a plenum. A detailed top view with all different components inside the technical room can be found in Appendix A.

A conceptual scheme is given in figure 5.45 where the blue boxes indicate the in- and outdoor unit of the split system. The blue arrows show where the conditioned air is blown in, from where the air follows the yellow arrows via the closet to the inlet of the concealed ceiling unit. The green lines represent the refrigerant.

Fans

For the circulation of the conditioned air through the Mobble fans are needed to overcome the pressure drop caused by the air distribution ducts, heat exchanger and indoor unit. These pressure losses were calculated according to the WTCB Report No 15: Calculation of pressure losses and dimensioning of air distribution networks, the result is given in figure 5.46.[64] For

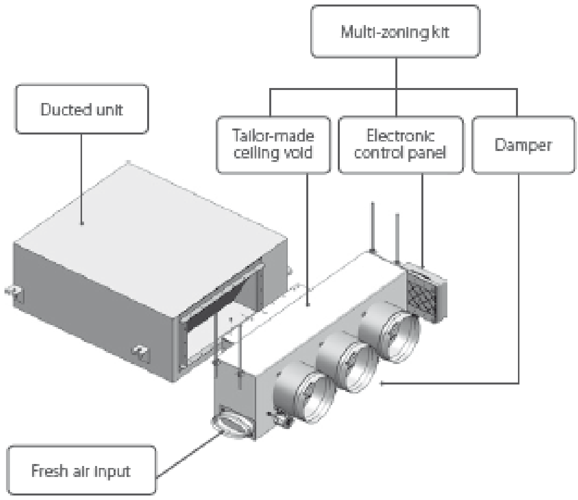


Figure 5.44: Multizoning kit

the design/maximum air flow rate the different factors are given in table 5.5. It is shown that the fan of the indoor unit is not powerful enough.
Correspondingly tube fans with a small outer diameter from the manufacturer Ruck were selected in order to fit in the design. The ETAMASTER can be integrated directly into the ductwork and the housing is only slightly larger than the pipe system, leading to almost no additional space requirements. Therefore on each air duct one fan of the type EM 125L EC 02 is placed. The EC motors have an intelligent control and their efficiency only drops slightly when speed controlled. The selection was based on an air flow rate of 200 m^2/h and a pressure drop of 25 Pa per tube. The technical datasheet of the fans is given in Appendix B.

The according maximum speed in the different ducts is 4,5 m/s, which is slightly too high, according acoustic measures in inhabited areas. Therefore a plenum is installed above the kitchen and bathroom, to reduce the speed of the end distribution. If it turns out that there is still noise nuisance, sound absorbers will be placed in the plenum. The velocity of the air entering the room is reduced to 1 to 2 m/s which is comfortable.

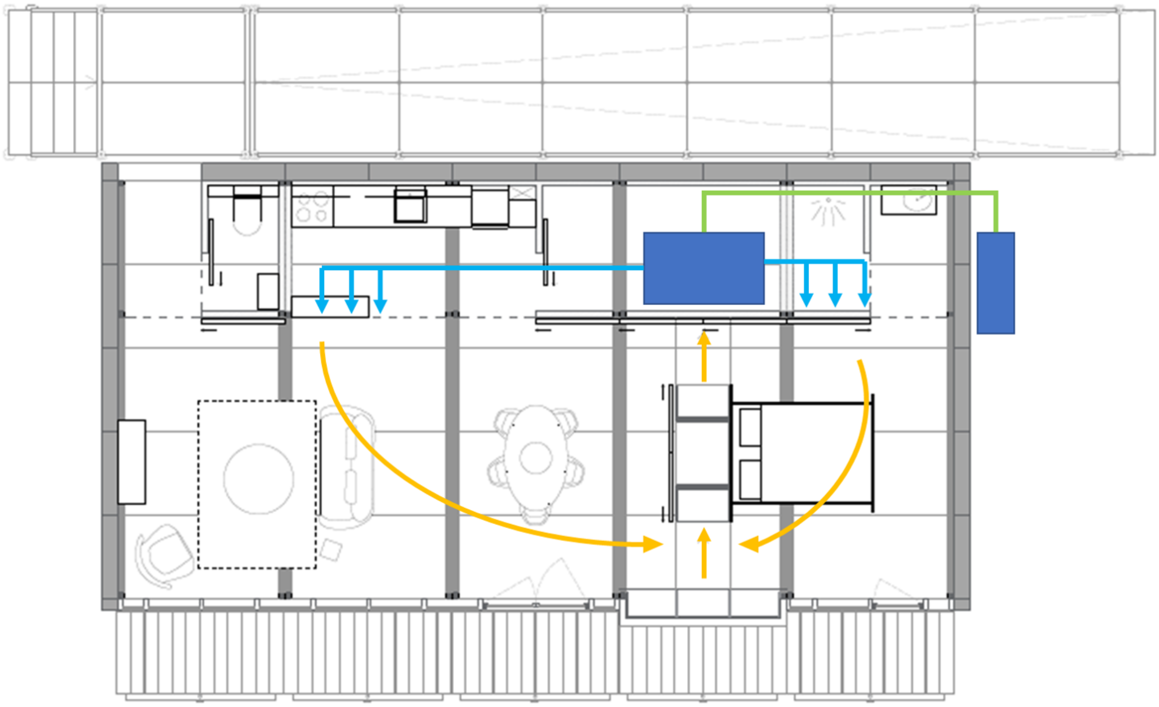


Figure 5.45: Conceptual scheme active system: air distribution

blue boxes: in- and outdoor unit of the split system, connected by the green lines (refrigerant)

blue arrows: flow conditioned air through ducts

yellow arrows: the air circulation through the conditioned area to the inlet of the concealed ceiling unit

Table 5.5: Pressure drop air path for 1000 m^3/h [Pa]

Pressure drop air path for 1000 m^3/h [Pa]	
Ducts technical room	81
Plenum closet	8
Indoor unit	40
Heat exchanger	20
Total	**148**
Fan Indoor unit	35
Fans	113

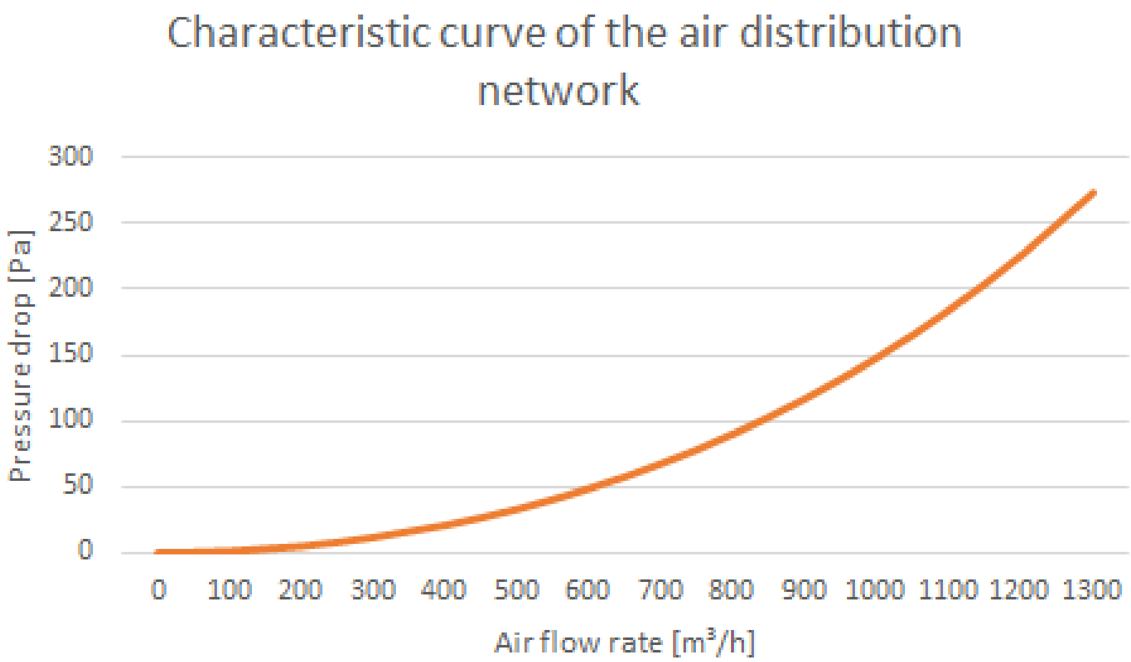


Figure 5.46: Characteristic curve of the air distribution network

5.4.3 Passive system

Since the energy required for cooling the building in summer makes big part of the building energy required, heat removal should be realised in an efficient, passive way. The pavilion uses thermal radiation against the night sky to cool down the H_2O-PCM buffervolume. The cooled water is available to cool the air in the room, by circulating the water through the cooling coils, when it heats up during the day. The total concept is explained in section 5.6 (since it needs information of the dimensioning and control strategy). This chapter starts with the hydraulic scheme of the passive installation, showing the different components that need to be dimensioned. Afterwards the calculation of the heat output by radiative night cooling and the corresponding design of the thermal buffer storage is given ending with the selection of the heat exchangers, pumps and valves.

Hydraulic scheme

The hydraulic scheme of the passive installation with the different components is given below. In the next sections the dimensioning of all different parts is discussed. The legend and different operating modes are shown in figure 5.47.

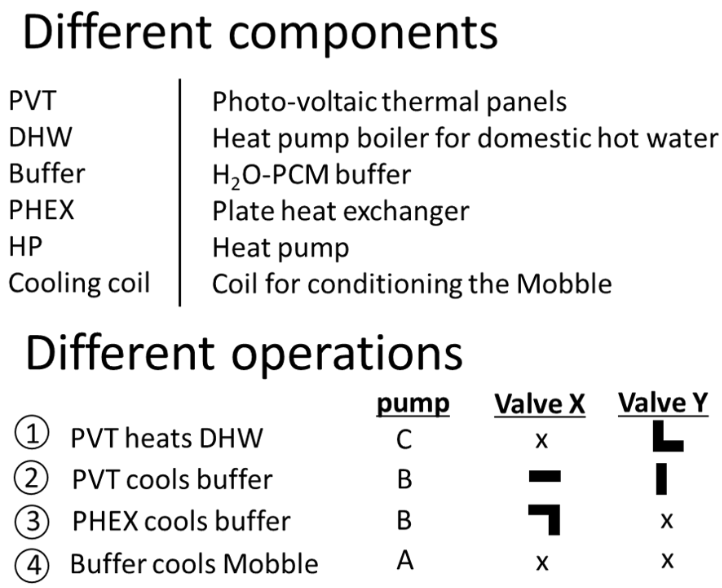
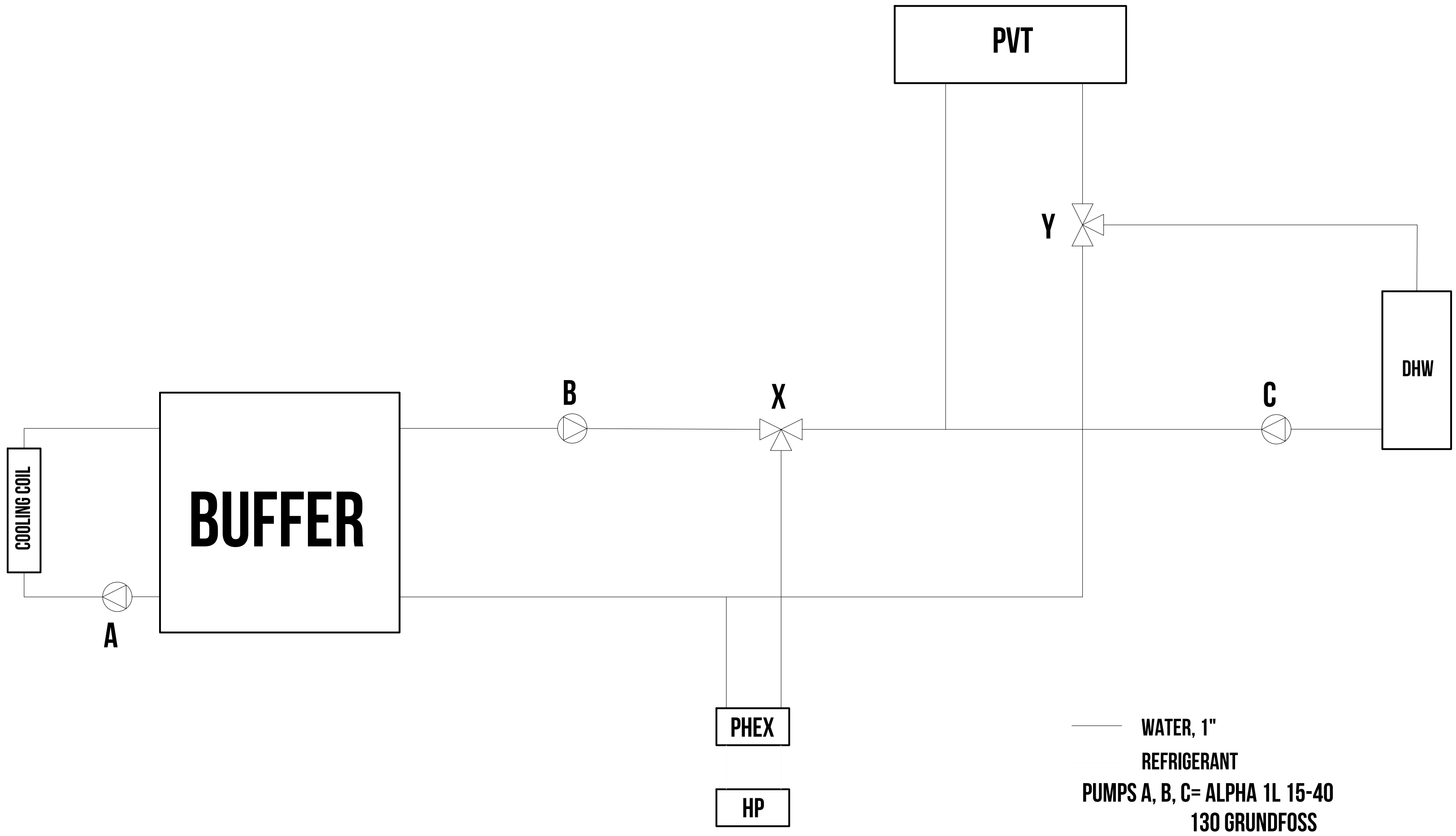


Figure 5.47: Legend of the hydraulic scheme with associated operating modes



HYDRAULIC SCHEME

Indication of the different components

ME 201	HVAC SYSTEM SCHEMATIC DRAWINGS
Delivarable (latest update)	Deliverable #6 June 11, 2019

Simulation night radiative cooling

During the summer nights, water will be circulated through the PVT panels thereby emitting heat to the sky by radiation. By using the RT Dobson model for night radiative cooling, the heating performance of this system can be investigated.

Modelling night sky temperature

Equation 5.9 shows that an estimation or measure of the incoming infrared radiation from the atmosphere ($R_{\downarrow}$) would be interesting. There are two methods to express the incoming radiation $R_{\downarrow}$:

1. Assume the sky acting as a blackbody emitter at an effective sky temperature (T_{sky}), such that by Stephan Boltzmann: $R_{\downarrow}=\sigma \cdot T_{sky}^4$
2. Assume the sky has the ambient dry bulb temperature (T_a) with an effective sky emissivity (ϵ_{sky}), such that $R_{\downarrow}=\epsilon_{sky} \cdot \sigma \cdot T_a^4$

A good estimation of the sky temperature is crucial when modelling the performance of radiative cooling systems. A relation between the sky temperature and the ambient dry bulb temperature can be found by combining the two equations for $R_{\downarrow}$. Leading to:

$$T_{sky} = \epsilon_{sky}^{1/4} \cdot T_a \tag{5.13}$$

Many models based on empirical or semi-empirical correlations are available in literature to calculate the effective sky emissivity and thus respectively the sky temperatures. Different correlations for clear sky and cloudy sky conditions were set up. A brief overview is given in table 5.6. The simplest models only use the ambient temperature (Swinbank), but these do not estimate properly the emissivity over wide geographical regions. More advanced models take into account the influence of the humidity by using the partial pressure of water vapour p_d or the dew point temperature T_{dp}. For the cloudy sky correlations coefficients are used to correct the clear sky values $\epsilon_{sky,0}$.

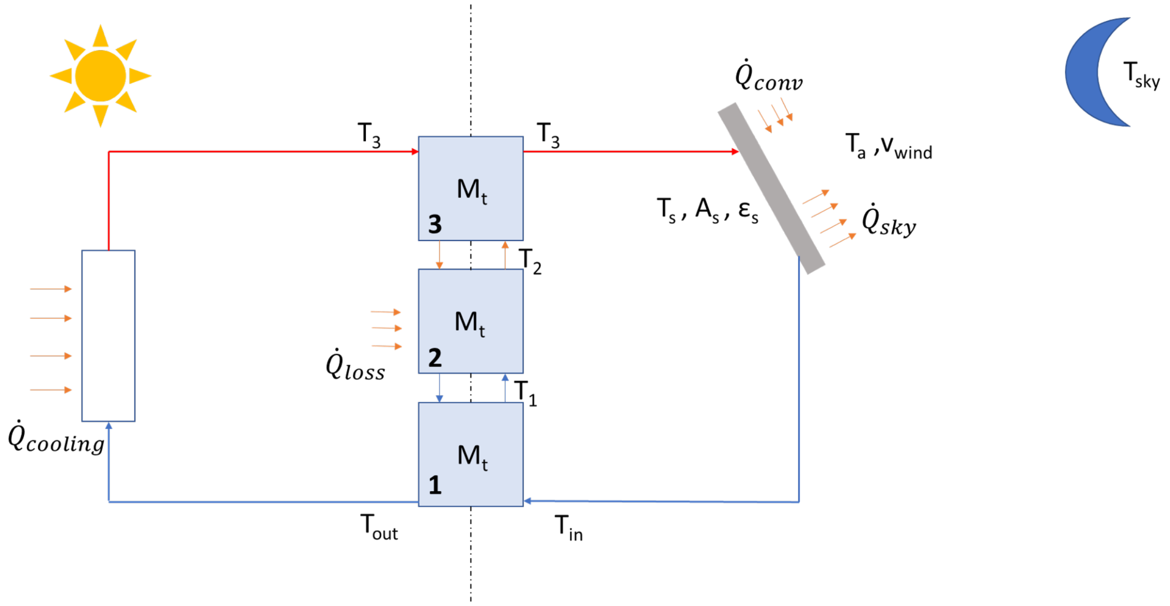


Figure 5.48: Thermal model system

<u>RT Dobson model</u>

The thermal design calculations of RT Dobson [75] were applied using the software package MATLAB to quantitatively validate the designed night radiative cooling system. The thermal model with the most important components, variables and parameters of the cooling system is shown in figure 5.48. The buffervolume exists of 3three cubic containers and for the simulations, they are assumed to be completely filled with water. Since the tank is relatively large and the circulating flow rates low, stratification will occur. Therefore it is important for the cold water coming from the PVT panels to enter at the bottom and the warmer water to supply the system from the top of the tank. During daytime this principle is reversed, thereby taking the coldest water to condition the room.

First the *thermal modelling of the PVT panels during nighttime* is done. A_s is the radiating surface, normal to the sky, with according temperature T_s and surface emissivity ϵ_s. σ is the Stefan-Boltzmann constant and T_a the ambient temperature of the surrounding. T_{sky} is the sky temperature, given by equation 5.13, wherefore different correlations for ϵ_{sky} were tested.

The heat transfer rate by long-wave radiation from the PVT panels to the sky is given by:

$$\dot{Q}_{sky} = \frac{T_s - T_{sky}}{R_{sky}} \tag{5.14}$$

Where

$$R_{sky} = \frac{1}{h_{sky} \cdot A_s} \tag{5.15}$$

$$h_{sky} = \epsilon_s \cdot \sigma \cdot (T_s^2 + T_{sky}^2) \cdot (T_s + T_{sky}) \tag{5.16}$$

The convective heat transfer rate from the PVT panels to the sky is:

$$\dot{Q}_{conv} = \frac{T_a - T_s}{R_{as}} \tag{5.17}$$

Where

$$R_{as} = \frac{1}{h_{as} \cdot A_s} \;\; with \;\; h_{as} = a + b \cdot v_{wind} \tag{5.18}$$

a and b are constants following from [57] with a=1,8 and b=3,8 for turbulent flows, being wind speeds of 1,35-4 m/s.

Lastly the solar radiation absorbed by the PVT panels can be taken into account, given by:

$$\dot{Q}_{solar} = \phi\alpha\tau\rho \cdot G \cdot A_s \tag{5.19}$$

With G the solar irradiance onto a horizontal surface and the factor $\phi\alpha\tau\rho$ the relation to the absorbed fraction. However for night radiative cooling this term is zero.

The PVT panels are not insulated so the conductive heat transfer can be ignored. This leads to:

$$\boldsymbol{\dot{Q}_{sky} - \dot{Q}_{conv} - \dot{Q}_{solar} = \dot{m}_{pvt} \cdot c_w \cdot (T_3 - T_{in})} \tag{5.20}$$

In the calculations it is assumed that the temperature of the surface T$_s$ is equal to the water temperature of the upper tank T$_3$. $\dot{m}_{pvt}$ is the mass flow rate through the PVT panels and c$_w$ the specific heat capacity of water.

The simulation of the three tanks during nighttime can be calculated according following equations with M$_t$ the mass of the tank.

$$M_t \cdot c_w \cdot \frac{dT_1}{dt} = \dot{m}_{pvt} \cdot c_w \cdot (T_{in} - T_1) + \dot{Q}_{loss} \tag{5.21}$$

$$M_t \cdot c_w \cdot \frac{dT_2}{dt} = \dot{m}_{pvt} \cdot c_w \cdot (T_1 - T_2) + \dot{Q}_{loss} \tag{5.22}$$

$$M_t \cdot c_w \cdot \frac{dT_3}{dt} = \dot{m}_{pvt} \cdot c_w \cdot (T_2 - T_3) + \dot{Q}_{loss} \tag{5.23}$$

Where

$$\dot{Q}_{loss} = \frac{(T_a - T_t)}{R_{loss}} \; with \; t = 1, 2, 3 \tag{5.24}$$

$$R_{loss} = 1/h_t A_t + L_t/k_t A_t \tag{5.25}$$

With h_t the heat transfer coefficient, A_t the tank surface area, L_t the insulation thickness of the tank and k_t the thermal conductivity of the storage tank insulation.

The modelling of daytime cooling load and corresponding temperature evolution of the tanks is given by following equation:

$$\boldsymbol{\dot{Q}_{cooling} = \dot{m}_{coil} \cdot c_w \cdot (T_3 - T_{out})} \tag{5.26}$$

$$M_t \cdot c_w \cdot \frac{dT_1}{dt} = \dot{m}_{coil} \cdot c_w \cdot (T_1 - T_{out}) + \dot{Q}_{loss} \tag{5.27}$$

$$M_t \cdot c_w \cdot \frac{dT_2}{dt} = \dot{m}_{coil} \cdot c_w \cdot (T_2 - T_1) + \dot{Q}_{loss} \tag{5.28}$$

$$M_t \cdot c_w \cdot \frac{dT_3}{dt} = \dot{m}_{coil} \cdot c_w \cdot (T_3 - T_2) + \dot{Q}_{loss} \tag{5.29}$$

Night cooling simulation

The specific weather conditions for the summer months July and August are given in figure 5.49. From this information an estimation for ϵ_{sky} can be done. After a comparison, the most conservative correlations for Hungarian conditions were used, being the correlations of Berdahl and Martin.[66, 73] This resulted in an average $\epsilon_{sky,0}$ of 0,8227 during nighttime for clear sky conditions, while for cloudy sky conditions a value of 0,9424 was obtained. The T_{sky} varies over the day and is shown in figure 5.50 for 4 different empirical formulas from table 5.6, showing the importance of ϵ_{sky} in simulations.

The dewpoint is nearly constant around 12,7 °C and this temperature determines the cooling limit (5.49b). At lower temperatures dew starts to form, and due to the latent heat of condensation the surface temperature will stay constant. The average wind speeds occurring in Hungarian summer nights is 2,2 m/s. The daily wind distribution is given in figure 5.49c.

Based on the solar irradiation a distinction was made between day and night for the simulation. On average 9 hours without solar irradiation can be distinguished, between 8 pm and 5 am in the morning. The constant input variables necessary to solve previous nighttime equations are given in table 5.7, some following out of literature, others from the design. The start temperature of the tanks T_{start} was chosen at 18 °C as basically this will be about the limit for cooling for the air-to-water heat exchanger. The mass flow rate $\dot{m}_{pvt}$ through the PVT panels is set 0 l/h when $\dot{Q}_{nightcooling} <= 0$, thereby preventing the buffer to warm up. This control mechanism will also be implemented in reality. The resulting temperature distribution is given in figure 5.51. The effect of clouds is clearly visible in the figures, thereby reducing the cooling capacity. However, clear sky conditions generate high solar gains during night. So a high cooling demand during day, generally results in a night with higher cooling production, thereby enabling to match the demand.

From the temperature data it seems more efficient to circulate water through the panels between 9 pm and 6 am. This case was also simulated with the MATLAB program resulting in a slightly higher cooling energy in either clear and cloudy sky conditions. However this increase is counteracted by the solar radiation coming in. In order to choose the most optimal control, tests must be carried out to see the effect of solar radiation.

During night the heat losses from the tank can be neglected, as the resultant after one night is in the order of some Watt.

Sensitivity analysis

A sensitivity analysis was performed for a variation of ± 25% of the most important system variables of table 5.7, being the PVT surface A_s, mass flow rate through the panels $\dot{m}_{pvt}$, the buffer storage volume M_t and the start tank temperature in the begin of the night T_{start}. The performance parameters are the tank temperatures T_1, T_2, T_3 and the total heat removed during the night sky cooling period of 9 hours, $Q_{nightcooling}$. The results of this analysis are shown in

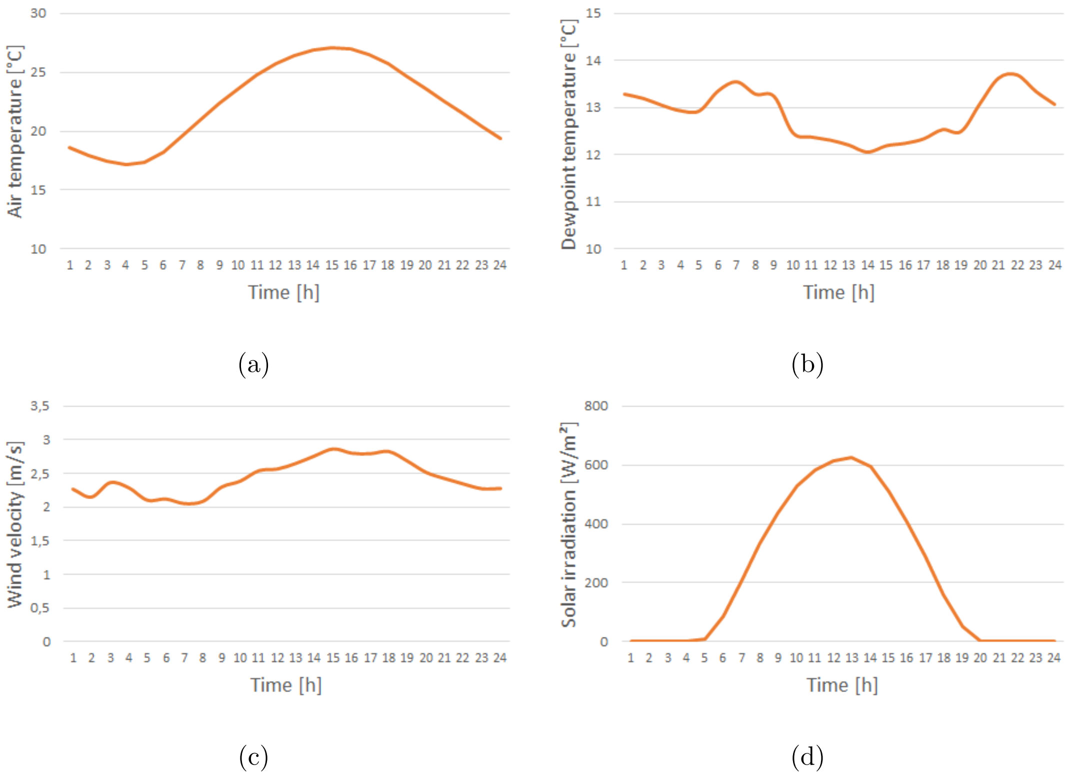


Figure 5.49: Hourly values of (a) air temperature T_a (b) dewpoint temperature T_{dp} (c) wind velocity v_{wind} (d) solar irradiation G

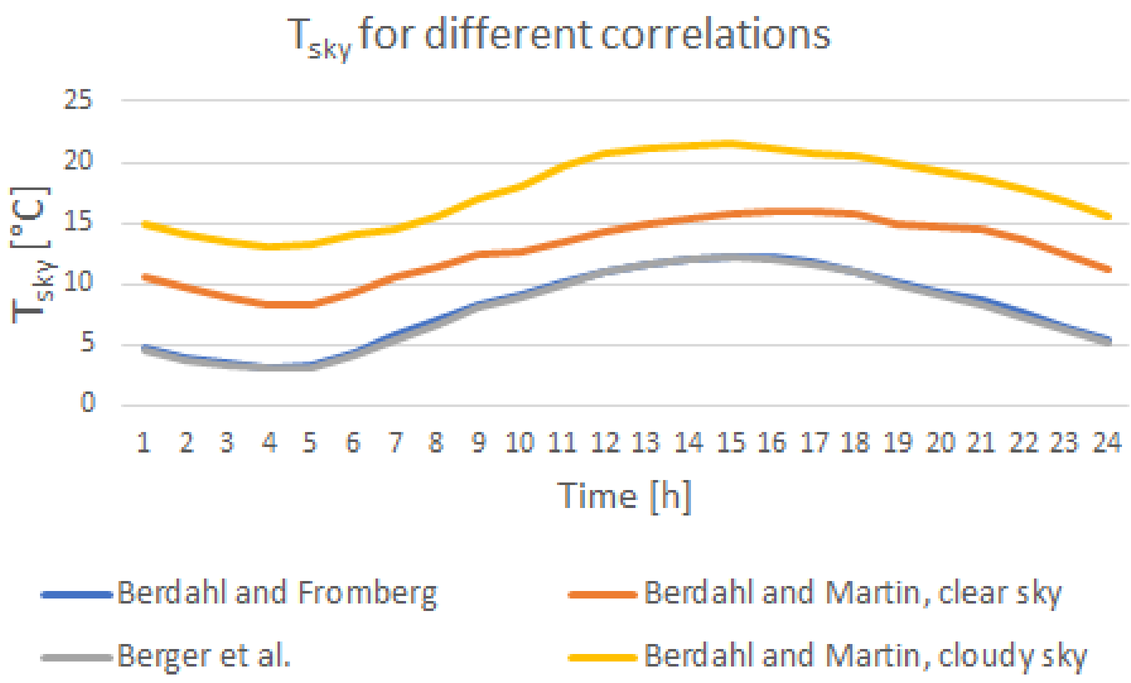


Figure 5.50: Tsky for different correlations

table 5.8. Changing the start temperature has the biggest impact, which could be expected. When lowering the start temperature the cooling potential is decreased as the convective losses to the surrounding increase and the radiation to the sky decreases. The average sky temperature of 10,8 ℃ would be around the cooling limit when no convective heat losses occur. The limit with heat losses follows from simulations and is around 14,5 ℃. Increasing the tank temperature from 18 to 22 ℃ doubles the total heat removal. Unsurprisingly increasing the radiating area has a positive effect on both the cooling energy and the lowest tank temperature. Decreasing the mass flow rate through the panels encourages the stratification of the tanks, thereby decreasing the temperature of the first tank and increasing the cooling potential for the day. This idea will be used in the control implementation. Also for a lower tank volume lower temperatures can be achieved, however the total cooling of the tanks is substantially reduced.

Result

Also a simulation of the two passive days with three water tanks was done, where the average cooling load of the summer months, July was used (see figure 5.41) and a clear sky was presumed. Before the passive days start the heat pump will cool the buffer to 10 ℃, being the starting

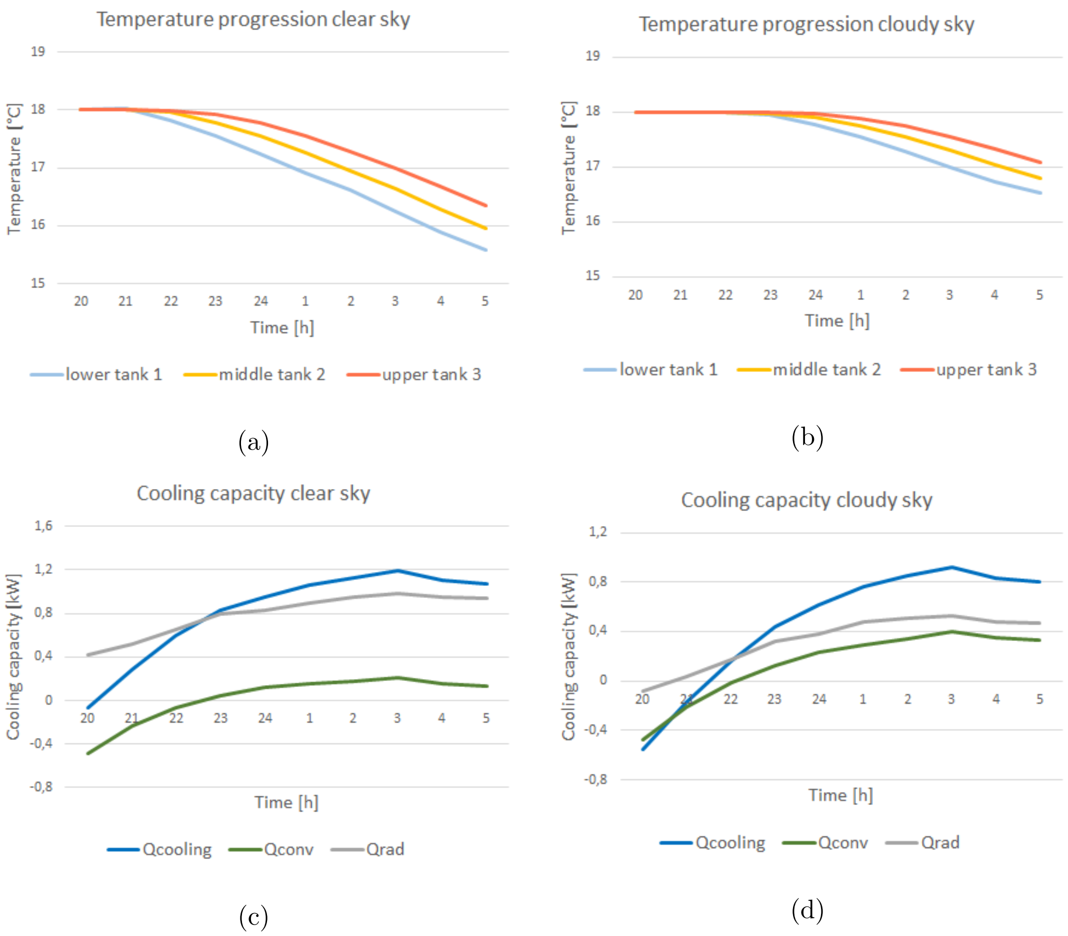
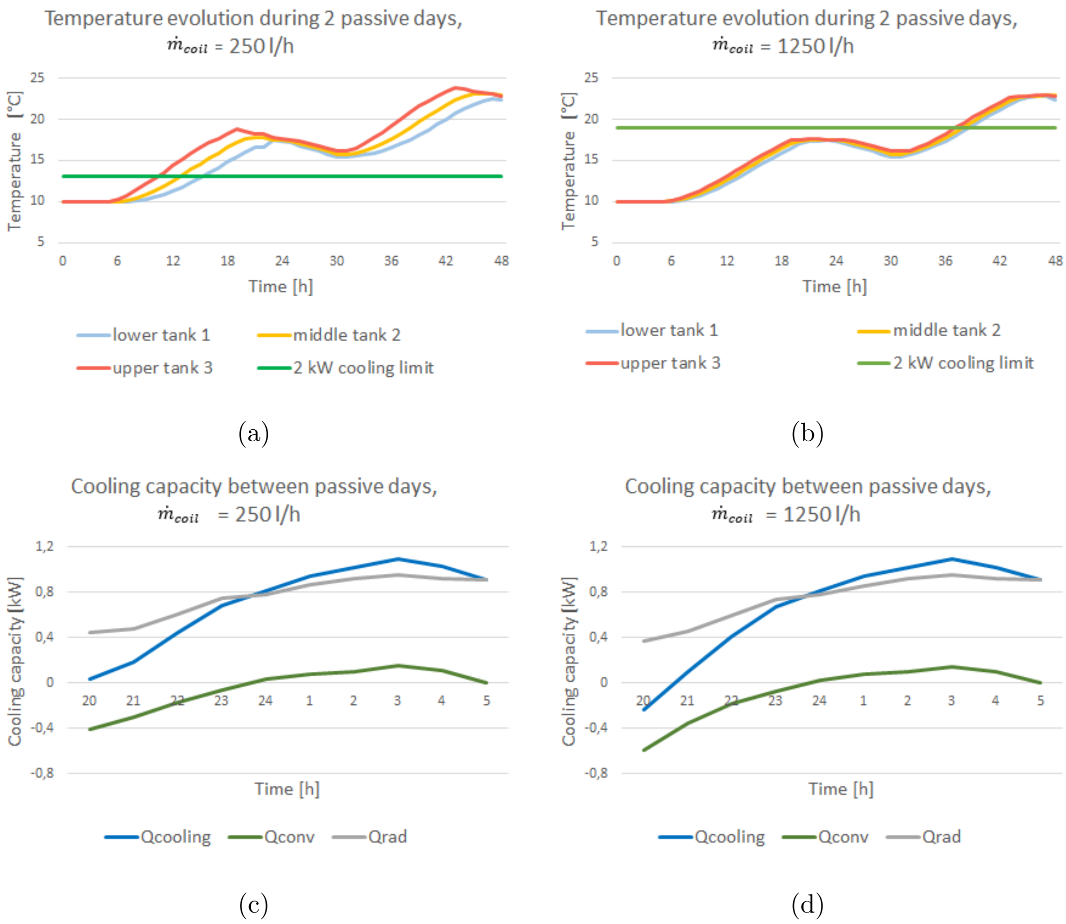


Figure 5.51: Hourly values (a) temperature progression clear sky (b) temperature progression cloudy sky (c) cooling capacity clear sky (d) cooling capacity cloudy sky

temperature of the simulation. The result is shown in figure 5.52 for different mass flow rates $\dot{m}_{coil}$ through the cooling coil inside. This mass flow rate influences the stratification but also the limit temperature for which a cooling power of 2 kW can be maintained. This limit temperature is based on the data from the cooling coil and is shown with the green line. Since stratification is useful to increase the cooling potential, during the passive days first the air flow rate will be maximized after which $\dot{m}_{coil}$ will increase gradually, covering the cooling loads.

For a maximum flow rate of 1250 l/h it becomes clear that the set point temperature of 24 ℃ can be maintained during the passive days till 7 pm the second day. Starting from that moment the loads decrease and night radiative cooling can almost start again. In combination with the PCM implementation in the tanks, comfort will be achieved during the passive days.

The total cooling energy stored during the night is around 7100 kWh, or an average cooling power of 32 W/m^2 and a maximum of 45 W/m^2, being in the same (even conservative) order as experimental results.



(a) (b) (c) (d)

Figure 5.52: Hourly values of (a) (b) temperature evolution during 2 passive days for $\dot{m}_{coil}$ 250 l/h respectively, 1250 l/h(b) (c) cooling capacity between passive days for $\dot{m}_{coil}$ 250 l/h respectively, 1250 l/h

Table 5.6: ϵ_{sky} correlations

Clear sky correlations	
Berdahl and Fromberg (night time) [65]	$\epsilon_{sky,0}$=0,741 + 0,0062 $\cdot T_{dp}$
Berdahl and Martin [66]	$\epsilon_{sky,0}$=0,711 + 0,56 $\cdot(T_{dp}/100) + 0,73 \cdot (T_{dp}/100)$
	+ 0.013 $\cdot cos(2\pi t/24)$
Berger et al.[67]	$\epsilon_{sky,0}$=0,770 + 0,0038 $\cdot T_{dp}$
Elsasser [68]	$\epsilon_{sky,0}$=0,21 + 0,22 $\cdot ln(p_d)$
Erell and Etzion [57]	$\epsilon_{sky,0}$=0,74 + 0,006$\cdot T_{dp}$
Satterlund [69]	$\epsilon_{sky,0}$=1,08 $\cdot(1 - exp(p_d^{T_a/2016})$
Swinbank [70]	$\epsilon_{sky,0}$=9,35 $\cdot T_a^2$
Cloudy sky correlations	
Aubinet [71]	T_{sky}=94 + 12,6 $\cdot ln(p_d) - 16 \cdot K_0 + 0,341 \cdot T_a$
Bolz [72]	ϵ_{sky}=$\epsilon_{sky,0}$ $\cdot$ $(1 + k \cdot f_{cloud}^2)$
Martin and Berdahl [73]	ϵ_{sky}=$\epsilon_{sky,0}$ + (1- $\epsilon_{sky,0}$) $\cdot f_{cloud}\epsilon_{cloud}$
Sridhar [74]	ϵ_{sky}=1,31 $\cdot(p_d/T_a)^{1/7}$

T_{dp} is the dew point temperature of ambient air in ℃

t is the time of the day in hour

p_d is the water vapour partial pressure in mbar

T_a is the ambient dry bulb temperature in K

T_{sky} is the effective sky temperature in K

K_0 is the daily clearness index

k is an empirical constant

f_{cloud} is the fractional area of sky covered by clouds

Table 5.7: Constants for simulation night radiative cooling system

Constants			
σ	Stefan-Boltzmann constant	$5{,}7 \cdot 10^{-8}$	W/m^2K^4
c_w	Specific heat of water	4186	J/kgK
ρ_w	Density of the water	1000	kg/m^3
PVT panel			
A_s	Normal radiating surface	24,4	m^2
ϵ_s	Surface emissivity	0,89	-
$\dot{m}_{pvt}$	Mass flow rate pvt	900	l/h
Tank			
M_t	Mass tank	1000	kg
L_t	Insulation thickness	0,1	m
k_t	Thermal conductivity	0,022	W/mK
A_t	Tank surface area	18	m^2
T_{start}	Start temperature	18	℃

Table 5.8: Sensitivity analysis night radiative cooling

Variable	$\mathbf{Q}_{nightcooling}$ **[kWh]**	$\mathbf{T}_{1,end}$	$\mathbf{T}_{2,end}$	$\mathbf{T}_{3,end}$
Base case	**8207,5**	**15,6**	**16,0**	**16,4**
0,75As	-2301,2	0,5	0,4	0,3
1,25As	269,5	-0,4	-0,4	-0,3
0,75Mt	-2252,7	-0,3	-0,4	-0,5
1,25Mt	-502,1	0,3	0,3	0,3
$0{,}75\dot{m}_{pvt}$	-737,0	-0,2	-0,1	0,1
$1{,}25\dot{m}_{pvt}$	-1118,2	0,1	0,0	-0,1
$0{,}75T_{start}$	-7545,3	-2,1	-2,5	-2,8
$1{,}25T_{start}$	8126,8	1,2	1,3	1,5

Design of the H_2O-PCM buffer

As previously mentioned the ideal buffervolume has a high storage capacity while having a high conductivity. The high storage capacity of PCM, with the high temperature control in his melting/solidifying range was already proven, however the low conductivity is shown below. This resulted in a H_2O-PCM buffervolume. The design and benefits are discussed.

The thermal energy storage buffer will be mainly used to cool the building during the passive days, therefore it is important that the required cooling power can be covered. Next to the ability to store energy, the buffer must be able to release its energy fast enough. A cooling power of at least 2 kW must be achieved, following the load calculations, to provide acceptable indoor conditions.

Low conductivity PCM

The first idea was to make a complete PCM buffer thereby reducing the required buffervolume by a factor 5 (950 kg), thanks to the small operating temperature range. Nevertheless PCM's also have less suitable properties, namely the low thermal conductivity coefficient and the volume change during phase transition.

It is shown that the effectiveness of these PCM buffers highly depends on the arrangement of the system. Some applications enhance the heat transfer by the use of conductors within the PCM, $\dot{Q}$=U · A · ΔT where U(v, ρ, k, c_p..). As developing an effective PCM storage involves a lot of numerical modelling, because of the solid/liquid behaviour of PCM's, a simplification was made. The thermal buffer was modelled as a tube-in-tank design filled with PCM, water will flow through an extended surface tube heat exchanger in a tank with PCM as storage media, see figure 5.53. Experimental studies can be used to optimally design a cold PCM storage and to simulate the behaviour.[76, 77]
The ϵ-NTU method determines the effectiveness of the PCM storage system like for a heat exchanger. The thermal resistance to heat transfer from a PCM was investigated and it followed that the tube spacing is an influencing parameter. Also the PCM melting temperature is crucial in this design and is best near the temperature of the heat transferring fluid. The heat exchange effectiveness typically decreases with increasing flow rate and increases with increasing heat transfer area. With sufficient heat transfer area the useful energy that can be stored can be

more than 70%, thereby showing that the tube in tank design with a suitable PCM is a good thermal storage system.

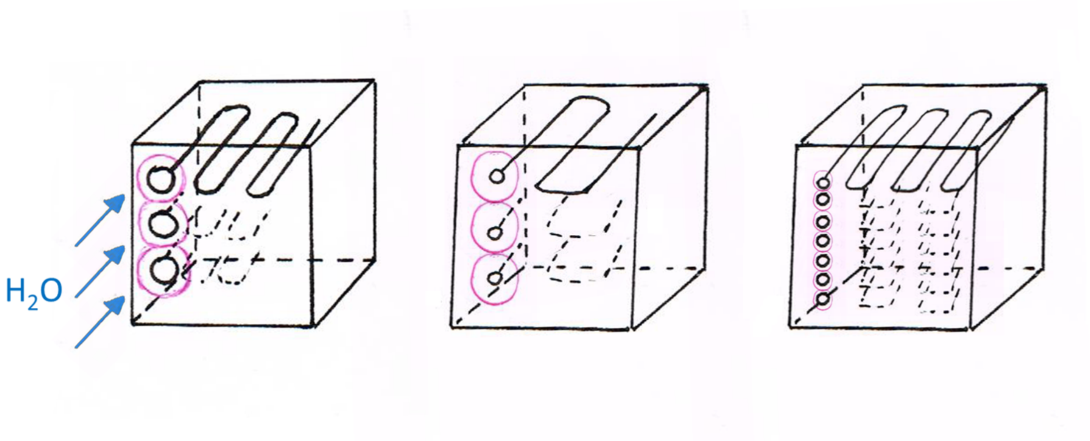


Figure 5.53: Tube-in-tank model

Based on the results from the studies a design was set up for our problem, with the tank being a cube, as shown in figure 5.53. If a power output of 2 kW during 5 hours is demanded, following the design tool there must be 3 layers of 3 tubes in series within the tank, as shown in the middle model of figure 5.53, to achieve the necessary energy. The PCM buildup is shown by the pink circles. However with this design the power output cannot be reached due to the high thermal resistance of the PCM. To achieve a cooling load of 2 kW during one hour, the ideal solidifying diameter of PCM is smaller. Consequently resulting in 7 layers of 7 tubes in series, right cube in the figure, and a lower thermal resistance. Therefore a higher power output is possible, being 0,9 kW for a mass flow rate of 1250 l/h and incoming water temperature of 20 °C. For this example the correlation between mass flow rate and pressure drop is shown in figure 5.54. By increasing the mass flow rate through the tubes the power output increases as well as the pressure drop. However this pressure drop is negligible compared to the pressure drop over the air-to-water heat exchanger.

It became clear that this buffer cannot directly condition the room, as the power output cannot be achieved. The considered design is simple because this research was not focused on the optimization of PCM storage tanks, consequently it may be possible to develop a PCM tank suitable for our design conditions, with minimal thermal resistance and maximum heat transfer.

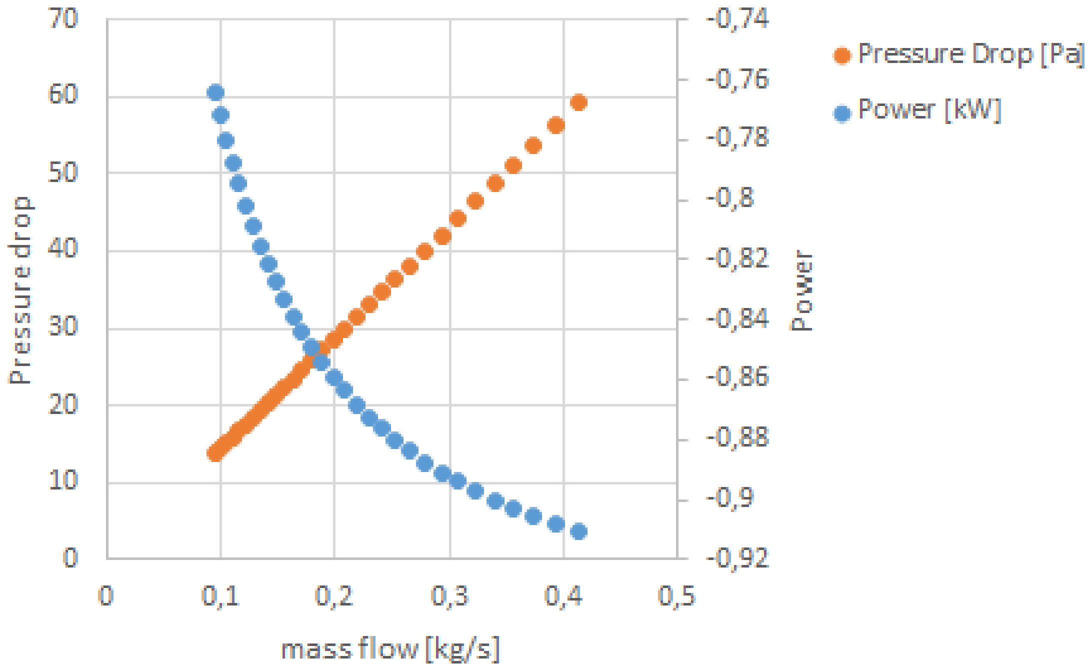


Figure 5.54: Pressure drop and cooling power of tube-in-tank design

Final design

As the tube-in-tank storage is not able to deliver the required power for indoor temperature conditioning a H_2O-PCM buffer will offer the solution. The advantages of sensible, high conductivity, and latent, high storage density, heat storage are combined in the design. Based on the design conditions of the heat exchangers and the night cooling simulation during the passive days a PCM between 13 and 16 degrees was chosen, namely the RT15 from Rubitherm. During the active days, this PCM probably won't be addressed, therefore also a SP18HC was selected.

In the period before the passive days the buffer is cooled down by the heat pump. By placing PCM in the coldest (lowest) tank 1 during the night between the passive days this tank can be regenerated by PCM RT15. The SP18HC will cover part of the loads during the last hours of the passive days. The storage capacity is increased by the PCM's, thereby ensuring comfort conditions during the second day. The temperature of the lowest tank will be damped, as shown conceptually in figure 5.55.

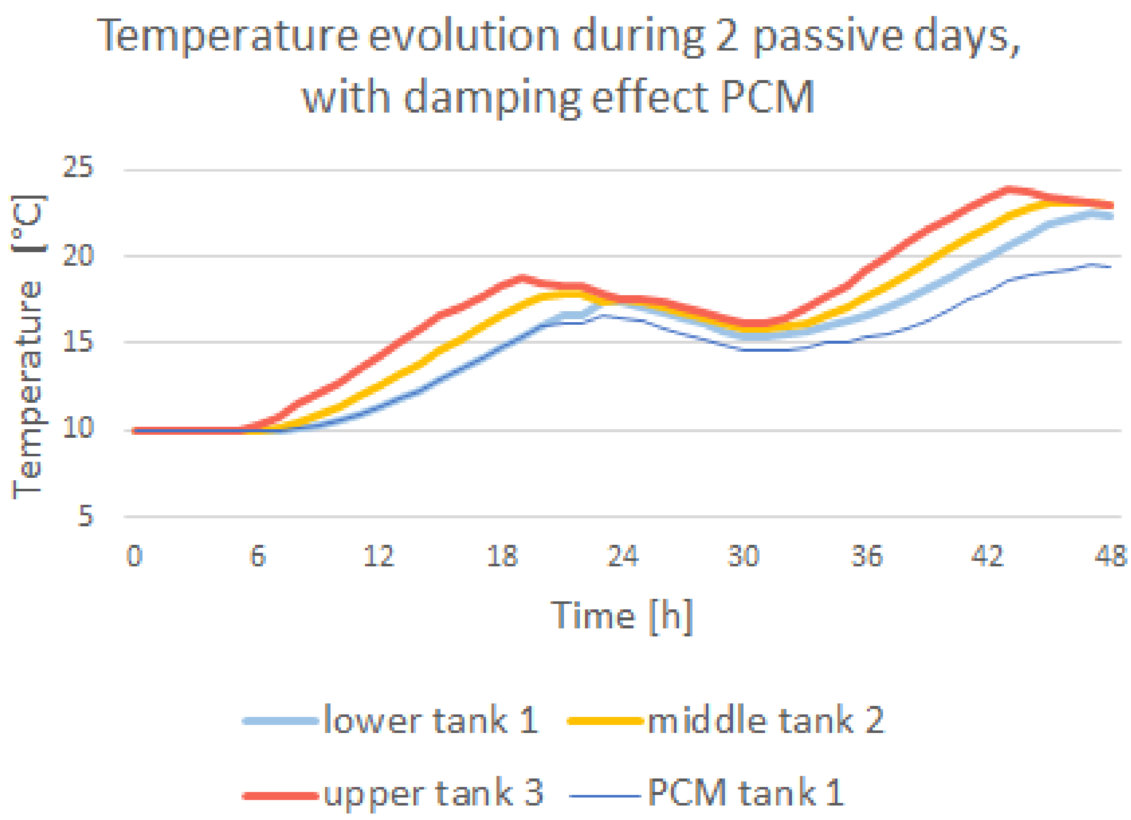


Figure 5.55: Temperature evolution during 2 passive days, with damping effect PCM

To conclude: by implementing the PCM in the buffer volume, the energy storage capacity is high enough. But the decisive factor in a PCM buffer design is the power output that must be reached. Therefore the water is used as a safety measure for the high cooling powers during daytime, discharging of the buffer. During charging of the buffer (before the passive days by the heat pump or by night cooling) high powers are not required. Therefore on these moments the PCM can be charged at low power.

The amount of PCM necessary to cover the two passive days is shown in figure 5.56. The yellow line represents the worst case in which the night radiative cooling has no effect, in reality this is not likely to occur. The green line represents the storage capacity needed to cover two days by taking the average cooling input of 7 kW by night cooling into consideration. Therefore 200 kg of PCM (0,25 m^3) is needed. So 200 RT15 and 100 SP18HC plates of 0,7 kg are placed into the lowest cubic container, see Appendix B, with a resulting water content of 2750 liters.

The energy storage attributed by the PCM is 11 kWh. This corresponds with a temperature decrease of 3 °C of the buffer. Compared to the simulation with 3 completely filled water tanks the 2 passive days will be completely covered.

In theory also a higher amount of PCM is possible, resulting in a more compact storage tank. A buffer of 1,5 m^3 can satisfy the storage and power output needs. Resulting in 1000 PCM panels of 0,7 kg surrounded by 830 liters water. This strategy was not applied due to cost reasons. And on the other hand because of the uncertainty of the night radiative cooling behaviour. A temperature of 15 °C will not be reached by the night radiative cooling and therefore a RT15 will only be addressed during the passive days. A melting temperature of 18 °C, PCM SP18HC, can be too close to the upper cooling limit temperature of the buffer tank. The temperature range of the application is so small such that selecting the right PCM is difficult and will probably result in only partly use.

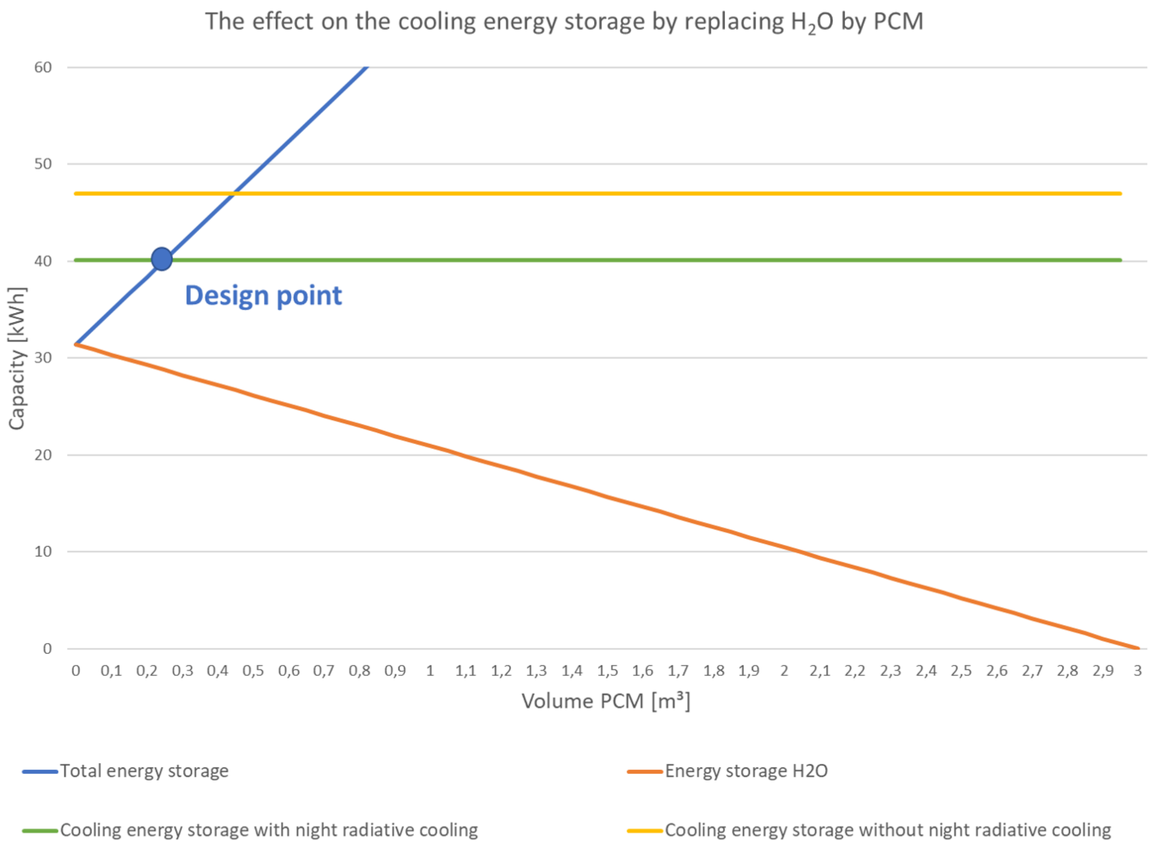


Figure 5.56: The effect on the cooling energy storage by replacing H_2O with PCM

Heat exchangers

According to the hydraulic scheme, two heat exchangers are selected. The design conditions are briefly explained below.

The first heat exchanger is the air-to-water heat exchanger, also called a cooling coil, which is installed inside the air ducts. The heat exchanger has to fit in the technical room, attached to the indoor unit of Daikin, and it must cover the cooling load. With the use of the ϵ-NTU method and datasheets of different cooling coils the cooling capacity was calculated for different water input temperatures. The chosen (and sponsored) heat exchanger is the one from Jaga out the Brise 08 unit. It's a cross flow heat exchanger with dimensions of 1,1 m x 0,3 m x 0,08 m. The coils are finned in order to enhance the heat transfer on the air side. The number of rows is 6 with a 6-tube face, the water is distributed by the header. For one coil 2 kW cooling capacity can be ensured for a $\dot{m}_{coil}$ of 1250 l/h and a water temperature of 19℃ . In order to have some safety built into the design, two units are used, thereby the heat transfer area is increased and so is the cooling capacity. On the air side as well as on the water side a parallel configuration was chosen. This results in a lower pressure drop on the water side compared to a series configuration.

Next to the night radiative cooling also the heat pump is able to cool down the buffer tank. As it is an air-to-air heat pump a modification is made. The refrigerant loop is opened and a plate heat exchanger (PHEX) is connected to the heat pump. Thereby it becomes possible to cool down water with an air-to-air heat pump. This PHEX was sized in order to cool down the buffer with 2 kW. It is assumed that a buffer temperature of 10 ℃ is feasible. Tests will have to prove it. Some models of Alpha Laval were regarded, however no design info is given in their datasheets. Therefore a model was set up to calculate the overall heat transfer coefficient, based on the geometry (conductive) and the flow properties and flow geometry (convective). The LMTD method was applied to get an idea of the cooling power. Based on these calculations the desired power can be reached with the sponsored heat exchanger AC40-42 even with a flow rate of 1 m^3/h.

Pumps and valves

Furthermore two suitable three way valves must be selected. First the necessary pipeline diameter was defined following the WTCB Report No 14: Design and dimensioning of hot water central heating systems. [78] This resulted in pipelines of 1 inch for the whole hydraulic scheme. According three way valves from Tameson with a connection of 1 inch were selected, see Appendix B. The electrical ball valves provide a robust, cost effective solution and will only be used for on-off functioning. When dimensioning a valve the authority is the determining factor, ideally it is 0,5 with a preferred range between 0,4 and 0,7. This resulted for both selected valves in a K_{vs} values of 4. However the on-off control cannot become unstable so a higher K_{vs} value only brings a lower pressure drop.

In order to complete the hydraulic scheme pumps are selected. Three pumps are needed, all with a 1 inch connection. The selection of the pumps is determined by the pipeline characteristics and the theoretical operating point of the installation. These are obtained on the basis of the total pressure drop Δp_{tot} (most unfavourable radiator circuit) and the calculated water flow.

Pump A on the scheme, provides water circulation to the cooling coils inside. The pump was designed at maximum occurring water flow rate, being 1250 l/h and corresponding pressure drop of 0,8 mlc. This is an (over)estimation as no detailed information about the pressure drop over the cooling coil was known. The pump characteristic curve should preferably be slightly higher than the theoretical operating point of the installation. Therefore an Alpha 1L 15-40 130 from Grundfos was selected. The pump characteristic together with the datasheets of the pump are given in Appendix B.

Pump B has to serve two circuits, being the one to the PVT panels for night radiative cooling, and the one to the PHEX from Alfa Laval. The unfavourable and thus determing circuit is the Alfa Laval circuit as the necessary mass flow rate must be provided. For a mass flow rate of 1250 l/h and according pressure drop of 1,04 mlc again the alpha 1L 15-40 130 from Grundfos was selected, the operating point is visible in Appendix B.

Pump C on the scheme connects the Monobloc domestic heat pump with the PVT panels. The corresponding pipeline characteristic is given in figure 5.57. According to the datasheet of the PVT panels of Climapac, 50 l/h per panel must be provided, leading to 900 l/h and a pressure

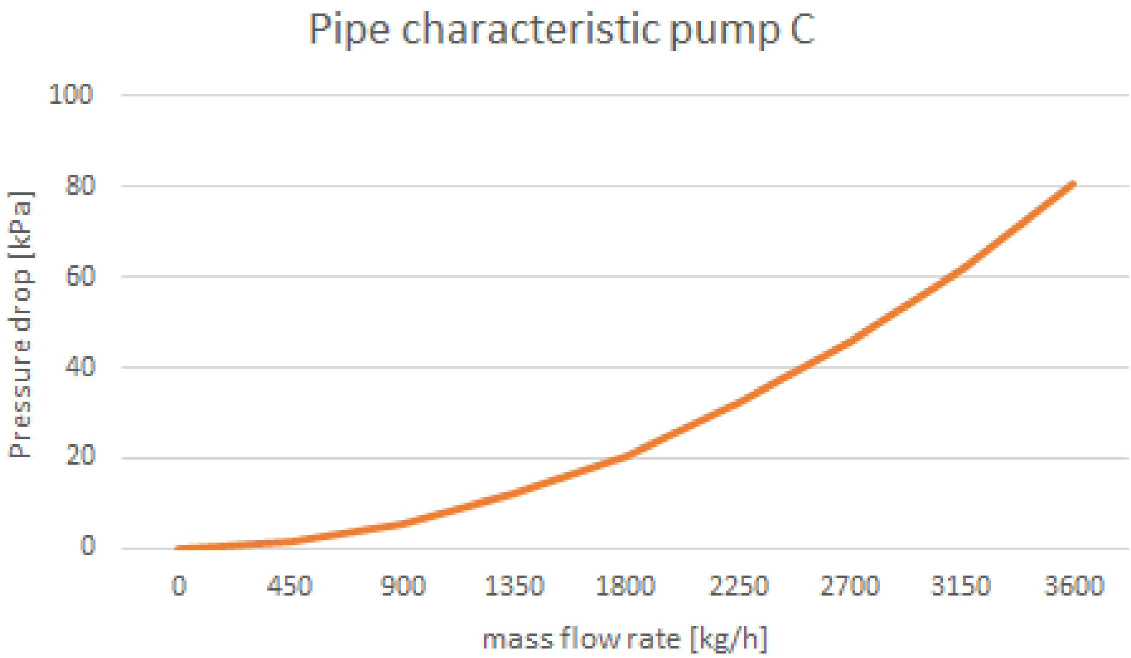


Figure 5.57: Pipe characteristic pump C

drop of 5,4 kPa or 0,56 mlc. This low pressure drop is thanks to the single pass design of the PVT panels. Again an Alpha 1L 15-40 130 from Grundfos was chosen.

5.5 Control strategy

Different possible control strategies for the system were investigated regarding the daily energy use. In order to make the system work properly on the competition site in Hungary a specific control algorithm is set up in compliance with the rules.

5.5.1 Different control strategies cooling

Three different approaches were investigated, searching for the most energy efficient control strategy. Also the (positive) effect of the passive system in summer was examined. The influence of the heat pump boiler (DHW) on the control strategy will be the same in all cases, therefore in the research this part is taken out of consideration.

Only active system: air-to-air heat pump

In the first strategy only the heat pump is used for room conditioning (no night radiative cooling). Based on the temperature distribution, cooling loads and COP of the heat pump (see figure 5.58) the resulting daily energy use was calculated, being 6,5 kWh.

Active system to cover base load, passive system to cover peaks

The minimal COP occurs when the cooling load is the highest, therefore it is useful to reduce these peak loads by the passive system. The effect of this strategy on the energy use is estimated.

From the night radiative cooling simulations, a cooling potential of 7 kWh over the whole night followed. This energy can assist the heat pump during peak periods, thereby leading to a smaller heat pump and minimizing the working in part-load (see figure 5.59). When this system is applied, the daily electricity use, pumps included, is 5 kWh so a reduction is achieved by using this buffer.

This strategy was also implemented in the MATLAB simulation, for two consecutive active days. A required daily start temperature of the buffer volume must be chosen. A relatively high tank

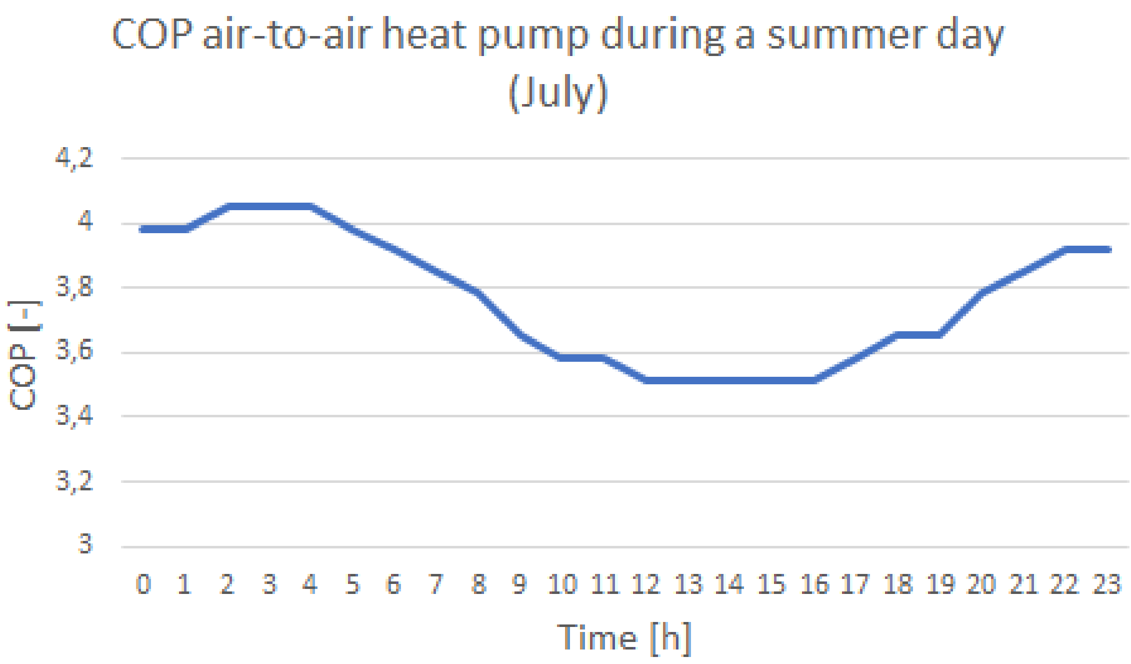


Figure 5.58: COP air-to-air heat pump during a summer day (July)

temperature reduces the heat losses to the surroundings, however the necessary power output must be ensured.
With a low start temperature the heat losses increase somewhat but even with a lower mass flow rate through the cooling coils the power output can be ensured, thereby reducing the energy use of the pumps. Heat losses to the surroundings are incorporated in the simulation for an outside temperature of 24 ℃ and lie in between the 25 and 55 Watt for respectively a tank temperature of 18 and 10 ℃.

The first simulation had a start tank temperature of 10 ℃. It is shown in figure 5.60a that the night radiative cooling doesn't have an effect at this low temperature, because of the limit due to the humidity (dewpoint temperature of 12,7 ℃, resulting in a lower cooling limit temperature of 14,5 ℃ out of the simulations). Therefore a higher start temperature in this control system is necessary. The heat losses due to storage in this example are around 50 W.

For a start temperature of 13 ℃, the cooling potential was still not fully used (see figure 5.60b), resulting in a higher start temperature of the tank at the beginning of the second day. After some trial and error the ideal start temperature was 16 ℃, because this way the buffer obtains

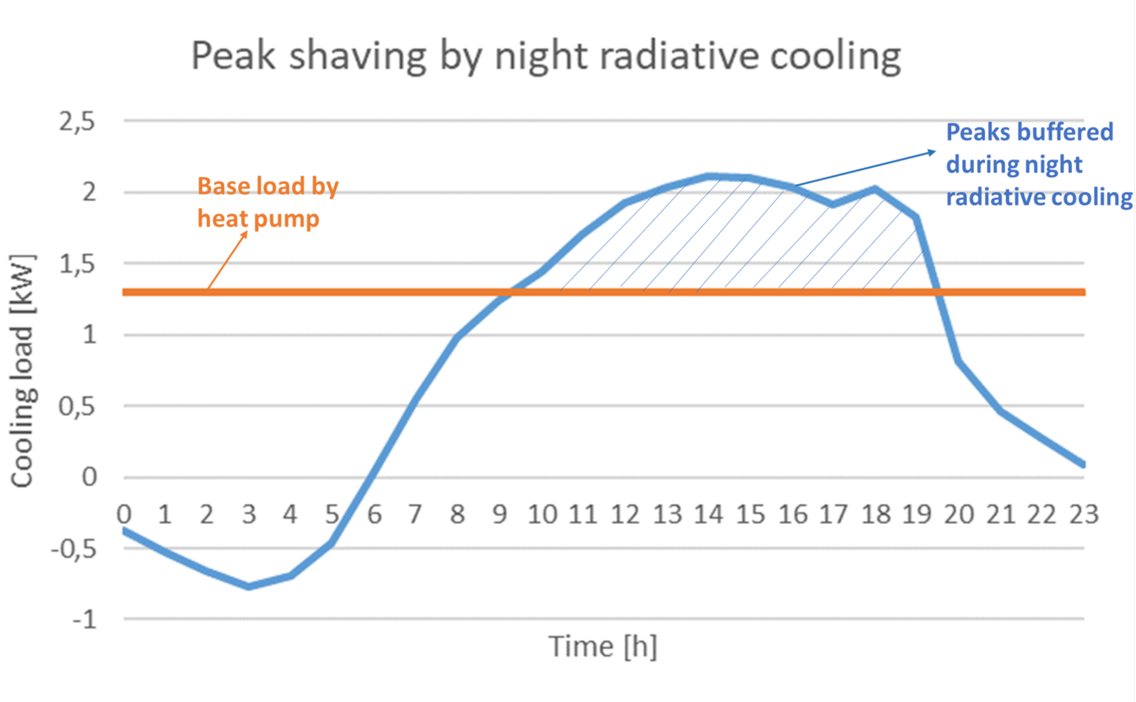
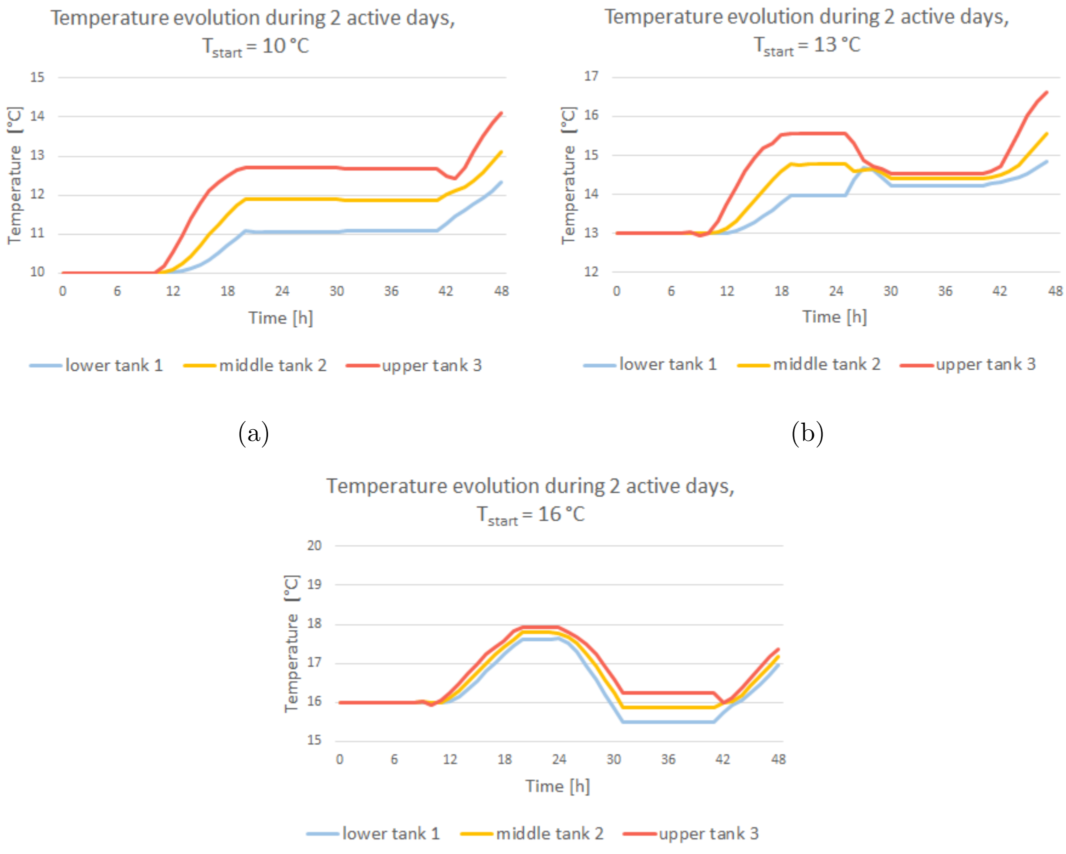


Figure 5.59: Peak shaving by night radiative cooling

a continuous temperature distribution over the days (see figure 5.60c). From this simulation follows that even 7,6 kWh cooling energy can be stored during the night.

Passive system supported by active system to cool the buffer volume

The last approach was the cooling of the buffer to 10 ℃ by the heat pump during nighttime while also operating the night radiative cooling, thereby making use of the higher COP. Of course the heat losses to the environment must be taken into account when charging this buffer. In a first estimation this strategy seems the most energy efficient, see table 5.9. However the transfer losses in the heat exchanger of Alpha Laval are not taken into account. Furthermore when simulating this idea in MATLAB an interesting phenomenon shows up. By cooling the tank during the night by both, passive cooling and the heat pump, the night radiative effect is reduced by 4,4 kWh per night due to the lower tank temperature. This reduction must be compensated by extra cooling from the heat pump, which again lowers the night radiative output. Therefore this control strategy basically overacts the passive cooling system. From tests must follow if it would be useful to regenerate the buffer to 16 ℃ in the morning by the heat



(a) (b) (c)

Figure 5.60: Temperature evolution during 2 active days, start temperature (a) 10 ℃ (b) 13 ℃ (c) 16 ℃

Table 5.9: First estimation daily energy use from control strategy: passive system supported by active system to cool the buffer

Daily cooling energy demand	**23,5**	**kWh**
Cooling energy by night radiative cooling	7	kWh
Heat losses	0,72	kWh
Cooling needed by heat pump	17,22	kWh
Cooling power heat pump/ heat exchanger Alpha Laval	2	kW
	9	hours
COP heat pump during night	5,2	
Electricity use heat pump	3,3	kWh
Electricity use pumps	0,245	kWh
Total	**3,6**	**kWh**

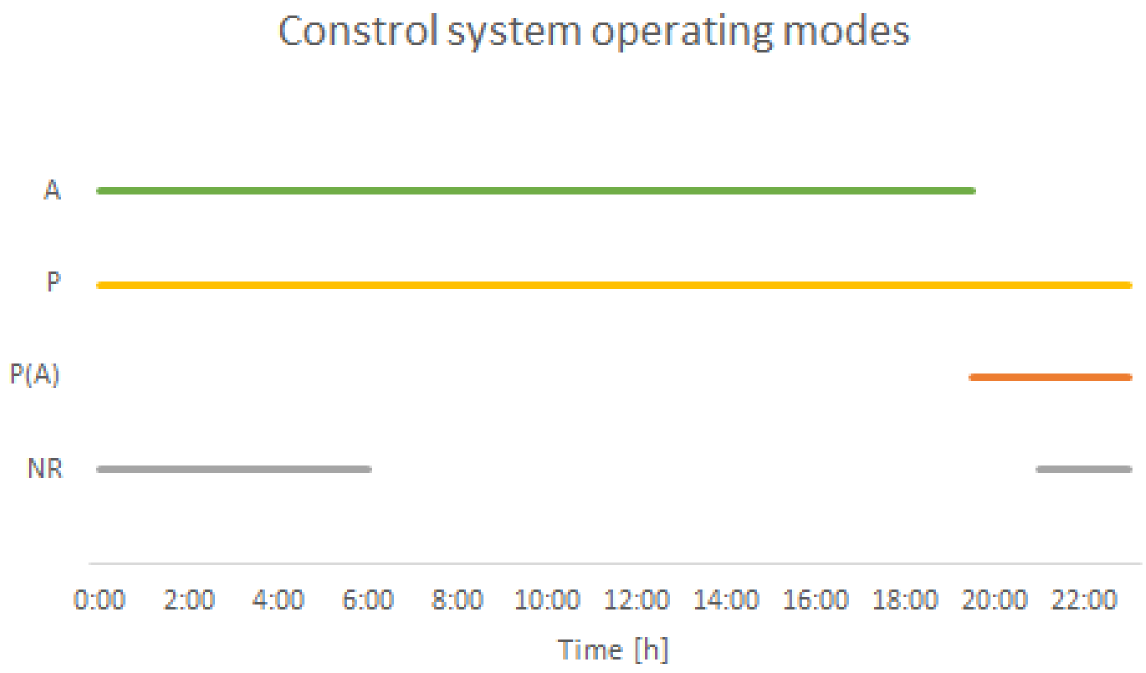
pump when an overcast night occurred.

5.5.2 Applied control strategy in the Mobble

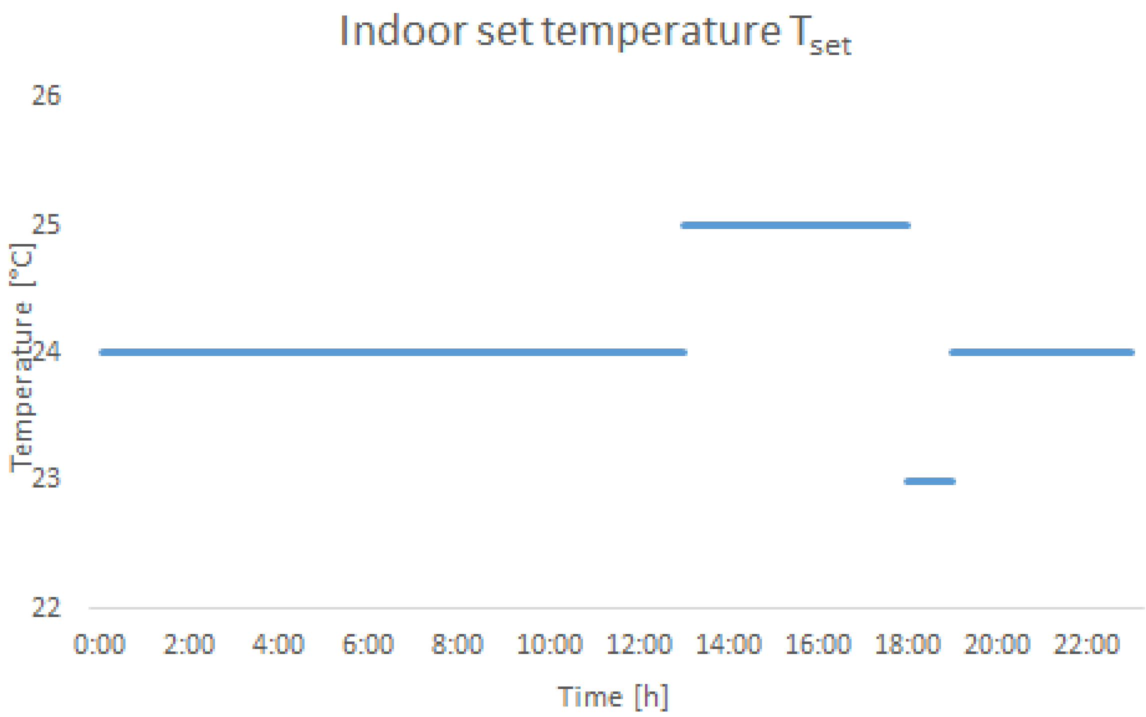
Ventilation, DHW and air conditioning are split up for the ease of control. During the competition only the cooling mode of the heat pump will be used. Electrical batteries on the ventilation are used to heat the building during night when necessary. This decision was made to be sure that the buffer volume will not be heated due to bad control.

Heating and cooling

In the competition penalty points are received when electricity is taken from the grid during the evening hours from 19:30 till 22:30 i.e. when the grid is overloaded. The applied control strategy takes this into account. Furthermore for the two consecutive passive days a different control mechanism is used. This resulted in four different control strategies, their operative timespan is shown schematically in figure 5.61a.



(a)



(b)

Figure 5.61: Control strategy with indoor set temperatures

- Active strategy (A): The air-to-air heat pump is responsible for the conditioning of the rooms.
- Passive strategy (P): This strategy is applied for the 2 consecutive passive days enforced by the competition. The control will already start in advance.
- Passive (Active) strategy (P(A)): This strategy is applied during the grid overloaded hours, when the passive system is not able to fully cover the loads, the active system can assist.
- Night radiative cooling (NR): This strategy is applied during nighttime (no solar irradiation).

Also the temperature range and moments of measurements are defined by the competition, thereby influencing the set point indoor temperature, shown in figure 5.61b. For each specific hour and day the strategy and the indoor set point temperature are determined. The different valves and sensors of the passive and DHW system are indicated on figure 5.62. The different circulation possibilities with corresponding activated pump and valve positions are shown, however a combination is possible.

Pump A has 3 operating points, with mass flow rates 250 l/h, 750 l/h and 1250 l/h. The pumps B and C have a fixed mass flow rate of 900 l/h and are on-off controlled as well as the valves.

Active strategy

The air-to-air heat pump (HP) is controlled by determining its set point temperature, fan speed (five settings) and cooling/heating mode. Based on the flowchart given in figure 5.63 the operating mode, explained below, is determined. However all the time: $T_{set,HP}=T_{set}$

1. Temperature extreme high
   - tube fans: 100%
   - HP fan: 5
2. Temperature high but not extreme
   - tube fans: PID

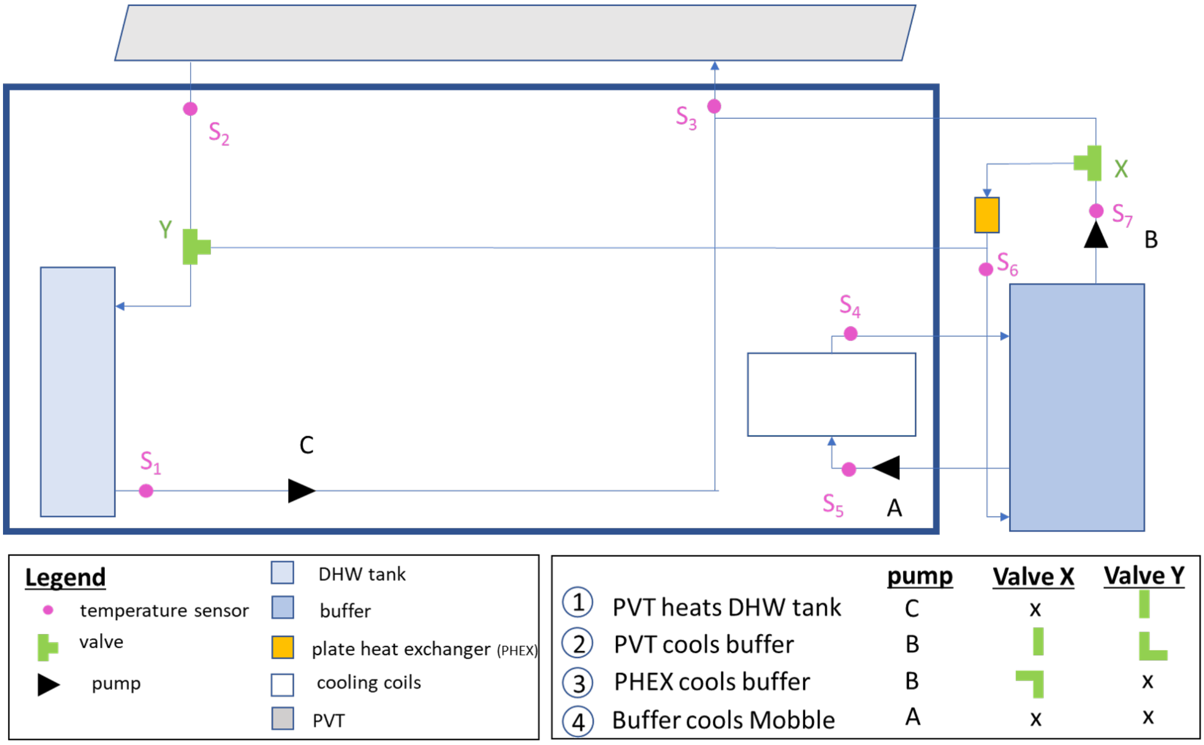


Figure 5.62: The implementation of the control of the technical installations (passive + DHW system)

- HP fan: 2

3. One room too high in temperature

   - tube fans: one PID, other out
   - HP fan: 1

4. Temperature drops below the limit

   - HP and fans out
   - if T_{living} or $T_{bedroom}$ < 21 ℃, electrical batteries in ventilation ducts (independent control)

Passive strategy

Before the passive days start the buffer volume will be cooled to 10 ℃ by the heat pump via the plate heat exchanger on figure 5.62, as has been explained. During the passive days only

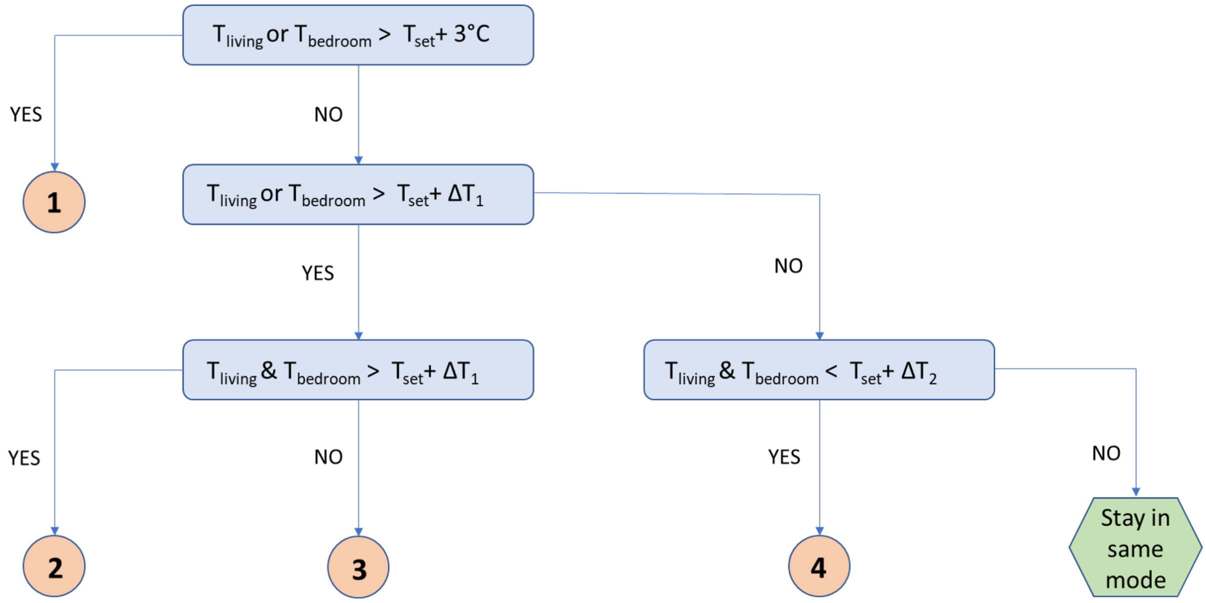


Figure 5.63: flowchart active strategy with ΔT_1 =0,2 ℃ and ΔT_2 = -2 ℃

this buffer can be used to condition the room.

The objective is to have T_{living},$T_{bedroom}$ = T_{set}, therefore two parameters can be controlled, shown conceptually in figure 5.64:

- air mass flow rate $\dot{m}_{air}$ over the cooling coils, by changing tube fan speed
- the water mass flow rate $\dot{m}_{water}$ through the cooling coils, by pump A

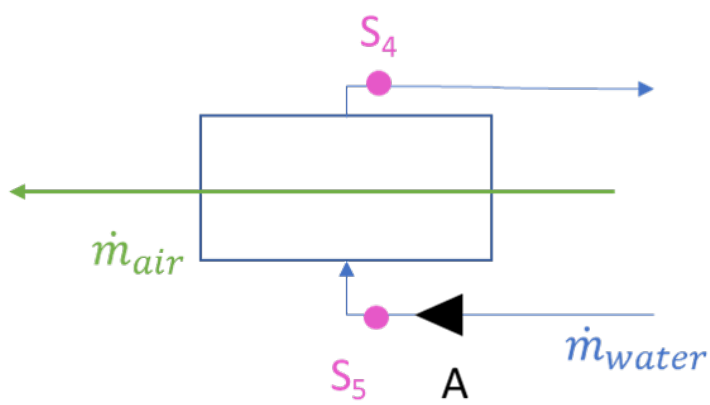


Figure 5.64: Control parameters passive system

The fans are PID controlled and the pump has 3 operating points. When the temperature rises above the setpoint temperature the tube fans start and pump A goes in mode 1. The idea is to first speed up $\dot{m}_{air}$ (in order to maintain stratification in the H_2O-PCM buffer) to attain the cooling power, followed by the increase of $\dot{m}_{air}$.
If the fan is working at 100% for 3 minutes, pump A goes one mode higher.
Else if the fan is working at <40% for 3 minutes pump A goes one mode lower.

If T_{living} or $T_{bedroom}$ < 21 ℃, electrical batteries in ventilation ducts (independent control)

Passive (Active) strategy

This strategy uses the passive system, but the active system (heat pump) can assist when necessary. The control mechanism is equal to the passive strategy control, however for:

1. Temperature extreme high: T_{living} or $T_{bedroom} > T_{set}$ + 3 ℃
   - HP on: $T_{set,HP}$=T_{set} until $T_{set} < T_{set}$ + 0.2 ℃
   - tube fans: 100%,
   - pump A: mode 3

Night radiative cooling

The strategy works in parallel with one of the other modes and is activated around sunset (21h) when $T_s < T_1$ -0,1 ℃. Pump B starts to operate and valve X connects the buffer with the PVT panels. This valve position is maintained during the whole night.

When circulating the water through the PVT panels during night, a cooling effect of the buffer must be guaranteed otherwise the pumping energy is lost.
If $\Delta T = S_7 - S_6 < 0{,}05$ ℃ the pump is stopped. In order to restart every half-hour a test can be done to see if the necessary cooling output can be achieved, but this can result in on off behaviour.
Another approach is checking the temperature change rate of the panels when no water is circulating. If $T_1 - T_s > 0{,}05$℃ and $\frac{dT_s}{dt} > 0{,}5$ ℃/h the cooling power of the panels is high enough to cool down the buffer. However this rate decreases when T_s drops so the circulation also starts again when $T_s < T_1$ - 0,5 ℃. This control algorithm will be fine-tuned by testing.

Domestic hot water

For domestic hot water production by the PVT panels pump C is set at a fixed mass flow rate. The on-off behaviour of the pump is based on the temperature difference S_2 - S_3 over the panels. The heat pump boiler has its own control. In a more advanced stadium of the project it is also possible to connect the heat pump boiler to the inside and outside of the building. In summer, by activating the production of hot water with the heat pump boiler, heat is removed from the inside and the room can be cooled.

Ventilation

The control for ventilation works automatically, however it is possible to intervene manually during 5 hours when needed. The D_{flow} system measures the indoor CO_2 concentration and controls the corresponding air supply. It is a demand based ventilation system, fitting perfectly in the Mobble approach. In figure 5.65 a comparison was made between a nominal flow vs a demand based supply for the Mobble in Hungary. The decreasing total air supply results in a decrease of the total energy use.

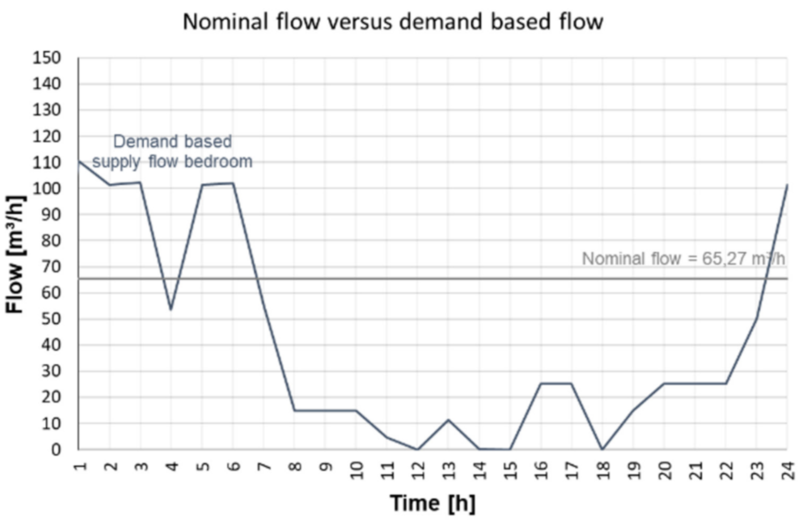


Figure 5.65: Nominal flow vs demand based flow [62]

5.6 Concept

Finding an ideal installation that meets the requirements of the competition was preceded by trial and error. A lot of systems were proposed, but every time another problem or gap in the concept showed up. The final design and concept of the HVAC system is presented in this section. The dimensioning of the different components is explained in the next chapter and was based on the load calculations. In order to make the analysis and the control system of the technical installations of the Mobble simple and robust, we decided to decouple the ventilation, DHW and the air conditioning system. This approach makes sure that DHW and ventilation can be provided in any circumstance, even when there is a malfunctioning of the airconditioning. The concept and focus of the technical installations is schematically shown in figure 5.66.

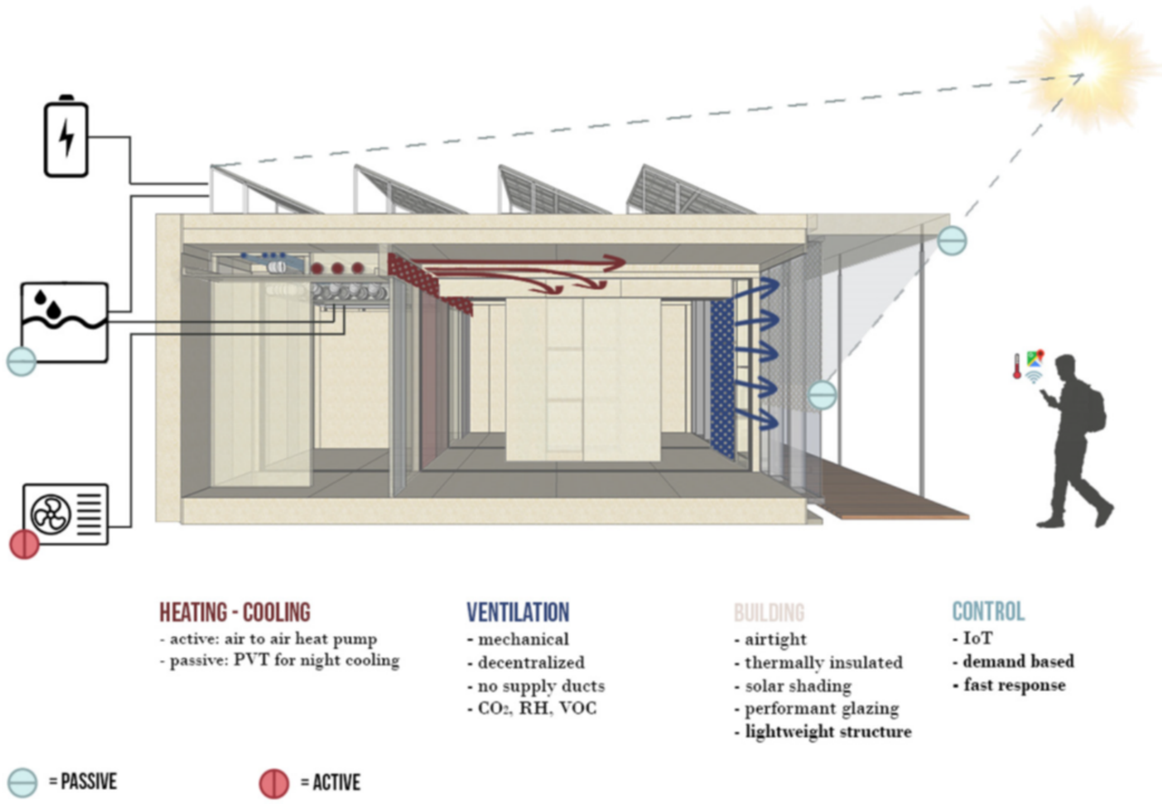


Figure 5.66: Concept of the technical installations [62]

5.6.1 Ventilation

For ventilation a clear similarity is found in the application between the pavilion and the renovation of Etrimo buildings. Etrimo apartment buildings need new ventilation systems, which will be provided efficiently in the façade renovation through a technical panel. In our pavilion this panel is placed in the glazing façade, thereby splitting the curtain wall between the living room and bedroom.

The ventilation system implemented is a D_{flow} system provided by Jaga, integrated in the technical panel (see Appendix A). Two air supply boxes are installed, for each supply room individually, at the bottom of the technical panel. Thereby providing fresh air to the living room and bedroom. These boxes will be connected to the exterior. The air is blown through a battery which might preheat the incoming air in severe winter conditions when the heat pump is not able to work efficiently. These batteries are also used during the competition during the summer months, to prevent that the temperature drops below the 21 ℃, in reality these will not be used in summer.

The exhaust box for the whole apartment is located at the top of the technical panel. Three separate zones can be controlled by the exhaust box, so extraction will occur in the toilet, kitchen and bathroom. This air is channeled to the technical room, where they come together in a uniflex box. From there, the air is guided through a bigger air duct in the closet into the exhaust box. The distribution network of the ventilation together with the uniflex box can be seen in the 3D figure 5.67 and on the floor plans provided in Appendix A.

The D_{flow} system provides a controlled mechanical ventilation supply which is in balance with the exhaust rooms. This makes it possible to reduce the energy costs of a ventilation system D, since fresh air is only supplied when actually needed. The technical fiche of the D_{flow} system is added in Appendix B.

5.6.2 Domestic hot water

Domestic hot water will be provided by a heat pump boiler, combined with PVT panels. By this connection we can support the DHW of the Mobble with renewable energy and the passive

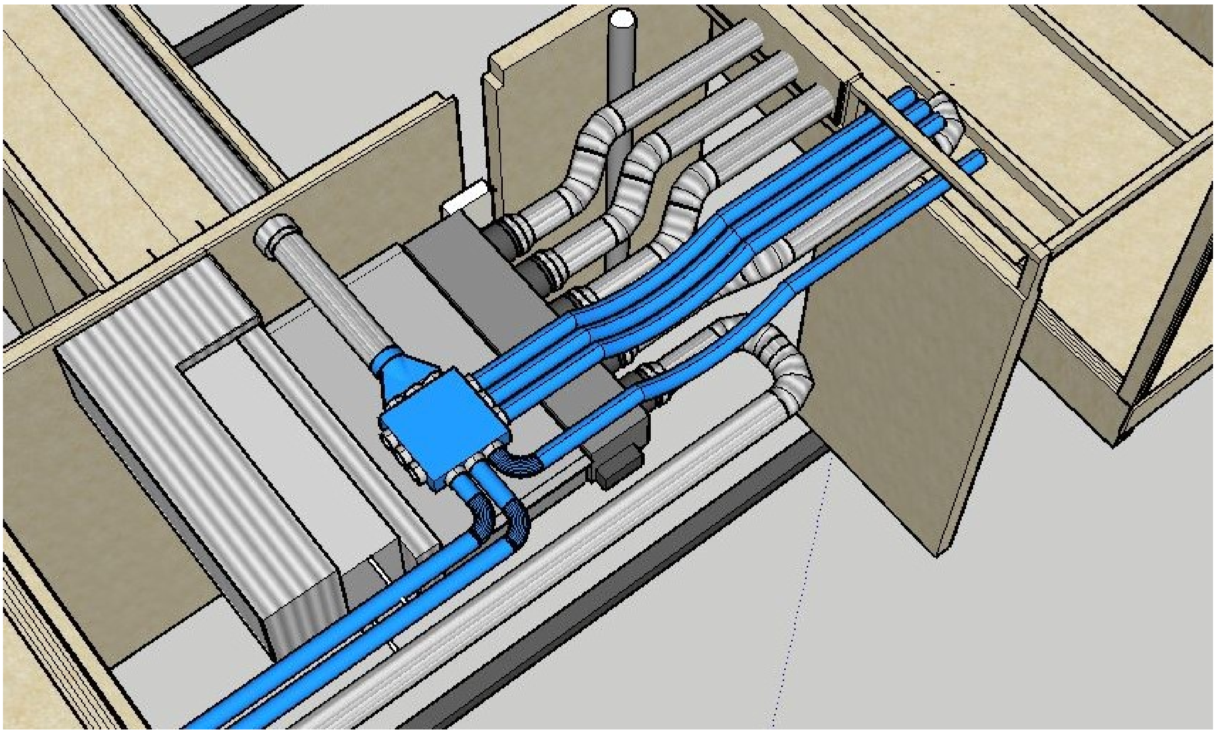


Figure 5.67: 3D top view of the technical room with in blue the ventilation system and in grey the air conditioning and distribution system [62]

days can be covered when a big enough storage tank is provided. Besides that, the system can be optimised for off-hour peak production, which is also supported by the rules.

The heat pump boiler will be placed in the technical room of the Mobble, as it is not that big and easy transportable. A heat pump boiler extracts heat from the air in order to condition the water. Different configurations of the air piping to and from the heat pump are possible. One of the peculiarities of this system is that it can cause a considerable reduction of the air temperature inside in addition to domestic hot water creation. As such we will use this peculiarity to lower the high cooling load in summer whenever possible. Therefore, the inlet and outlet of the heat pump boiler will be connected to the outside area and to the technical room. The heat pump will choose the most efficient way to heat up the water, without undercooling the building.

The PVT panels connected to the heat pump boiler have a stagnation temperature of 70 ℃, so the panels are prevented from overheating. The use of thermal solar energy to provide DHW will considerably lower the required energy use. Furthermore, the heat pump boiler fits perfectly in the renovation concept of Etrimo apartment buildings as it can be used as a collective system

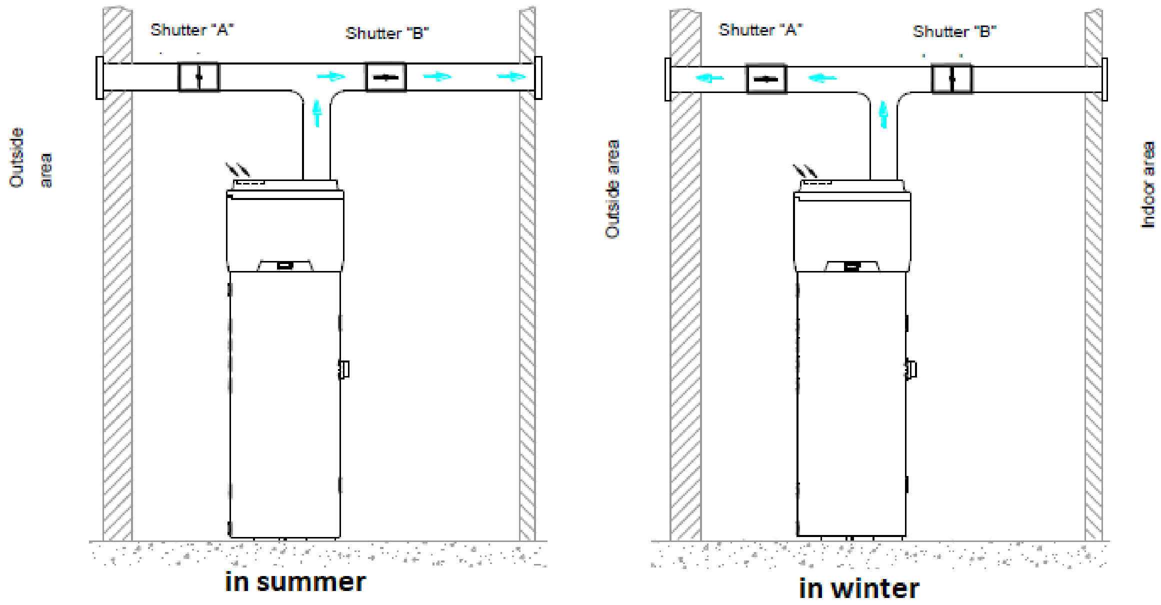


Figure 5.68: DHW and space cooling [63]

and is connectable to any existing system.

5.6.3 Active system

For the active system the first objective was to use an air-to-water heat pump combined with an efficient low temperature emission system, such as a radiant floor or ceiling. However this idea did not fit in the renovation story of the Mobble, due to the long reaction time of these systems.

Therefore an air-to-air heat pump was selected to provide thermal comfort in the Mobble. The COP of air-to-air heat pumps is higher compared to air-to-water systems, since there are less heat transfer losses. In heating mode, the heat pump extracts heat from the outside air by the outdoor unit, even in cold weather. For cooling the system is reversed, thereby it is possible to use the same equipment for cooling and heating. The air-to-air heat pump uses an electrically powered compressor and is extremely effective at heating or cooling a flat or a house by the indoor unit.

In this way, 80% of the energy used to condition the Mobble comes from the outside air, a free and infinitely renewable resource. As an air-to-air system cannot fulfil the requirement of thermal comfort on passive competition days and air has a low specific heat capacity, an additional water storage system will be provided.

This air-to-air heat pump will supply conditioned air to the living area and the bedroom via an air gap connected to the false ceiling, shown in figure 5.66. Meanwhile, unconditioned air is sucked in at the end of the closet, thereby providing a good circulation (see figure 5.45). The implementation inside the technical room becomes clear from figure 5.67 and 5.69.

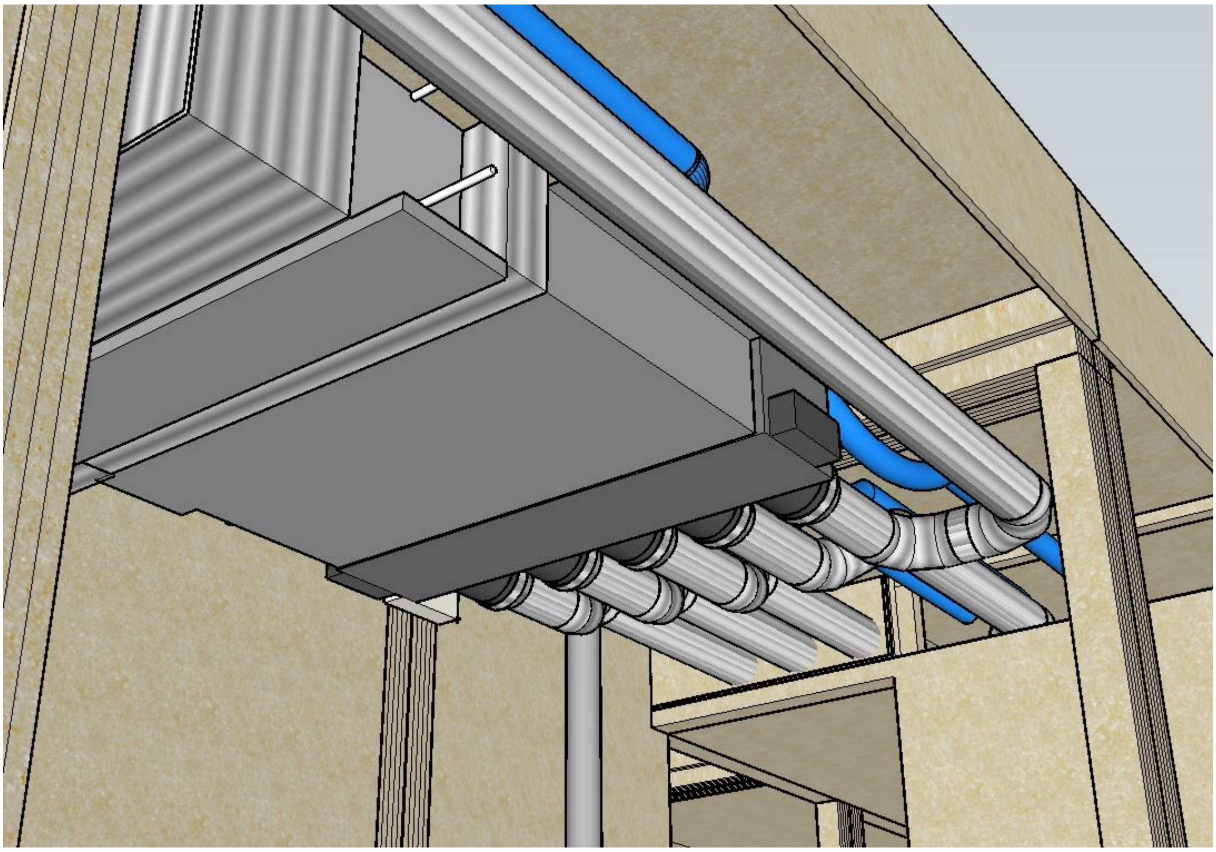


Figure 5.69: 3D bottom view of the technical room with in grey the air conditioning and distribution system [62]

5.6.4 Passive system

For energy efficiency in the Mobble there is deployed on demand based control and passive strategies. These passive strategies are encouraged by the competition, because the Mobble must be thermally conditioned during two passive days in the competition. But also the electricity use of the Mobble is scored, therefore an innovative passive system was conceived to shift the peak loads. As cooling issues are gaining interest, and the competition takes place in summer, the passive system was mainly designed for cooling purposes. However it can be adapted to winter conditions, for the sake of completeness this modification is shortly described in the end of this section.

Passive cooling

The passive cooling of the Mobble is achieved by the night radiative cooling of a H_2O-PCM buffer by PVT panels. As the control for the use of passive cooling is different during active days compared to the two consecutive passive days, a distinction was made.

During the active days two approaches are possible when coming to the application of the cold H_2O-PCM buffer during daytime. On one hand, the passive strategy can be used to apply peak shaving all day long, thereby leading to smaller active systems (see figure 5.59). On the other hand it can be used to shift the peak loads of the heat pump, by using the passive cooling when the grid is overloaded. The peak load will then take place around noon, when an overproduction of electricity by the PVT panels is likely to occur.

In the competition points are lost when using electricity in the evening, so the second approach is applied, however depending on the performance of the PVT panels for night radiative cooling the passive cooling can be activated earlier. The principle is explained based on figure 5.70.

When the sun comes up, around 6:00 am, and the habitants wake up the temperature inside the house starts to rise. Once higher than the indoor set point temperature the active system (heat pump) starts to operate. At the same time the PVT panels are used to generate DHW. If there is not sufficient solar energy the heat pump boiler is activated, thereby removing heat from the technical zone.

Around 7:30 pm the electricity grid is heavily loaded, so the passive system is activated. The buffer volume heats up slowly, while cooling the building. If the set point temperature is not reached the heat pump can help out. This regime is operated as long as the delta T over the cooling coils is high enough.

After sunset, around 9 pm, the night radiative cooling starts. The pump is switched on and the H_2O-PCM buffer is cooled down by thermal radiation against the night sky. This principle is applied as long as advantageous.

During the passive days the principle is nearly the same, however two consecutive days must be bridged. Therefore before the start of the passive competition the buffers will be charged directly by the air-to-air pump (see figure 5.71). Presumably a maximum of 17 hours will be needed to cool the buffer from 20 to 10 ℃, tests will give a more accurate estimation.

Passive heating

The applied passive system can also be used during winter times. However cold winter days are mostly sunny. Therefore when the DHW tank is charged, the excess solar heat can be used to heat up the H_2O-PCM tank. This heated tank will condition the air through the air-to-water heat exchanger and can be used to cover part of the heat load. The control mechanism stays nearly the same only the night radiative cooling is replaced by day radiative heating. The 'summer' PCM inside the buffer can be replaced by a PCM with a higher phase change temperature, probably between 25-30 ℃, however specific simulations of the heat gain of the PVT panels is needed. The PVT panels will stay untouched during night time.

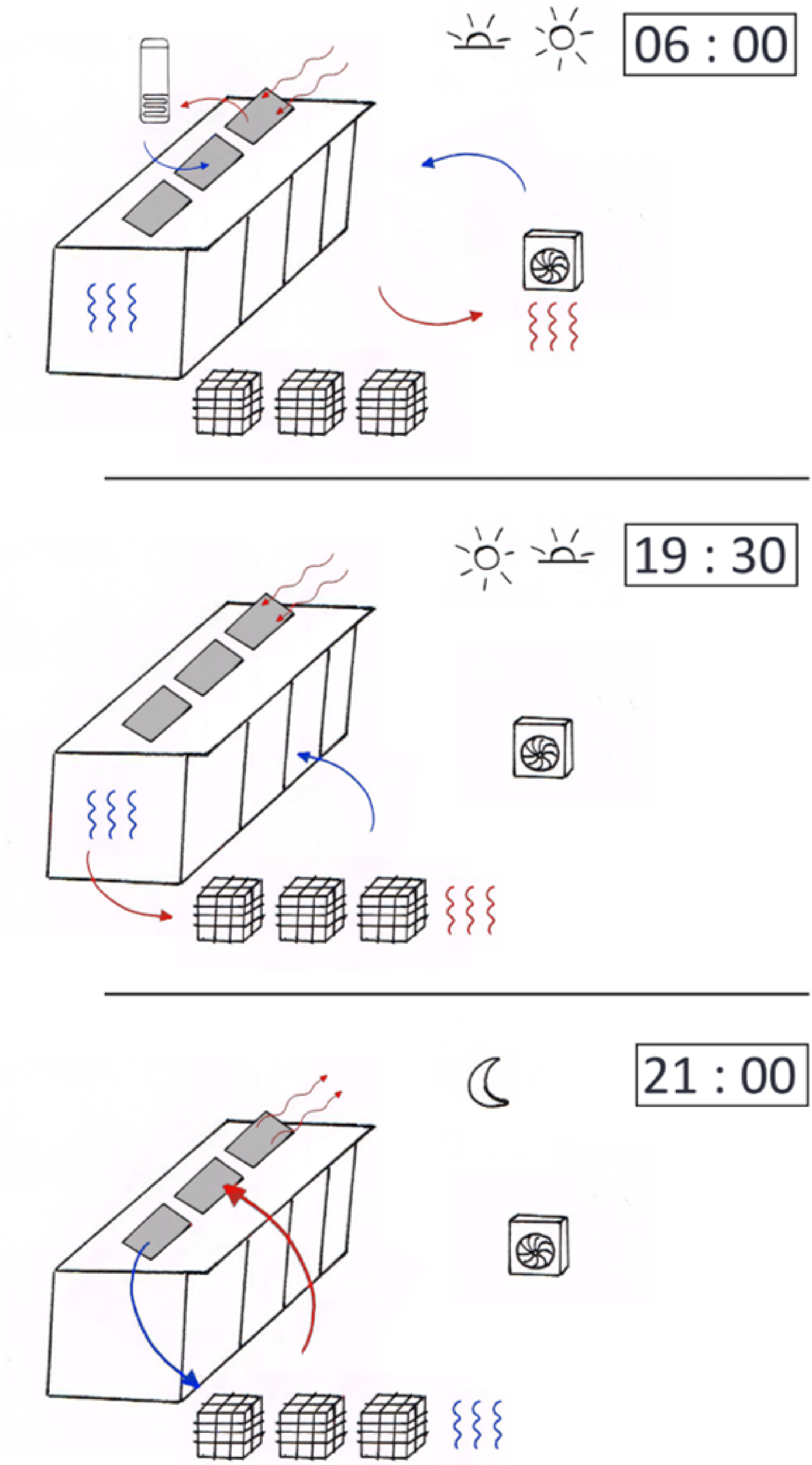


Figure 5.70: Working principle system on active days

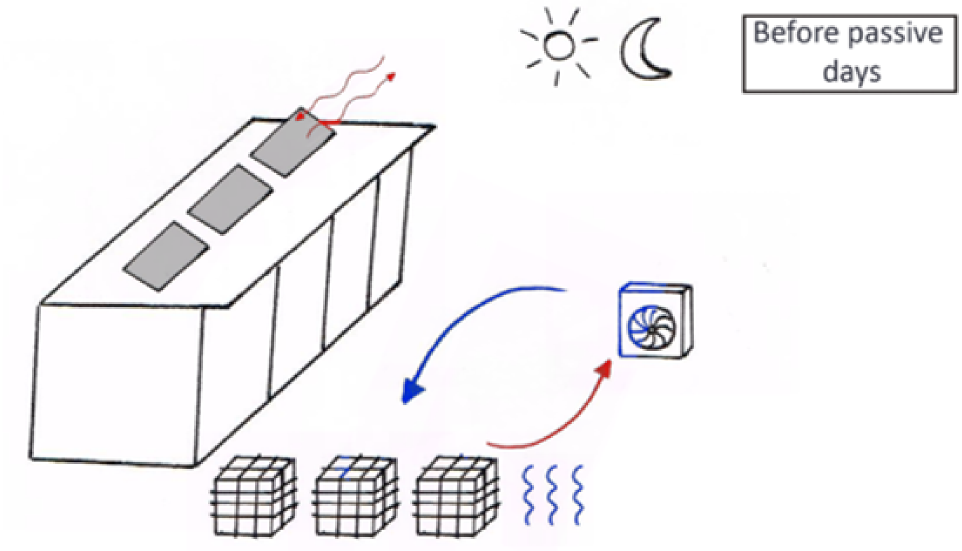


Figure 5.71: Working principle system before the passive days

Chapter 6

Conclusion

Due to the rising CO_2 emissions the Earth is warming up, resulting in major natural disasters such as floods and hurricanes. These will increase in number and severity and the many climate marches of 2019 confirm the need for action. In order to achieve the climate goals for 2050 the CO_2 emissions in buildings must decrease by 90%. As HVAC systems comprise a large part of the building energy use, the design of an energy efficient HVAC system is a hot topic. This study is performed in the context of the Solar Decathlon Europe 2019 (SDE19) competition in Hungary and aims to find an innovative energy efficient HVAC design for the Mobble (SDE19 house of team Ghent University).

First the Mobble concept was investigated in order to match the HVAC system with the compact and modular building block. *Therefrom the idea followed to move away from slow systems and to bet on fast reacting systems inside a lightweight building.* Two main principles will reduce the energy use of the Mobble: demand based control and passive strategies. Also renewable energy had an important influence on the design process.

Hungarian and Belgian weather data were studied and load calculations performed. Different state-of-the art methods for an energy efficient HVAC design were investigated and checked if feasible for the Mobble. In the first place solar energy will be exploited by passive strategies and by PVT panels. These PVT panels provide electricity and domestic hot water. For both storage is needed in order to match demand and supply.

By constructing wooden buildings the thermal inertia is removed, thereby enabling a high demand based control. Though higher peak loads and temperature fluctuations can be expected. *For comfort one needs fast reaction time together with the smoothening effect of the thermal mass.* In order to optimize the installed capacity and hence the specific energy consumption it seemed logical to find a possibility to store excess energy and to reuse this to realize peak shaving. A research was conducted into energy storage with following features: light, compact, fast response and cheap. This led to the implementation of a basic H_2O-PCM storage tank.

Global warming increases the cooling energy requirement for buildings. To meet this growth without increasing the emissions, more efficient cooling technologies and green electricity are needed. But even a more radical way of thinking is vital i.e. the implementation of passive cooling strategies. As the competition takes place during summer, a perfect opportunity arose for the implementation of a passive cooling system. Night radiative cooling by the PVT panels was investigated, based on theoretical literature and experimental studies. During nighttime this strategy will cool down the H_2O-PCM storage tank. In this way the cold storage can be activated when the grid is overloaded and electricity is more costly. Also a shift of the peak load to off-peak hours for cooling demands is possible.

A model of the system was made and also a control system was set up. Simulations were performed and the effect of the night radiative cooling on the system efficiency has been considered. It became obvious that the energy use can decrease with 25% compared to a purely active cooling strategy. It demonstrates the feasibility of cooling using night radiative cooling in combination with a buffer tank. Though it is not yet possible to completely cover the cooling load by passive strategies.

The dimensioning in this work was developed for this particular project. Nevertheless every system depends on the building design, needs of the habitants and geographical location. However the approach of cancelling the thermal inertia inside the building, while maintaining its favourable properties next to the building shows great opportunities for the near future. It can bring a breath of fresh air to the building sector. Also the use of night radiative cooling by PVT panels or thermal solar collectors has shown its profit. Even though night radiative cooling is a well-researched area it is seldom applied in buildings. Hopefully this strategy will gain interest as the extra cost is nearly zero and in particular in more southern located countries it can offer significant energy savings, because of the higher temperature difference between day and night and the common open night sky.

The main behaviour of this system still needs to be tested. Therefore the analysis of the data coming from measurements on the Mobble could give an extra dimension to this research. After the competition it will become clear if this prototype meets its expectations. In the future, one could even think about the implementation of complete PCM cold storage buffers, thereby increasing the compactness of the system. Also a continuation of the recent researches to nanophotonic surfaces with a high emissivity inside the atmospheric window as well as a high solar reflection is necessary.

Chapter 7

Addendum: HVAC systems in single family houses

Abstract

Heating, Ventilation, and Air Conditioning (HVAC) system installations are representing a wide field, but often the objective is to provide a comfortable environment for the human occupants. But what exactly is thermal comfort and how is an accurate system chosen?

The pros and con's of air-air, liquid-liquid and hydronic systems are discussed in this chapter. To conclude the integration of different energy sources is covered, since this can be one of the principles to achieve the target of nearly net zero energy buildings (NZEB).

7.1 Comfort

Heating, Ventilation and Air Conditioning (HVAC) systems are an important part of a healthy, comfortable and energy-efficient building. Maintaining optimal temperature and air circulation are the basis of a comfortable indoor environment. Satisfying the thermal comfort of occupants is done by adjusting the outdoor air conditions to the desired condition of the building. HVAC systems are used in different types of buildings such as industrial, commercial and residential.

Since HVAC systems are the largest energy consumers, this calls for sustainable solutions while ensuring a comfortable indoor climate for the inhabitants. This seems obvious until you consider the variety of factors that influence the comfort of an individual (see figure 7.1).

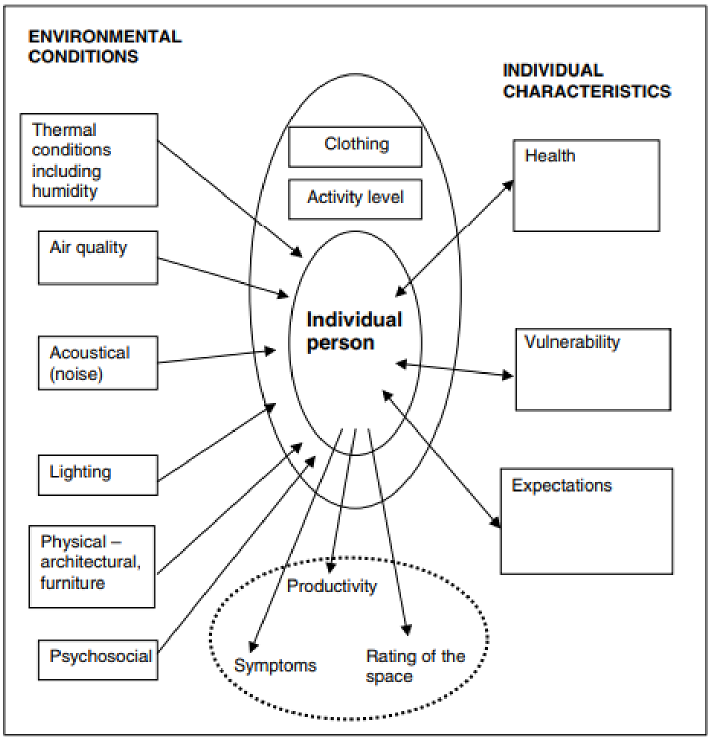


Figure 7.1: Personal environment model [79]

From this variety, only thermal comfort is primarily controlled by building's HVAC systems, though the architectural aspect may also have influences. There are six factors affecting thermal comfort.[79] Air temperature, radiant temperature and humidity are factors that can be controlled by the air conditioning system as well as the air speed. But also the level of activity, determines the amount of heat released to the environment, and clothing, acting like an insulator, influence the comfort experience.

Consequently only air temperature is not always a good indicator of thermal comfort. The design of the building and individual choices can have major influence.

Choosing an HVAC installation is a complex task as a result of the great variety of systems. Various systems must be considered during the design and a good interaction between the engineer and architect is necessary. The total package has to fit. The selection of the HVAC system will depend on the climate, age of the building, location issues, budget, indoor requirements and client issues, the architectural design of the building.

The design and dimensioning process should involve following steps[80]:

1. Load calculations of the building, how do they vary, what's the humidity, etc.? The calculations for the Mobble are included in chapter 5.4.1.
2. Choice of the system type
3. Equipment sizing: can exert a significant impact on consumption in variable load operation. Over- and undersizing should be avoided when designing the HVAC system.
4. Equipment efficiencies: choosing performance above minimum levels will have some energy credit
5. Simulation

To get an idea about the different air-conditioning systems, the four basic types are discussed below. A subdivision is made based on the medium used in the control system to provide the thermal energy: all-air, all-water, air-and-water and unitary systems.[81]

7.2 Common residential systems

All-air systems

All-air systems distribute heated or cooled air to the conditioned space through ducts, bringing the indoor air to the desired room conditions. Mostly the conditioning of the mixed air (return and outside air) is achieved by passing over heating or cooling coils. Due to the low heat capacity of air, sufficient space for the ducting will be needed. The cooling/heating capacity, $\dot{Q}$, is measured in Joules/sec or Watts and calculated with following formula:

$$\dot{Q} = \dot{m} \cdot c_p \cdot \Delta T \tag{7.1}$$

Where $\dot{m}$ is the mass [kg/s], c_p the specific heat capacity [J/(kgK)] and ΔT the temperature difference [K]. Because heat gains in space vary with time, a mechanism to change the capacity of the air supply is necessary. There are two possibilities: vary the flow rate of the supplying air to the zone or adapt the temperature of the air delivered to the space.

In this section the air-handling unit, the simplest all-air supply system is discussed. Then a sub-classification was made based on the zone supply system. A zone is a grouping of spaces with sufficiently similar loads individually controlled by a single sensor, mostly a thermostat.

Air-handling unit (AHU) The basic air-handling system is an all-air single-zone air handler, often called the air-handling unit (AHU). This AHU draws in and mixes outside air with air that is being recirculated. This mixture is conditioned and blown into the space, while the excess return air is exhausted to the outside. The AHU consists out of different components, these are briefly explained. In figure 7.2 a basic single-zone air handler is shown.

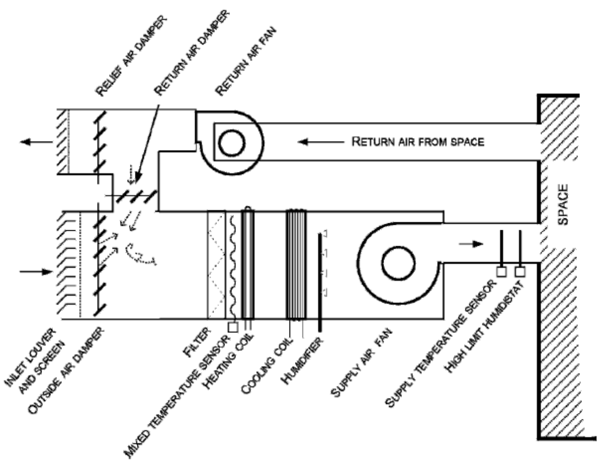


Figure 7.2: Single-zone air handler [79]

- *Air inlet and mixing section*: The inlet air grill and screen are designed to minimize the entry of rain and snow. Once the outside air is drawn in, it is mixed with the return air. In the figure parallel blade dampers are used, they direct the air streams towards each other causing turbulence and mixing. However, the mixing chamber is just one of the options that serves as heat recovery unit. There can also be a rotational regeneration of heat or an enthalpy heat recovery unit.

- *Air filter*: removes particles and contaminants of various sizes from the air. Since overloaded filters can increase the energy demand of fans, it is recommended to replace them regularly. Overloaded filters can reduce the volume of supply air, resulting in inferior system operation.

- *Mixed temperature sensor*: An average temperature is needed for the temperature control. To maximize the mixing, the sensor is placed after the filter. By adjusting the damper opening the set mixed temperature can be maintained. For ventilation a minimum of outside air may be required, this can cause the need for heating or cooling coils when set indoor temperature conditions cannot be achieved.

- *Heating coil*: This heating device is almost always needed to raise the mixed air temperature. The basic methods for heating are: hot-water or electrical heat. From which the electric is the simplest, but non-economic and the hot water coils are the most controllable, but are sensible to freezing in cold weather.

- *Cooling coil*: This coil is cooled by water or refrigerant and as the coil is mostly colder than the dewpoint, condensation and thus dehumidification will occur.

- *Humidifier*: This device adds moisture to the air by injecting water or steam, preferably rainwater ($CaCO_3$). The high limit humidistat controls the humidifier as excessive operation could cause condensation on the duct surface.

- *Fans*

- *Ducts and terminal devices*

The primary equipment includes heating, air delivery and refrigeration equipment. These can be either centralized or decentralized, depending on the application. Most large AHU use a central refrigeration plant, for small individual AHU's direct expansion cooling is used to generate chilled water that passes through the cooling coil. For heating a central, fuel fired plant is often used.

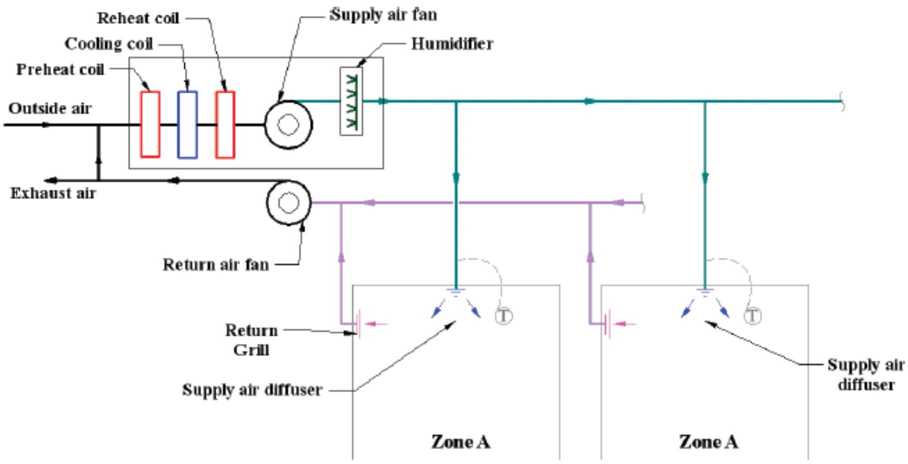
Single zone systems are the simplest all-air systems, consisting out of an air handling unit, a heat and cooling source, distribution network and delivery devices (see figure 7.3a). Short ductwork leads to low pressure drop and energy use of a fan. This system can correspond dynamically to the space needs and thereby maintain the temperature and humidity at their setpoint.

For **multi-zone** systems individual supply air ducts are required for each thermal zone in the building. This system consists of an AHU with parallel flow paths through cooling and heating coils (see figure 7.3b). A maximum of 12 zones is recommended because of physical restrictions on duct connections and damper size.[81] The advantage compared to a reheat system is the conditioning of several zones without energy waste. The disadvantage is the need for multiple supply ducts.

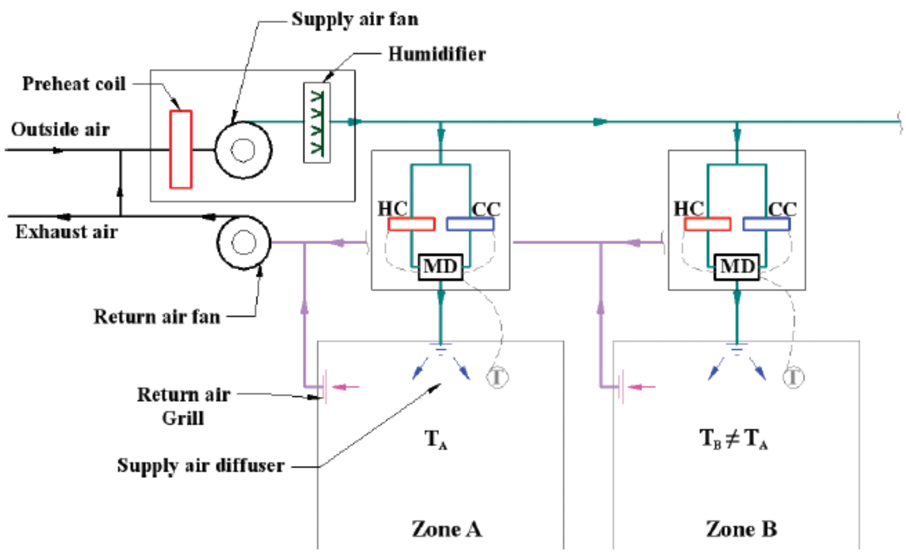
Multi-zone **reheat or constant volume systems** are a modification of the single-zone system (see figure 7.4a). They provide zone or space control for areas with unequal loading and close control for process and comfort applications. The main air system provides air that is cool enough to satisfy all possible cooling loads. Thus, all supply air is cooled the maximum amount. Before entering the zone, the air passes over a reheat coil. A thermostat controls the reheating by the coil, depending on the required zone temperature. When the load is less than peak cooling load, or heating is required, the cooling effect and reheat are working against each other. This results in excessive energy use, therefore the use of this system is discouraged.

The **dual duct system** is a terminal-controlled modification of the multi-zone concept. It splits the mixed air into two parallel ducts, one carrying the cold air('cold deck') and the other the warm('hot deck')(see figure 7.4b). When entering a zone, the valves mix warm and cold air in order to satisfy the space setpoint temperature. The system is more expensive compared to the single duct system, because it requires twice the amount of material for ducts. Thanks to the terminal control the system is more flexible than the others.

A **variable air volume (VAV) system** controls temperature in a space by varying the quantity of supply air instead of the temperature (see figure 7.4c). A volume control damper acts as a throttle for the supply air volume in each zone. The air temperature must be low enough to meet the cooling load in the most demanding zone and to maintain appropriate humidity. A minimum ventilation volume is always required, so when this minimum is reached a reheat coal is activated. The VAV has low initial and low operation costs, but a more expensive control system is required.[82, 83]

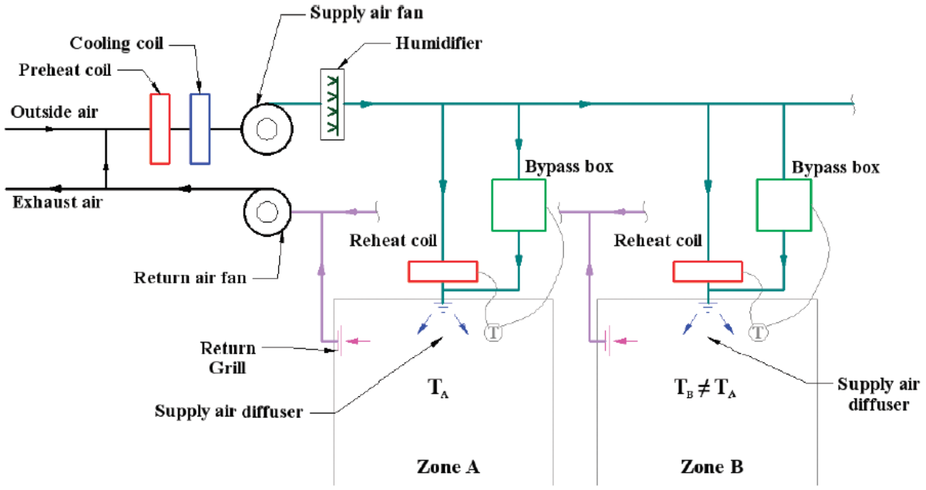


(a)

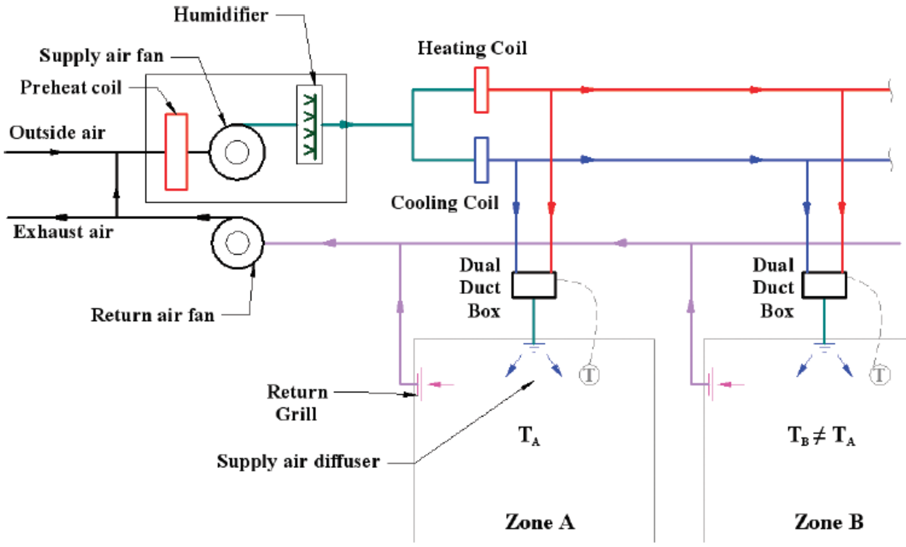


(b)

Figure 7.3: All-air HVAC for (a) Single zone and (b) Multi-zone [81]



(a)



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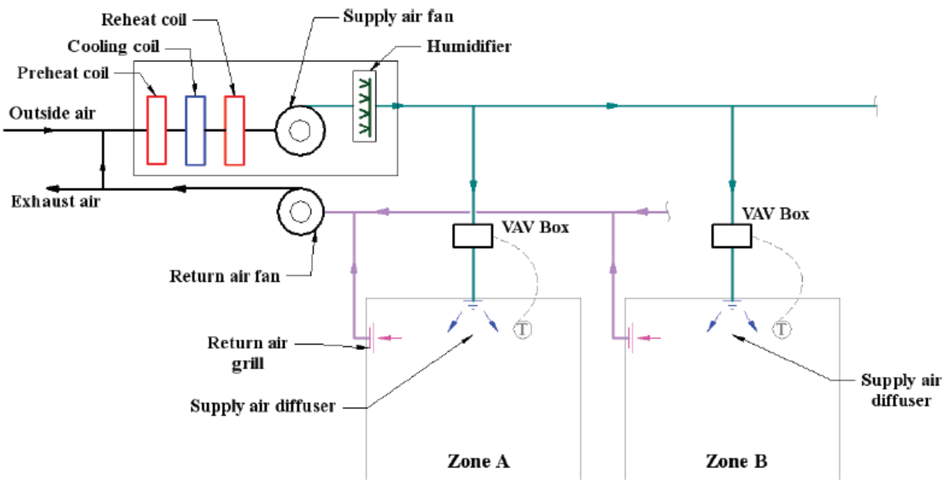


(c)

Figure 7.4: All-air HVAC for (a) reheat system (b) dual duct system (c) variable air volume [81]

All-water systems

These systems, also called all-hydronic, accomplish space cooling and heating by circulating water or steam from a central plant to the terminal units. This type of system is small compared to the others, because water has a higher heat capacity, conductivity and density than air, which requires a lower volume to transfer heat. Heating systems represent the largest group of the all-water systems.

Low temperature radiation, natural convection heating systems are the simplest water heating systems consisting out of hot water flowing through a surface. The hot-water panel-radiator is very popular and emits heat by radiation and convection by water at a temperature below 105°C. This is considered 'low temperature' as far as radiation is concerned. These terminal units are closed systems and heat the room-air as soon as it contacts the heated coils. These water heaters can be controlled by varying the water flow, throttling, or by varying the water supply temperature.

Heating and cooling panels can be source of heating and cooling. When a floor surface is used for heating it is called a radiant floor. Water is circulated into tubes, which are impeded inside the surface, to cool or heat. The floor temperature is limited to a range of 19-29°C for human comfort, as such the heat transfer is depending on the radiant area. Though radiant floors are often expensive to install, low temperature heating is possible, which increases the energy efficiency. Due to this low temperature character, the heat exchanging surface must be large enough to cover the load, following from equation 7.1. These panels provide the highest quality heat, because there is no moving air, it is quiet and no significant thermal stratification occurs. For cooling ceilings only low capacities can be achieved due to the risk for condensation.

Fan coil units consist out of a heating and cooling coil, a circulation fan and proper control system. The fan coil units are connected to boilers for heating and chillers to produce cooling. Control is done by a room thermostat, which adapts the water flow to the coils. In order to obtain ventilation, the fan coil can be connected with the outside air.

Air-water systems

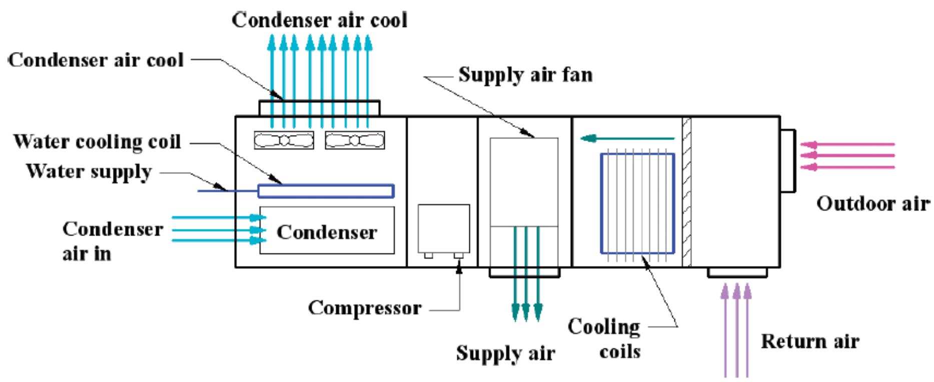
The air-water system, provides all the primary ventilation air from a central system, but local units provide additional conditioning. The central system is similar to the all-air system with the local units supplied with chilled/hot water coils instead of refrigerant coils. These systems combine the advantages of both all-air and all-water systems, however their control is more complicate.

Unitary, refrigerant-based systems

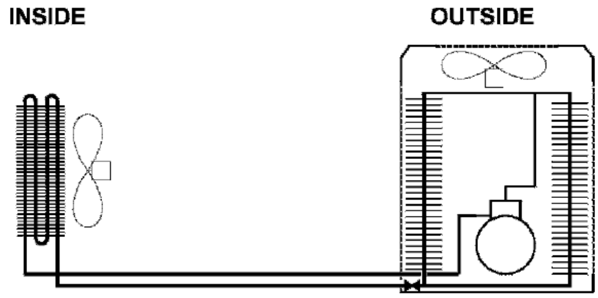
This final system is an air-conditioning unit that provides all or part of the air-conditioning functions. It uses local refrigerant-based cooling instead of a central refrigeration unit to either cool the air-conditioning airflow or to chill water. The components are factory-assembled into an integrated package. As such there is no delay for detailed manufacturer design work.

A typical rooftop unit is shown in figure 7.5a. This unit is a self-reliant DX (direct expansion) air conditioner, typically installed on the roof of a building using ducts to distribute cool air to the conditioned space. It can be used in single-zone or multiple-zone applications, with a constant-volume or variable-volume fan. DX units may often be equipped with an air economizer.

The split (DX) system consists of two factory-made assemblies. The condensing/compressing part of the refrigeration system is chosen separately from the rest and uses outside air as the heat sink. This part is connected with the indoor DX coil(air system) by the refrigerant lines, like shown in figure 7.5b. The main advantage is that the noise of the compressor can be located at some distance of the air-handling unit. Furthermore the pipes of the refrigerant are much smaller compared to the ducts. These split systems can range in size from residential to commercial applications. When using multi-split systems, you can cool multiple rooms using an individual control of each indoor unit.



(a)



(b)

Figure 7.5: (a) rooftop unit (b) Split system [81, 79]

7.3 Renewable energy sources

High performance buildings with limited energy demand and significant coverage by renewable energy sources are the future. A short overview is given about the renewable energy sources useful for HVAC purposes. It must be kept in mind that using the same energy source for heating and cooling is advantageous.

Electricity

Electricity is not yet totally produced out of renewable energy sources, but a trend toward decarbonized electricity is growing. Sun, wind, water, they all have the possibility to generate electricity in an inexhaustible way. Once the mismatch between consumption and demand peaks of electricity is solved, by thermal, electrical, mechanical or chemical storage, electricity

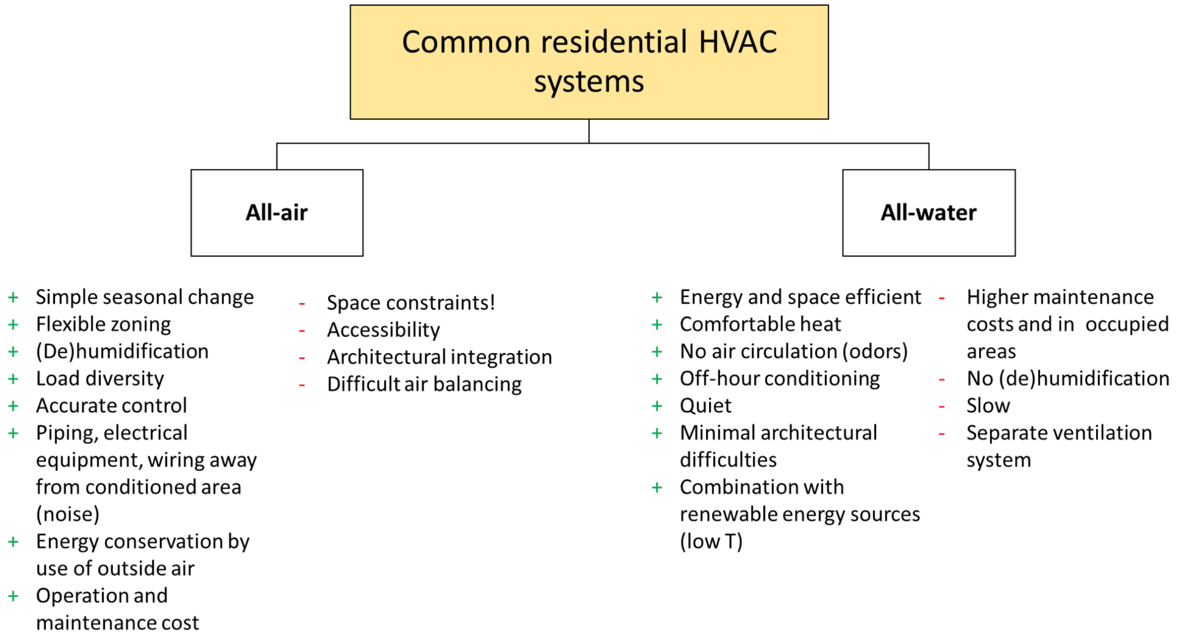


Figure 7.6: Pro's and con's of all-air vs all-water systems

will become the major clean energy in buildings.

Heat pump/chiller

A heat pump is a device that provides heating, cooling and sanitary hot water for building applications. It transforms energy from the ground, air and water to useful heat by running a refrigerant cycle. During the heating season, heat is pumped from the cool outdoors into the house. Often the heat pump includes a reversing valve so that the direction of the heat flow may be reversed. During the cooling season the heat pump is operated as a chiller and heat is removed to the outside.

The working principle of a heat pump is based on the physical property that the boiling point of a liquid increases with increasing pressure. By changing the pressure, a medium can be evaporated at a low pressure and condensed at a high pressure. Figure 7.7 shows the heat pump principle. At low pressure and temperature the refrigerant is evaporated, by heat from the outside. Then the compressor increases the pressure of the refrigerant gas. At high pressure and temperature the gas condenses in the condenser, releasing heat. This heat can be used to warm the building or DHW. The liquid formed in the condenser passes the expansion valve and flows to the evaporator, where the cycle starts again. Heat pumps use electricity to provide heat, but

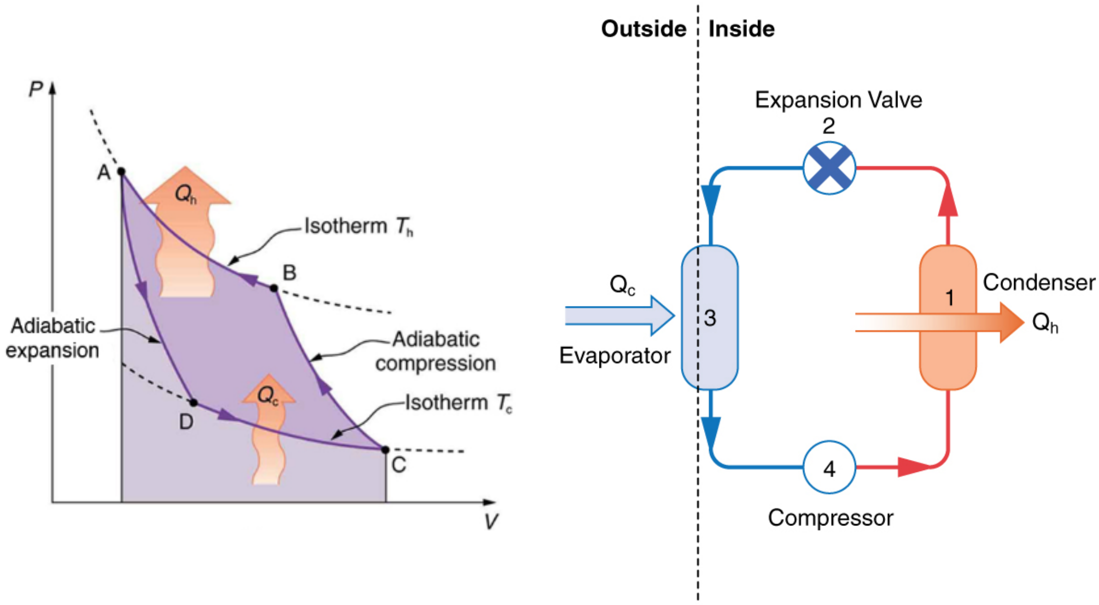


Figure 7.7: Heat pump principle [84]

offer an energy-efficient alternative to furnaces and air conditioners. There are different types of heat pumps, depending on the heat resource.

The air-to-air heat pump is the most common type, transferring heat between the inside and outside air.

Air-to-water heat pumps transfer energy between the outside air and water. This allows it to be used with f.e. underfloor heating systems.

Geothermal heat pumps transfer heat between your house and the ground or a nearby water source. They achieve higher efficiencies than air source heat pumps as the temperatures of the ground are generally more constant. Also they can be used in more extreme climates.

Absorption heat pumps are driven by an external heat source instead of electricity.

The benefits of heat pumps make it the heating choice for future buildings. A small amount of electricity can convert heat to a higher exergetic level.

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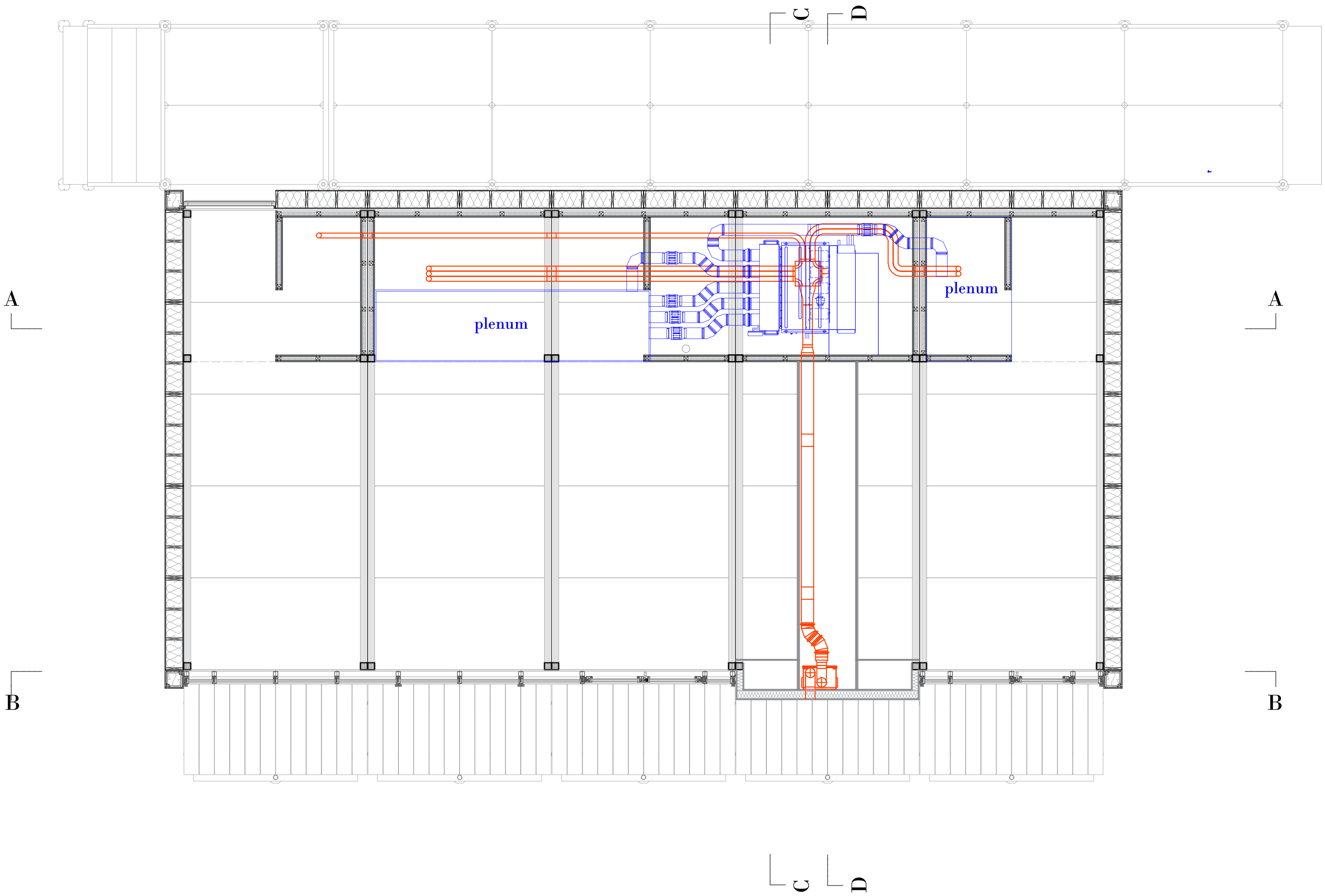
Appendix A



Distribution of HVAC - Heating/cooling and Ventilation

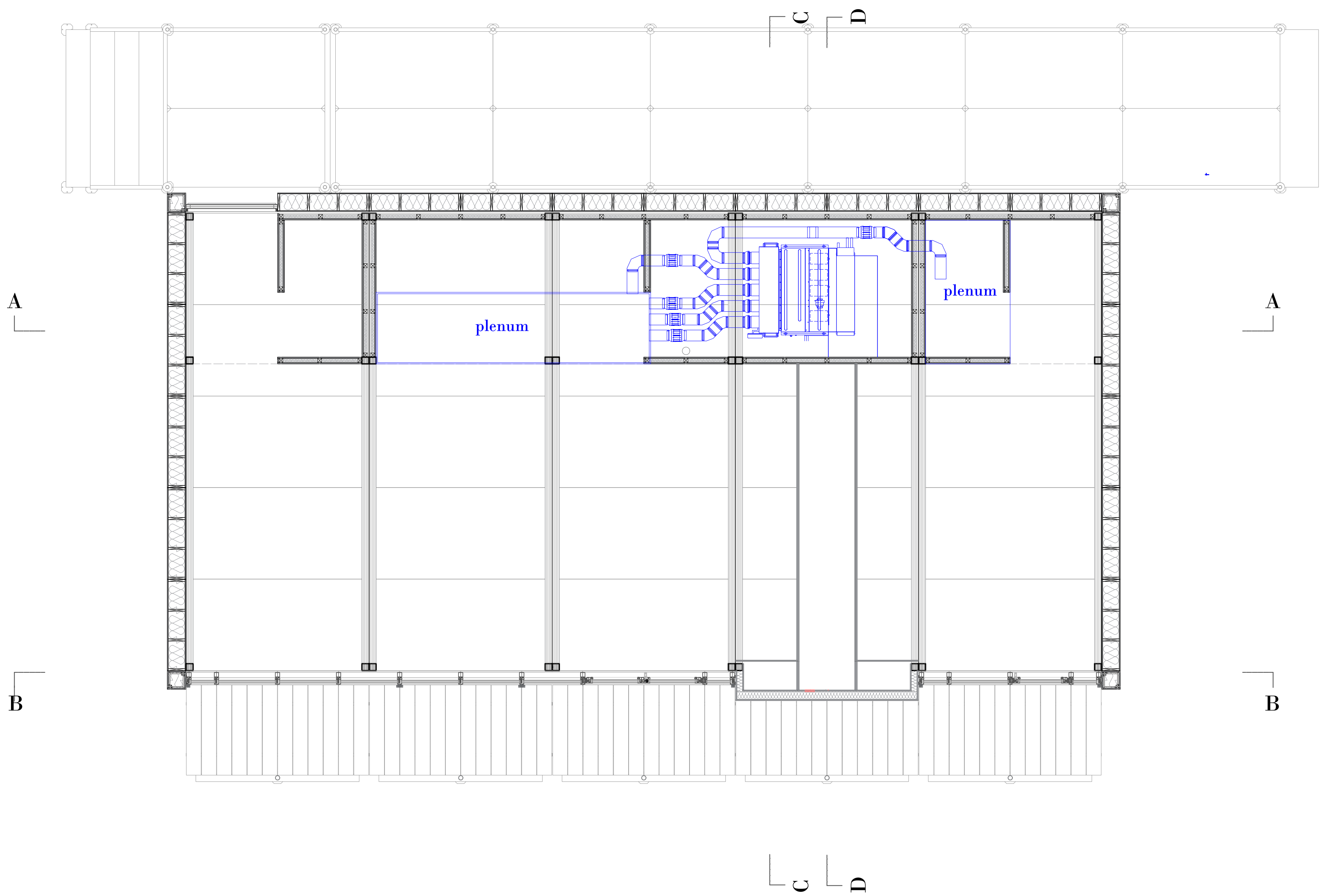
Layout

Scale 1:50

Heating / cooling

Ventilation

ME 001	HVAC distribution Plan
Delivarable (latest update)	Deliverable #5 April 26, 2019

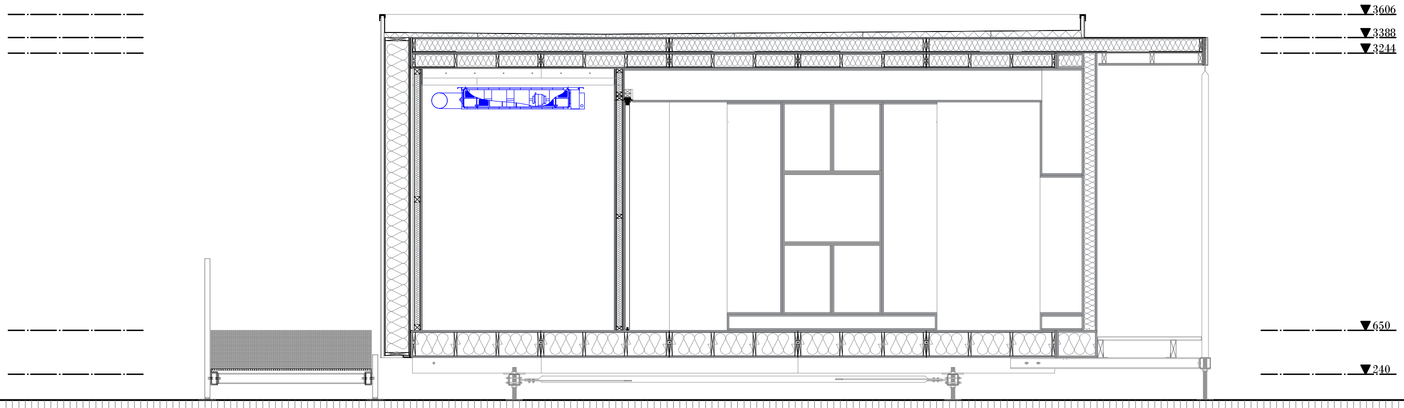


Distribution of Heating Ducts

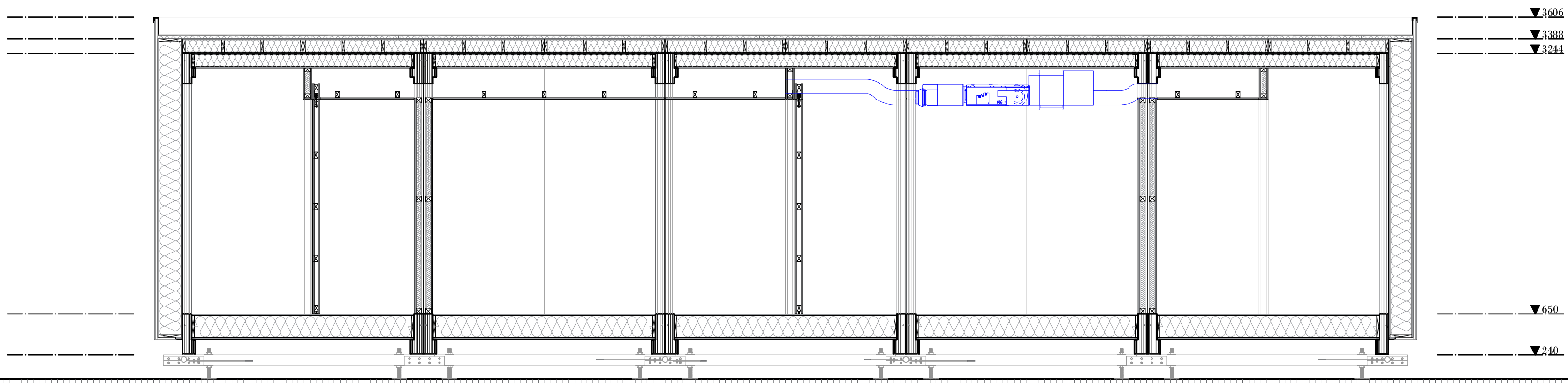
Placement Air to air Heat Pump

Scale 1:50

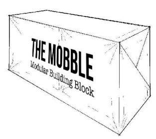
ME 021	Heating
Delivarable (latest update)	Deliverable #5 April 26, 2019



Transversal Section DD



Longitudinal Section AA



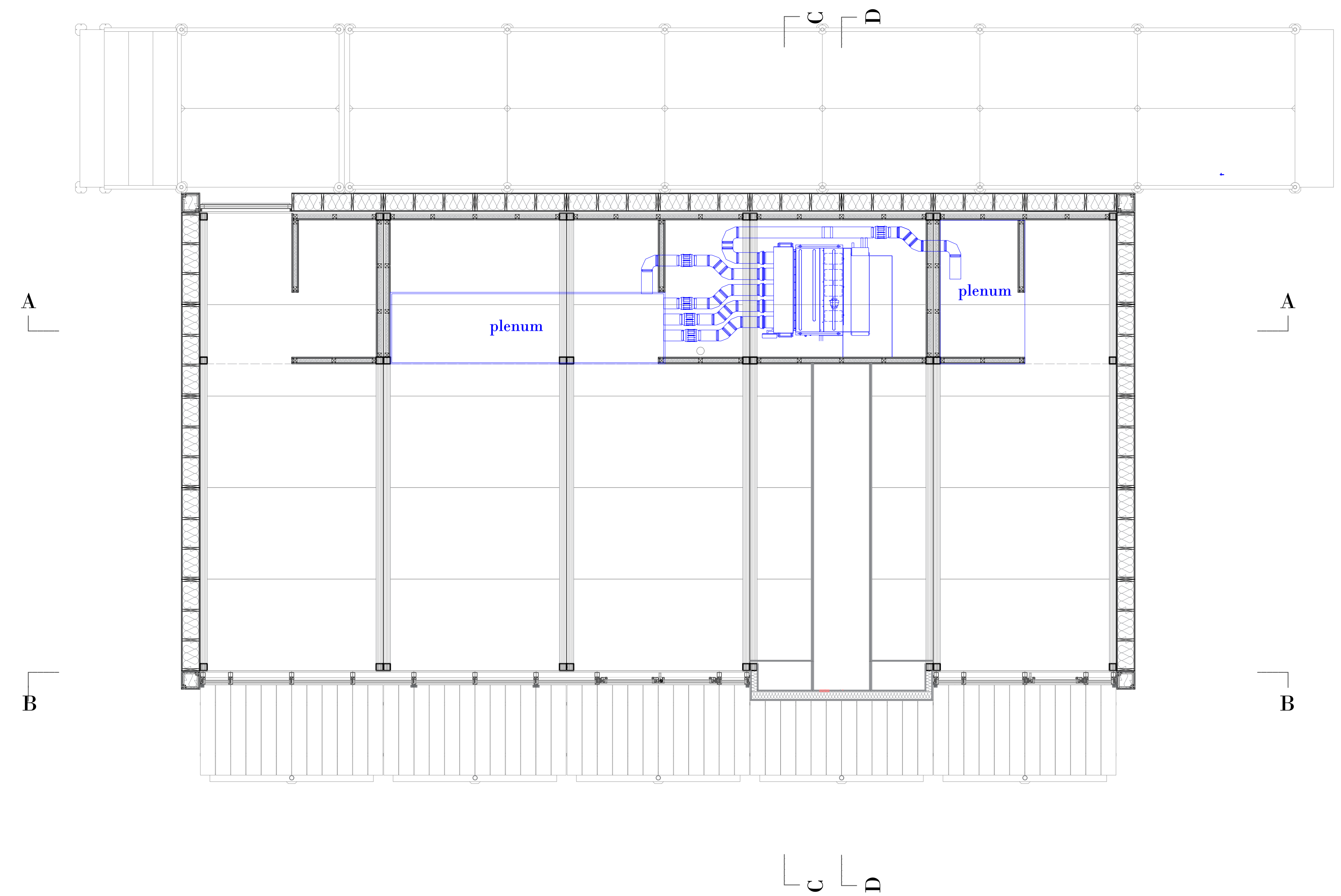
Sections showing Heating installation

Air to air Heat Pump

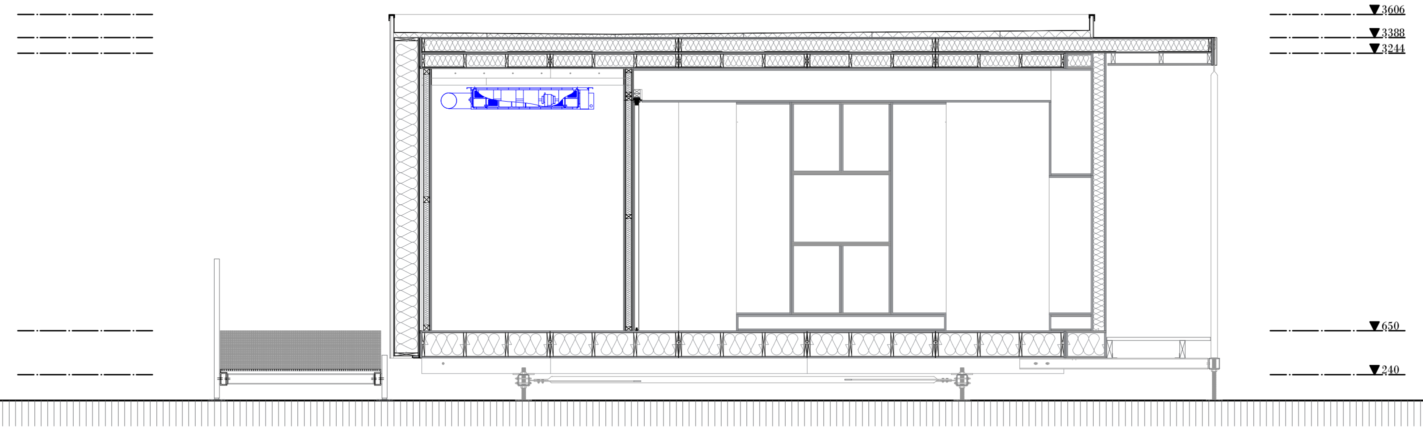
Scale 1:50

ME 021	Heating
Delivarable (latest update)	Deliverable #5 April 26, 2019

page 2



Distribution of Cooling Ducts Placement Air to air Heat Pump Scale 1:50	**ME 031**	Cooling
	Delivarable (latest update)	Deliverable #5 April 26, 2019 — page 1



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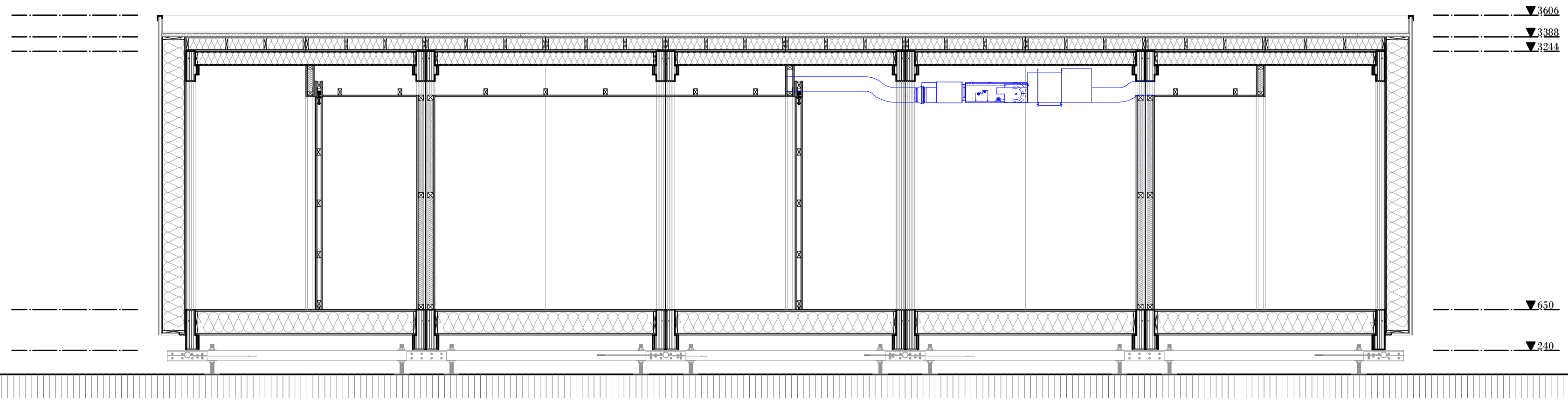


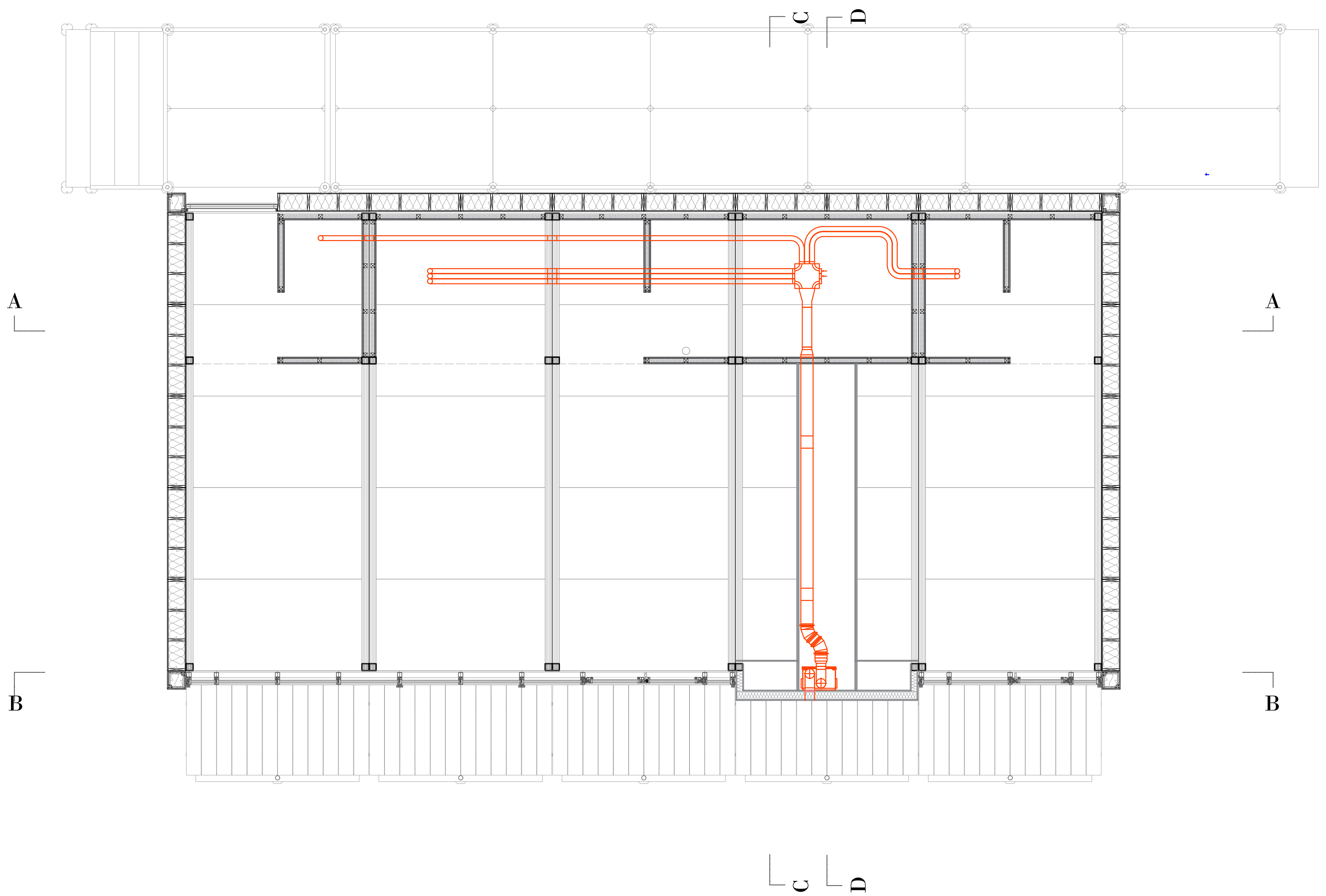
Longitudinal Section AA

Sections showing Cooling installation

Air to air Heat Pump

Scale 1:50

ME 031	Cooling
Delivarable (latest update)	Deliverable #5 April 26, 2019

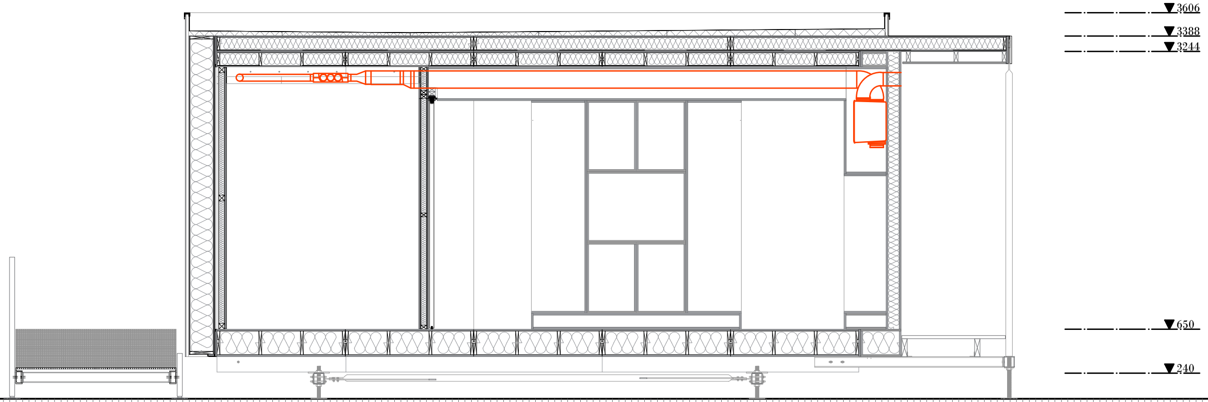


Distribution of Exhaust ducts and Placement of Exhaust Box

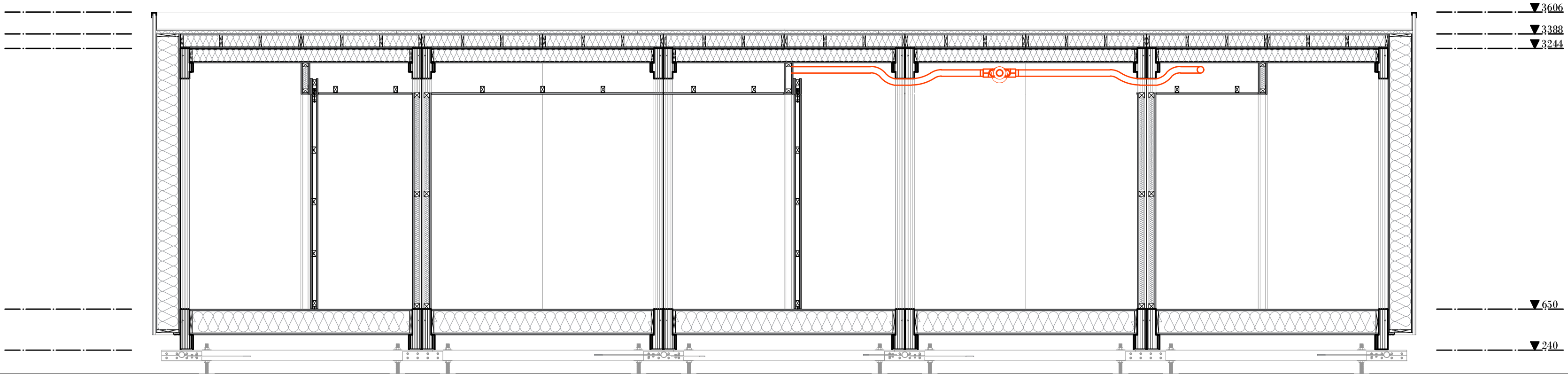
Exhaust Box in Technical Panel (facade)

Scale 1:50

ME 041	Ventilation	
Delivarable (latest update)	Deliverable #5 April 26, 2019	page 1



Transversal Section DD



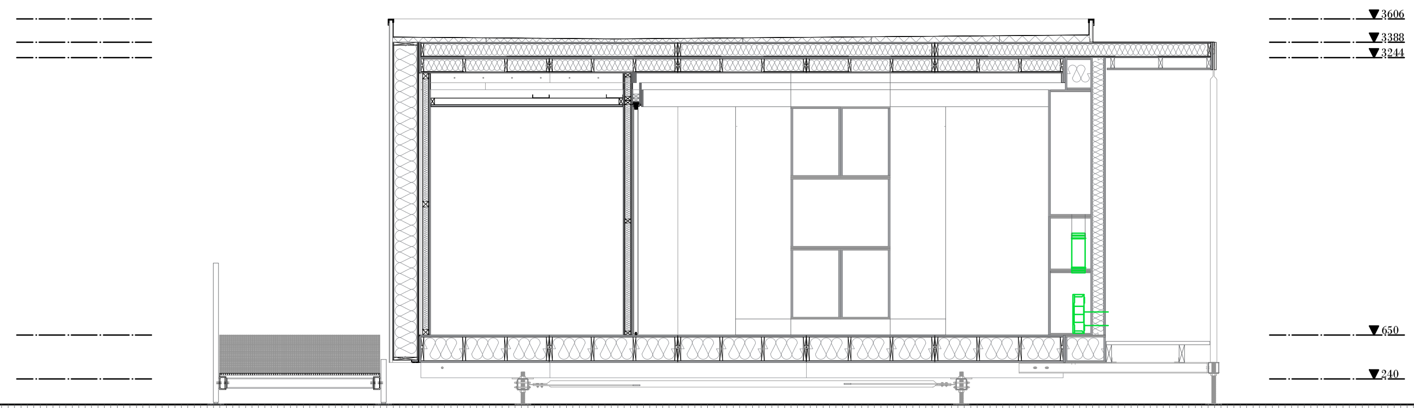
Longitudinal Section AA

Distribution of Exhaust ducts and Placement of Exhaust Box

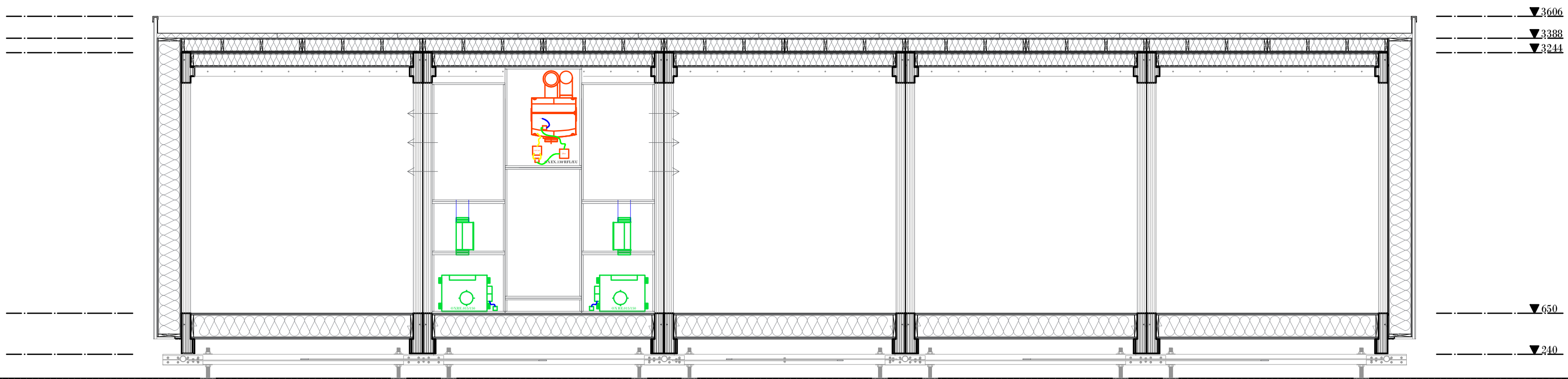
Exhaust Box in Technical Panel (facade)

Scale 1:50

ME 041	Ventilation	
Delivarable (latest update)	Deliverable #5 April 26, 2019	page 2



Transversal Section CC



Longitudinal Section BB

Layout of Technical Panel in facade

Inlet of fresh air via plenum into pavilion

Scale 1:50

Supply box

Exhaust box

ME 041	Ventilation
Delivarable (latest update)	Deliverable #5 April 26, 2019

Appendix B

Monobloc warmtepompboiler voor warm tapwater

EKHH2E-PAV3

Klaar voor zonne-energie

Warmtepompboiler voor warm tapwater met sterke prestaties, gegarandeerd comfort en ultieme energiebesparing met aansluiting op zonnesysteem.

- Een van de stilste systemen in zijn soort door de stille werking.
- Gebruiksgemak en eenvoudig te vervoeren: dankzij het compacte formaat past het systeem eenvoudig door een deur.
- Verbeterd comfort: de drie bedrijfsmodi beantwoorden al uw behoeften.
- Voorzie uw woning van duurzame energie met een zonnesysteem.
- Ruim bedrijfsbereik: de warmtepomp werkt tot een buitentemperatuur van -7 °C. Onder -7 °C wordt de warmtepomp ondersteund door het elektrische verwarmingselement.

EKHH2E-PAV3

EKHH2E-PAV3

Binnendeel				EKHH	2E260PAV3
Totale capaciteit				l	260
Prestatiecoëfficiënt (COP)					3,10 (1) / 3,60 (2)
Warmtepomp	Behuizing	Kleur			Witte behuizing/grijze bovenkant
		Materiaal			Deksel: EPP-afwerking
	Werkingsbereik	Omgeving	Min.	°CDB	-7
			Max.	°CDB	38
	Spanningsvorm	Fase			1P
		Frequentie		Hz	50
		Spanning		V	230
Tank	Behuizing	Kleur			Wit
		Materiaal			ABS met reliëf
	Afmetingen	Unit	Hoogte	mm	1.500
	Werkingsbereik	Waterzijde	Min.	°C	10
			Max.	°C	56
	Passief warmteverlies			W	71
	Spanningsvorm	Fase			1P
		Frequentie		Hz	50
		Spanning		V	230

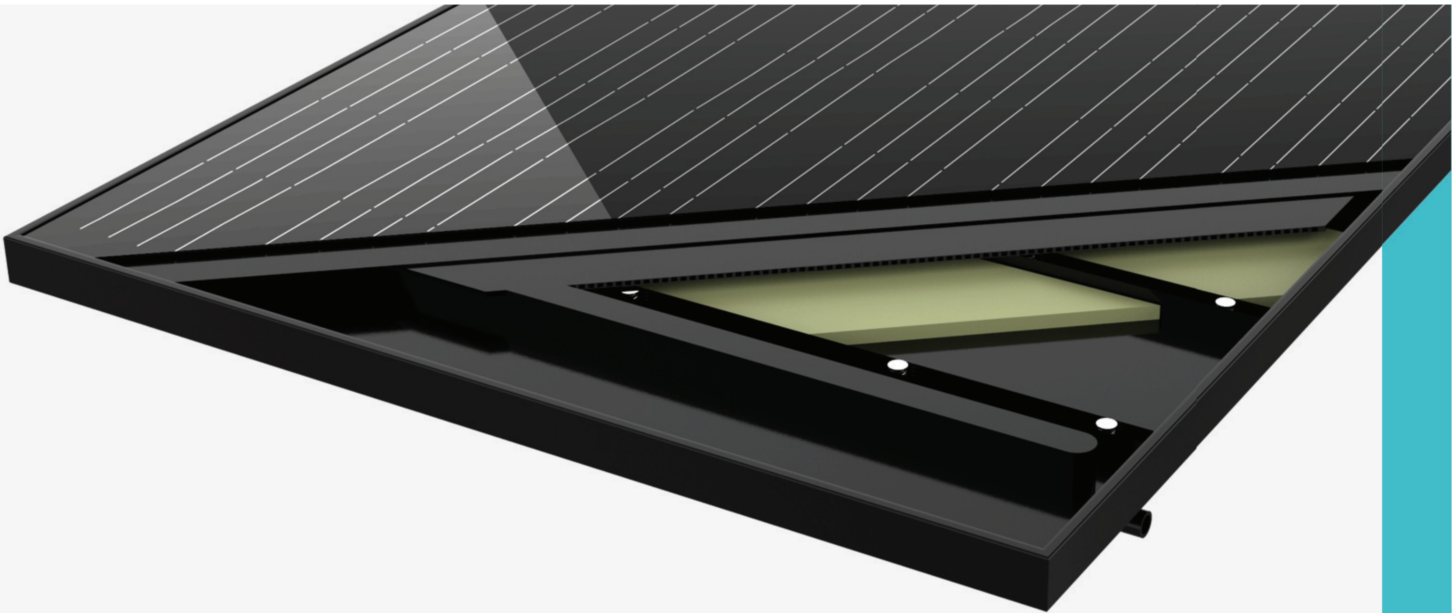
(1) Getest bij Ta DB/WB 7 °C/6 °C, conform EN 16147. (2) Getest bij Ta DB/WB 15 °C/12 °C, conform EN 16147.

Daikin Nederland Bel 088 324 54 55, stuur een e-mail naar verkoop@daikin.nl of kijk voor meer informatie op www.daikin.nl.

ECPNL18-781 9/18

DUALSUN Spring

Het revolutionaire hybridepaneel dat simultaan
elektriciteit en warm water produceert.



Elektrische opbrengst

Standaard PV paneel (60 Cellen van 6 Duim)

Monocristalijne cellen met hoog rendement gekoeld door watercirculatie op de achterzijde.

Elektrisch vermogen 280Wp

Warm water

Dunne thermische collector volledig geïntegreerd.

Zeer goede warmteoverdracht tussen PV en thermisch gedeelte.

Thermisch vermogen 570 Watt/m² (*)

(*) Solar Keymark certificaat n°011-752783P .

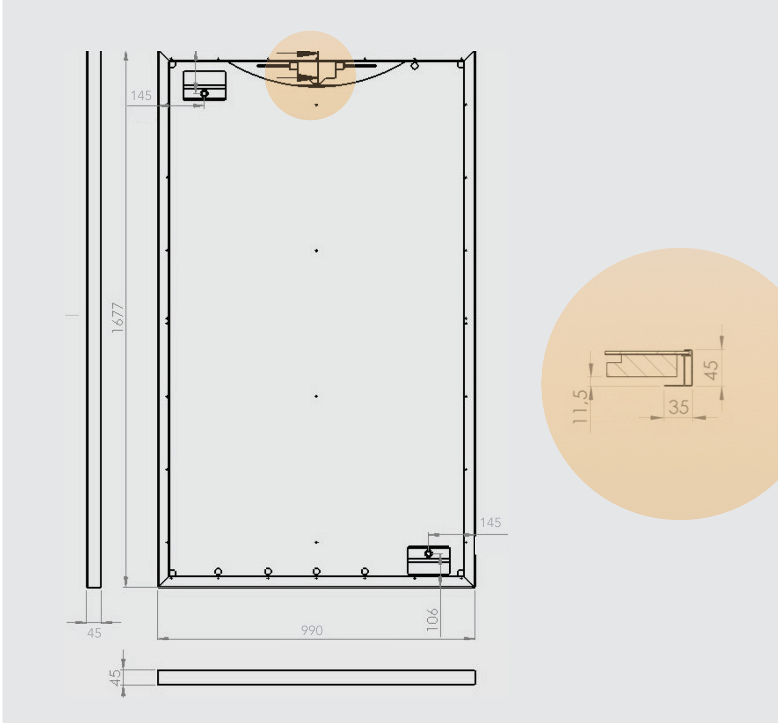
25 – Jaar PV vermogensgarantie – 10 Jaar product garantie

IEC gecertifieerd 61215 & 61730 en Solar Keymark n°011-752783P

Geproduceerd en geassembleerd in Frankrijk

Aangepast voor elk daktype en montage frame

Technische eigenschappen



ALGEMENE GEGEVENS		
Lengte	1677 mm	
Breedte	990 mm	
Frame dikte	45 mm	
Frame kleur/achterzijde	Zwart/Zwart	
	Niet-geïsoleerd	Geïsoleerd
Gewicht Leeg/gevuld	25 / 30 kg	28 / 33 kg

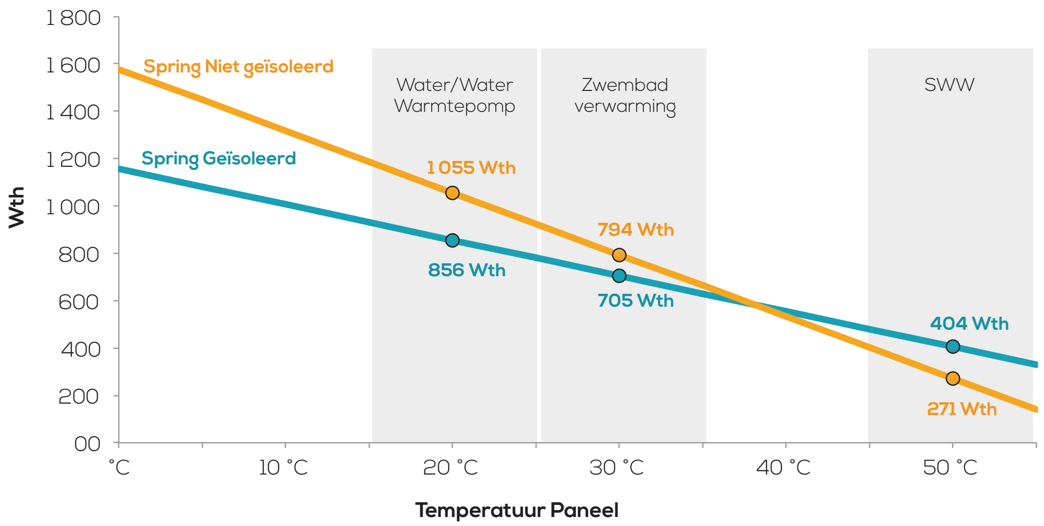
ELEKTRISCHE DATA	
Aantal cellen per module	60
Cel type (afmetingen)	Monocrystalijn (6 duim, 156mm x 156mm)
Nominaal vermogen (P_{mpp})	280 Wc
Module efficiëntie	17,20 %
Vermogenstolerantie	0/+3 %
Nominale spanning (V_{mpp})	31,95 V
Nominale Stroom (I_{mpp})	8,77 A
Open spanning (V_{oc})	38,88 V
Kortsluitstroom (I_{sc})	9,30 A
Maximum Spanning	1000 V DC
Reverse current	15 A
NOCT	46,9 °C
Aansluitingen	MC4
Classe	Classe A
Spanning (μVoc)	-0,345 %/°C
Stroom (μIsc)	0,047 %/°C

THERMISCHE EIGENSCHAPPEN		
Collectoroppervlakte	1,654 m²	
Waterinhoud	5 Liter	
Max werkdruk	1,2 bar	
Drukval per paneel	4 kPa bij 200 l/h	
Hydraulische aansluiting	15mm fiting	
	Niet geïsoleerd	Geïsoleerd
Stagnatietemperatuur	70 °C	80 °C
Optische efficientie A_0	55,9 % *	47,2 % *
Warmteverlies coëff a_1	15,8 W/K/m² *	9,1 W/K/m² *
Warmteverlies coëff a_2	0 W/(m²,K²) *	

* De coëfficienten a0, a1 en a2 zijn gemeten waardes bij de EN 12975 testen TUV Rheinland voor niet beglaasde collectoren bij windsnelheid u =1m/s: **a0 = n0 - c6*u ; a1 = c1 + c3*u.**

Thermisch vermogen in functie van de ingaande watertemperatuur

Vermogens zijn berekend aan de hand van de a0, a1 coëfficiënten, paneeloppervlakte 1,654 m² in STC condities (Test = 25°C, G = 1000 W/m²).



Air Conditioning
Technical Data

3MXM-M

- 3MXM40M2V1B
- 3MXM52M2V1B
- 3MXM68M2V1B

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3MXM-M

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1 Features

- Seasonal efficiency values up to A+++ in cooling and heating thanks to its up--to-date technology and built-in intelligence.
- Outdoor units for multi model application.
- Outdoor units are fitted with a swing compressor, renowned for its low noise and high energy efficiency
- Up to 3 indoor units can be connected to 1 multi outdoor unit; all indoor units are individually controllable and do not need to be installed in the same room or at the same time. Each unit works individually and independently from the other regarding set
- Different types of indoor units can be connected: e.g. wall mounted units, concealed ceiling units
- Choosing for an R-32 product, reduces the environmental impact with 68% compared to R-410A and leads directly to lower energy consumption thanks to its high energy efficiency

2 Specifications

2-1 Technical Specifications					3MXM40M	3MXM52M	3MXM68M
Casing	Colour				Ivory white		
Dimensions	Unit	Height		mm	734		
		Width		mm	868		
		Depth		mm	320		
	Packed unit	Height		mm	820		
		Width		mm	1,050		
		Depth		mm	480		840
Weight	Unit			kg	57		62
	Packed unit			kg	61		66
Packing	Weight			kg	4		
Heat exchanger	Length			mm	920		
	Rows	Quantity			2		
	Fin pitch			mm	1.4		
	Stages	Quantity			32		
	Tube type				ø8 Hi-XA		
	Fin	Type			WH8 fin-hydrophilic		WHS8 FIN-HYDROPHILIC
		Treatment			Anti-corrosion treatment		
Compressor	Model				2YC40JXDC		2YC71DXD#C
	Type				Hermetically sealed swing compressor		
	Output			W	1,300		2,400
Fan	Type				Propeller fan		Propeller
	Air flow rate	Cooling	High	m³/min	42		46.5
				cfm	1,483		1,642
			Nom.	m³/min	42		42.5
				cfm	1,483		1,501
			Super low	m³/min	24		24.1
				cfm	847		851
		Heating	High	m³/min	41		43.8
				cfm	1,447		1,547
			Nom.	m³/min	41		43.8
				cfm	1,447		1,547
			Super low	m³/min	24		24.1
				cfm	847		851
Fan motor	Model				D55F-31		
	Output			W	55		
	Speed	Cooling	High	rpm	700		760
			Nom.	rpm	700		
			Low	rpm	-		420
			Super low	rpm	420		-
		Heating	High	rpm	680		720
			Nom.	rpm	680		720
			Low	rpm	-		420
			Super low	rpm	420		-
Sound power level	Cooling			dBA	59		61
	Heating			dBA	59		61
Sound pressure level	Cooling	Nom.		dBA	46		48
	Heating	Nom.		dBA	47		48
Operation range	Cooling	Ambient	Min.	°CDB	-10		
			Max.	°CDB	46		
	Heating	Ambient	Min.	°CWB	-15		
			Max.	°CWB	18		
Refrigerant	Type				R-32		
	Charge			kg	1.80		2.0
				TCO_2eq	1.2		1.4
	GWP				675		

2 Specifications

2-1 Technical Specifications					3MXM40M	3MXM52M	3MXM68M
Piping connections	Liquid	Quantity			3		
		OD		mm	6.35		
	Gas	Quantity			1		
		OD		mm	9.5		
	Drain	ID		mm	-		
		OD		mm	16		
	Gas 2	Quantity			2		
		OD		mm	12.7		
	Piping length	OU - IU	Max.	m	25		
		System	Chargeless	m	30		
	Additional refrigerant charge			kg/m	0.02 (for piping length exceeding 30m)		
	Level difference	IU - OU	Max.	m	15		
		IU - IU	Max.	m	7.5		
	Heat insulation				Both liquid and gas pipes		
	Total piping length	System	Actual	m	50		
Refrigerant oil	Type				FW68DA		
	Charged volume			l	0.65		0.90

Standard Accessories : Installation manual; Quantity : 1;

Standard Accessories : Screw bag; Quantity : 1;

Standard Accessories : Drain plug; Quantity : 1;

Standard Accessories : Drain cap; Quantity : 9;

Standard Accessories : Reducer assembly; Quantity : 1;

2-2 Electrical Specifications				3MXM40M	3MXM52M	3MXM68M
Power supply	Name			V1		
	Phase			1~		
	Frequency		Hz	50		
	Voltage		V	220-240		
Current - 50Hz	Maximum fuse amps (MFA)		A	30		
Current	Nominal running current (RLA)	Cooling	A	3.78	5.34	8.37
		Heating	A	4.23	6.81	9.49
	Starting current	Cooling	A	4.1	4.6	9.8
		Heating	A	4.1	4.6	9.8
Current - 60Hz	Maximum fuse amps (MFA)		A	-		

Notes

Contains fluorinated greenhouse gases

3 Electrical data

3 - 1 Electrical Data

3MXM40-52M

Model		Unit				Power supply		COMP.		OFM	
Outdoor	H/P C/O	Hz	Voltage	MIN.	MAX.	MCA	MFA	MSC	RLA	kW	FLA
3MXM40M2V1B	H/P	50	220	198	242	15,8	30	4,1	3,13	0,056	0,37
			230	207	253				2,99		
			240	216	364				2,87		
3MXM52M2V1B	H/P	50	220	198	242	15,8	30	5,5	4,97	0,056	0,37
			230	207	253				4,75		
			240	216	364				4,55		
3AMXM52M2V1B	H/P	50	220	198	242	15,8	30	6,1	4,42	0,056	0,37
			230	207	253				4,23		
			240	216	364				4,06		

Symbols

MCA: Minimum Circuit Ampere [A]

MFA: Maximum Fuse Ampere [A]

MSC: Maximum current of the starting compressor [A]

RLA: Rated load amps [A]

OFM: Outdoor fan motor [A]

FLA: Full Load Ampere [A]

kW: Fan motor rated output [kW]

Notes

1. The RLA is based on the following conditions.
   Cooling
   Indoor temperature 27°C DB / 19°C WB
   Outdoor temperature 35°C DB
2. Voltage range
   The units are suitable for use with electrical systems in which the voltage supplied to the unit terminals is not below or above the listed range limits.
3. The maximum allowable voltage that is unbalanced between phases is 2%.
4. Select the wire size according to the MCA.
5. MFA is used to select the circuit breaker and the ground fault circuit interruptor.
   Earth leakage circuit breaker

3D102307

3MXM68M

Model		Unit				Power supply		COMP.		OFM	
Outdoor	H/P C/O	Hz	Voltage	MIN.	MAX.	MCA	MFA	MSC	RLA	kW	FLA
3MXM68M2V1B	H/P	50	220	198	242	21,0	30	9,1	8,76	0,056	0,37
			230	207	253				8,37		
			240	216	264				8,03		
4MXM68M2V1B	H/P	50	220	198	242	21,0	30	8,3	7,65	0,056	0,37
			230	207	253				7,31		
			240	216	264				7,01		
4MXM80M2V1B	H/P	50	220	198	242	21,0	30	9,7	8,47	0,075	0,50
			230	207	253				8,10		
			240	216	264				7,77		
5MXM90M2V1B	H/P	50	220	198	242	24,5	30	11,8	10,40	0,075	0,50
			230	207	253				9,94		
			240	216	264				9,53		

Symbols

MCA: Minimum Circuit Ampere [A]

MFA: Maximum Fuse Ampere [A]

MSC: Maximum current of the starting compressor [A]

RLA: Rated load amps [A]

OFM: Outdoor fan motor [A]

FLA: Full Load Ampere [A]

kW: Fan motor rated output [kW]

Notes

1. The RLA is based on the following conditions.
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2. Voltage range
   The units are suitable for use with electrical systems in which the voltage supplied to the unit terminals is not below or above the listed range limits.
3. The maximum allowable voltage that is unbalanced between phases is 2%.
4. Select the wire size according to the MCA.
5. MFA is used to select the circuit breaker and the ground fault circuit interruptor.
   Earth leakage circuit breaker

3D102733

4 Combination table

4 - 1 Combination Table

4

3MXM40M

Cooling (50Hz 230V)

Outdoor unit	Indoor unit	Cooling capacity [kW]			Total capacity [kW]			Power input [kW]			Total current [A]			Power factor [%]	EER	ENERGY LABEL	AEC (kWh)	Seasonal data			
		Room A	Room B	Room C	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.					label	SEER	Pdesign	AEC
3MXM40M2V1B	1,5	1,50	---	---	1,40	1,50	2,20	0,32	0,35	0,46	1,52	1,63	2,20	91,00	---	---	---	---	---	---	---
	2,0	2,00	---	---	1,40	2,00	2,90	0,32	0,48	0,71	1,52	2,28	3,40	91,00	---	---	---	---	---	---	---
	2,5	2,50	---	---	1,40	2,50	3,10	0,32	0,64	0,82	1,52	3,05	3,90	91,00	---	---	---	---	---	---	---
	3,5	3,50	---	---	1,40	3,50	4,10	0,32	0,98	1,19	1,52	4,68	5,70	91,00	---	---	---	---	---	---	---
	1.5+1.5	1,50	1,50	---	1,60	3,00	4,20	0,34	0,59	1,14	1,63	2,82	5,44	91,00	5,12	A	293,00	A+++	8,64	3,00	122,00
	1.5+2.0	1,50	2,00	---	1,60	3,50	4,20	0,34	0,71	1,12	1,63	3,40	5,33	91,00	4,96	A	353,00	A+++	8,59	3,50	143,00
	1.5+2.5	1,50	2,50	---	1,60	4,00	4,20	0,34	0,86	1,12	1,63	4,11	5,33	91,00	4,68	A	427,00	A+++	8,51	4,00	164,00
	1.5+3.5	1,20	2,80	---	1,60	4,00	4,20	0,34	0,85	1,12	1,63	4,07	5,33	91,00	4,72	A	424,00	A+++	8,50	4,00	165,00
	2.0+2.0	2,00	2,00	---	1,60	4,00	4,50	0,34	0,84	1,09	1,63	4,02	5,22	91,00	4,76	A	420,00	A+++	8,52	4,00	165,00
	2.0+2.5	1,78	2,22	---	1,60	4,00	4,50	0,34	0,83	1,09	1,63	3,97	5,22	91,00	4,82	A	415,00	A+++	8,52	4,00	165,00
	2.0+3.5	1,45	2,55	---	1,60	4,00	4,50	0,34	0,83	1,09	1,63	3,97	5,22	91,00	4,86	A	412,00	A+++	8,50	4,00	165,00
	2.5+2.5	2,00	2,00	---	1,60	4,00	4,50	0,34	0,83	1,09	1,63	3,97	5,22	91,00	4,84	A	413,00	A+++	8,51	4,00	165,00
	2.5+3.5	1,67	2,33	---	1,60	4,00	4,50	0,34	0,82	1,09	1,63	3,92	5,22	91,00	4,88	A	410,00	A+++	8,50	4,00	165,00
	3.5+3.5	2,00	2,00	---	1,60	4,00	4,50	0,34	0,82	1,07	1,63	3,92	5,11	91,00	4,92	A	407,00	A+++	8,50	4,00	165,00
	1.5+1.5+1.5	1,33	1,33	1,33	1,70	4,00	4,60	0,36	0,78	0,98	1,74	3,73	4,68	91,00	5,18	A	386,00	A+++	8,55	4,00	164,00
	1.5+1.5+2.0	1,20	1,20	1,60	1,70	4,00	4,60	0,36	0,77	0,98	1,74	3,68	4,68	91,00	5,20	A	385,00	A+++	8,55	4,00	164,00
	1.5+1.5+2.5	1,09	1,09	1,82	1,70	4,00	4,60	0,36	0,77	0,98	1,74	3,68	4,68	91,00	5,22	A	383,00	A+++	8,54	4,00	164,00
	1.5+1.5+3.5	0,92	0,92	2,15	1,70	4,00	4,60	0,36	0,76	0,98	1,74	3,64	4,68	91,00	5,26	A	380,00	A+++	8,53	4,00	165,00
	1.5+2.0+2.0	1,09	1,45	1,45	1,70	4,00	4,60	0,36	0,77	0,98	1,74	3,68	4,68	91,00	5,25	A	381,00	A+++	8,53	4,00	164,00
	1.5+2.0+2.5	1,00	1,33	1,67	1,70	4,00	4,60	0,36	0,76	0,98	1,74	3,64	4,68	91,00	5,29	A	378,00	A+++	8,54	4,00	164,00
	1.5+2.0+3.5	0,86	1,14	2,00	1,70	4,00	4,60	0,36	0,76	0,98	1,74	3,64	4,68	91,00	5,31	A	377,00	A+++	8,53	4,00	165,00
	1.5+2.5+2.5	0,92	1,54	1,54	1,70	4,00	4,60	0,36	0,76	0,98	1,74	3,64	4,68	91,00	5,27	A	380,00	A+++	8,53	4,00	165,00
	2.0+2.0+2.0	1,33	1,33	1,33	1,70	4,00	4,60	0,36	0,76	0,98	1,74	3,64	4,68	91,00	5,30	A	378,00	A+++	8,52	4,00	214,00
	2.0+2.0+2.5	1,23	1,23	1,54	1,70	4,00	4,60	0,36	0,76	0,98	1,74	3,64	4,68	91,00	5,32	A	376,00	A+++	8,51	4,00	165,00
	2.0+2.5+2.5	1,14	1,43	1,43	1,70	4,00	4,60	0,36	0,75	0,98	1,74	3,59	4,68	91,00	5,35	A	374,00	A+++	8,50	4,00	165,00

Heating (50Hz 230V)

Outdoor unit	Indoor unit	Heating capacity [kW]			Total capacity [kW]			Power input [kW]			Total current [A]			Power factor [%]	COP	ENERGY LABEL	Seasonal data				
		Room A	Room B	Room C	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.				label	SCOP	Pdesign	AEC	Back-up heater capacity at -10℃
3MXM40M2V1B	1,5	2,30	---	---	1,10	2,30	3,30	0,30	0,60	0,82	1,38	2,77	3,83	93,00	---	---	---	---	---	---	---
	2,0	2,70	---	---	1,10	2,70	3,70	0,30	0,76	1,23	1,38	3,51	5,75	93,00	---	---	---	---	---	---	---
	2,5	3,40	---	---	1,10	3,40	4,10	0,30	1,01	1,28	1,38	4,68	5,96	93,00	---	---	---	---	---	---	---
	3,5	4,20	---	---	1,10	4,20	4,80	0,30	1,42	1,71	1,38	6,60	7,98	93,00	---	---	---	---	---	---	---
	1.5+1.5	1,80	1,80	---	1,20	3,60	5,00	0,32	0,69	1,30	1,49	3,23	6,07	93,00	5,25	A	A++	4,60	3,60	1096,00	0,50
	1.5+2.0	1,54	2,06	---	1,20	3,60	5,00	0,32	0,69	1,28	1,49	3,23	5,96	93,00	5,29	A	A++	4,62	3,60	1091,00	0,50
	1.5+2.5	1,50	2,50	---	1,20	4,00	5,00	0,32	0,86	1,28	1,49	4,03	5,96	93,00	4,68	A	A+	4,39	4,20	1338,00	0,70
	1.5+3.5	1,38	3,22	---	1,20	4,60	5,00	0,32	0,98	1,28	1,49	4,59	5,96	93,00	4,72	A	A+	4,28	4,80	1570,00	0,80
	2.0+2.0	2,30	2,30	---	1,20	4,60	5,00	0,32	0,97	1,25	1,49	4,54	5,85	93,00	4,76	A	A+	4,24	4,80	1582,00	0,90
	2.0+2.5	2,04	2,56	---	1,20	4,60	5,00	0,32	0,98	1,25	1,49	4,59	5,85	93,00	4,72	A	A+	4,27	4,80	1572,00	0,90
	2.0+3.5	1,67	2,93	---	1,20	4,60	5,00	0,32	0,97	1,25	1,49	4,54	5,85	93,00	4,76	A	A+	4,30	4,80	1560,00	0,80
	2.5+2.5	2,30	2,30	---	1,20	4,60	5,00	0,32	0,96	1,25	1,49	4,49	5,85	93,00	4,84	A	A+	4,34	4,80	1548,00	0,90
	2.5+3.5	1,92	2,68	---	1,20	4,60	5,00	0,32	0,95	1,25	1,49	4,45	5,85	93,00	4,88	A	A+	4,37	4,80	1537,00	0,80
	3.5+3.5	2,30	2,30	---	1,20	4,60	5,00	0,32	0,94	1,23	1,49	4,40	5,75	93,00	4,92	A	A+	4,38	5,00	1598,00	0,90
	1.5+1.5+1.5	1,53	1,53	1,53	1,30	4,60	5,10	0,32	0,89	1,02	1,49	4,17	4,79	93,00	5,18	A	A++	4,65	5,00	1505,00	0,90
	1.5+1.5+2.0	1,38	1,38	1,84	1,30	4,60	5,10	0,32	0,89	1,02	1,49	4,17	4,79	93,00	5,20	A	A++	4,63	5,00	1511,00	0,90
	1.5+1.5+2.5	1,25	1,25	2,09	1,30	4,60	5,10	0,32	0,89	1,02	1,49	4,17	4,79	93,00	5,22	A	A++	4,61	5,00	1517,00	0,90
	1.5+1.5+3.5	1,06	1,06	2,48	1,30	4,60	5,10	0,32	0,88	1,02	1,49	4,12	4,79	93,00	5,26	A	A++	4,61	5,00	1518,00	0,90
	1.5+2.0+2.0	1,25	1,67	1,67	1,30	4,60	5,10	0,32	0,88	1,02	1,49	4,12	4,79	93,00	5,25	A	A++	4,60	5,00	1520,00	0,90
	1.5+2.0+2.5	1,15	1,53	1,92	1,30	4,60	5,10	0,32	0,87	1,02	1,49	4,07	4,79	93,00	5,29	A	A++	4,60	5,00	1521,00	0,90
	1.5+2.0+3.5	0,99	1,31	2,30	1,30	4,60	5,10	0,32	0,87	1,02	1,49	4,07	4,79	93,00	5,31	A	A++	4,62	5,00	1515,00	0,90
	1.5+2.5+2.5	1,06	1,77	1,77	1,30	4,60	5,10	0,32	0,88	1,02	1,49	4,12	4,79	93,00	5,27	A	A++	4,62	5,00	1513,00	0,90
	2.0+2.0+2.0	1,53	1,53	1,53	1,30	4,60	5,10	0,32	0,87	1,02	1,49	4,07	4,79	93,00	5,30	A	A++	4,60	5,00	1521,00	0,90
	2.0+2.0+2.5	1,42	1,42	1,77	1,30	4,60	5,10	0,32	0,87	1,02	1,49	4,07	4,79	93,00	5,32	A	A++	4,62	5,00	1515,00	0,90
	2.0+2.5+2.5	1,31	1,64	1,64	1,30	4,60	5,10	0,32	0,86	1,02	1,49	4,03	4,79	93,00	5,35	A	A++	4,63	5,00	1512,00	0,90

Notes

1. The total capacity of each connected indoor unit is up to 7.0kW.
2. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5 kW class
   Wall-mounted CTXM-M,FTXM-M series
3. These indoor units can only be used in a multi-unit setup.
4. Heating capacity conditions
   Indoor temperature 20°C DB
   Outdoor temperature 7°C DB / 6°C WB
5. Cooling capacity conditions
   Indoor temperature 27°C DB / 19°C WB
   Outdoor temperature 35°C DB

3D102715

4 Combination table

4 - 1 Combination Table

3MXM52M

Cooling (50Hz 230V)

Outdoor unit	Indoor unit	Cooling capacity [kW]			Total capacity [kW]			Power input [kW]			Total current [A]			Power factor [%]	EER	ENERGY LABEL	AEC (kWh)	Seasonal data			
		Room A	Room B	Room C	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.					label	SEER	Pdesign	AEC
3MXM52M2V1B	1,50	1,50	---	---	1,40	1,50	2,40	0,34	0,36	0,63	1,50	1,62	2,86	96,00	---	---	---	---	---	---	---
	2,00	2,00	---	---	1,60	2,00	3,00	0,36	0,48	0,78	1,60	2,17	3,51	96,00	---	---	---	---	---	---	---
	2,50	2,50	---	---	1,60	2,50	3,20	0,36	0,64	0,87	1,62	2,89	3,92	96,00	---	---	---	---	---	---	---
	3,50	3,50	---	---	1,60	3,50	4,20	0,37	0,98	1,30	1,63	4,43	5,88	96,00	---	---	---	---	---	---	---
	4,20	4,20	---	---	1,60	4,20	4,60	0,37	1,21	1,49	1,63	5,47	6,70	96,00	---	---	---	---	---	---	---
	5,00	---	5,00	---	1,60	5,00	5,40	0,35	1,76	2,03	1,55	7,94	9,18	96,00	---	---	---	---	---	---	---
	1.5+1.5	1,50	1,50	---	1,70	3,00	4,70	0,35	0,55	1,32	1,55	2,50	5,98	96,00	5,48	A	274,00	A+++	8,64	3,00	122,00
	1.5+2.0	1,50	2,00	---	1,70	3,50	4,70	0,35	0,66	1,30	1,55	2,99	5,88	96,00	5,31	A	330,00	A+++	8,60	3,50	143,00
	1.5+2.5	1,50	2,50	---	1,70	4,00	5,00	0,35	0,78	1,92	1,55	3,54	8,66	96,00	5,16	A	388,00	A+++	8,54	4,00	164,00
	1.5+3.5	1,50	3,50	---	1,70	5,00	6,00	0,35	1,06	2,17	1,55	4,81	9,80	96,00	4,75	A	527,00	A+++	8,51	5,00	206,00
	1.5+4.2	1,37	3,83	---	1,70	5,20	6,10	0,35	1,10	2,26	1,55	4,99	10,21	96,00	4,74	A	549,00	A+++	8,51	5,20	214,00
	1.5+5.0	1,20	4,00	---	1,70	5,20	6,30	0,35	1,10	2,28	1,55	4,99	10,31	96,00	4,77	A	546,00	A+++	8,50	5,20	215,00
	2.0+2.0	2,00	2,00	---	1,70	4,00	6,00	0,35	0,85	2,25	1,55	3,85	10,16	96,00	4,72	A	424,00	A+++	8,52	4,00	165,00
	2.0+2.5	2,00	2,50	---	1,70	4,50	6,20	0,35	0,95	2,21	1,55	4,31	9,99	96,00	4,74	A	475,00	A+++	8,50	4,50	186,00
	2.0+3.5	1,89	3,31	---	1,70	5,20	6,30	0,35	1,10	2,30	1,55	4,99	10,38	96,00	4,76	A	547,00	A+++	8,53	5,20	214,00
	2.0+4.2	1,68	3,52	---	1,70	5,20	6,30	0,35	1,09	2,25	1,55	4,94	10,18	96,00	4,78	A	544,00	A+++	8,52	5,20	214,00
	2.0+5.0	1,49	3,71	---	1,70	5,20	6,50	0,35	1,09	2,19	1,55	4,94	9,89	96,00	4,80	A	542,00	A+++	8,51	5,20	214,00
	2.5+2.5	2,50	2,50	---	1,70	5,00	6,30	0,35	1,04	2,34	1,55	4,72	10,59	96,00	4,85	A	516,00	A+++	8,59	5,00	204,00
	2.5+3.5	2,17	3,03	---	1,70	5,20	6,30	0,35	1,09	2,28	1,55	4,94	10,31	96,00	4,78	A	544,00	A+++	8,58	5,20	213,00
	2.5+4.2	1,94	3,26	---	1,70	5,20	6,40	0,35	1,09	2,30	1,55	4,94	10,41	96,00	4,80	A	542,00	A+++	8,56	5,20	213,00
	2.5+5.0	1,73	3,47	---	1,70	5,20	6,50	0,35	1,06	2,14	1,55	4,81	9,68	96,00	4,92	A	529,00	A+++	8,53	5,20	214,00
	3.5+3.5	2,60	2,60	---	1,70	5,20	6,40	0,35	1,08	2,28	1,55	4,90	10,31	96,00	4,82	A	540,00	A+++	8,57	5,20	213,00
	3.5+4.2	2,36	2,84	---	1,70	5,20	6,40	0,35	1,08	2,26	1,55	4,90	10,21	96,00	4,83	A	539,00	A+++	8,55	5,20	213,00
	3.5+5.0	2,14	3,06	---	1,70	5,20	6,60	0,35	1,06	2,19	1,55	4,81	9,89	96,00	4,94	A	527,00	A+++	8,50	5,20	215,00
	4.2+4.2	2,60	2,60	---	1,70	5,20	6,50	0,35	1,07	2,24	1,55	4,85	10,11	96,00	4,88	A	533,00	A+++	8,54	5,20	213,00
	1.5+1.5+1.5	1,50	1,50	1,50	1,80	4,50	6,70	0,37	0,90	2,28	1,65	4,08	10,30	96,00	5,00	A	450,00	A+++	8,58	4,50	184,00
	1.5+1.5+2.0	1,50	1,50	2,00	1,80	5,00	6,70	0,37	1,06	2,26	1,65	4,81	10,20	96,00	4,76	A	526,00	A+++	8,51	5,20	214,00
	1.5+1.5+2.5	1,42	1,42	2,36	1,80	5,20	6,70	0,37	1,09	2,23	1,65	4,94	10,10	96,00	4,78	A	544,00	A+++	8,50	5,20	215,00
	1.5+1.5+3.5	1,20	1,20	2,80	1,90	5,20	6,80	0,37	1,09	2,28	1,65	4,94	10,30	96,00	4,81	A	541,00	A+++	8,50	5,20	215,00
	1.5+1.5+4.2	1,08	1,08	3,03	1,90	5,20	6,80	0,37	1,08	2,26	1,65	4,90	10,20	96,00	4,83	A	539,00	A+++	8,50	5,20	215,00
	1.5+1.5+5.0	0,98	0,98	3,25	2,00	5,20	7,10	0,35	1,05	2,17	1,55	4,76	9,80	96,00	4,98	A	523,00	A++	8,24	5,20	221,00
	1.5+2.0+2.0	1,42	1,89	1,89	1,80	5,20	6,70	0,37	1,10	2,21	1,65	4,99	10,00	96,00	4,77	A	546,00	A+++	8,50	5,20	215,00
	1.5+2.0+2.5	1,30	1,73	2,17	1,80	5,20	6,70	0,37	1,09	2,19	1,65	4,94	9,90	96,00	4,79	A	543,00	A+++	8,50	5,20	215,00
	1.5+2.0+3.5	1,11	1,49	2,60	1,90	5,20	6,80	0,37	1,08	2,23	1,65	4,90	10,10	96,00	4,82	A	540,00	A+++	8,50	5,20	215,00
	1.5+2.0+4.2	1,01	1,35	2,84	1,90	5,20	6,80	0,37	1,08	2,19	1,65	4,90	9,90	96,00	4,84	A	538,00	A+++	8,50	5,20	215,00
	1.5+2.0+5.0	0,92	1,22	3,06	2,00	5,20	7,20	0,35	1,04	2,15	1,55	4,72	9,70	96,00	5,01	A	519,00	A++	8,24	5,20	221,00
	1.5+2.5+2.5	1,20	2,00	2,00	1,80	5,20	6,70	0,37	1,09	2,17	1,65	4,94	9,80	96,00	4,81	A	541,00	A+++	8,52	5,20	214,00
	1.5+2.5+3.5	1,04	1,73	2,43	1,90	5,20	6,80	0,37	1,08	2,21	1,65	4,90	10,00	96,00	4,85	A	537,00	A+++	8,51	5,20	214,00
	1.5+2.5+4.2	0,95	1,59	2,66	1,90	5,20	6,80	0,37	1,07	2,19	1,65	4,85	9,90	96,00	4,87	A	534,00	A+++	8,50	5,20	214,00
	1.5+2.5+5.0	0,87	1,44	2,89	2,00	5,20	7,30	0,35	1,04	2,17	1,55	4,72	9,80	96,00	5,03	A	517,00	A++	8,17	5,20	223,00
	1.5+3.5+3.5	0,92	2,14	2,14	1,80	5,20	7,30	0,37	1,07	2,15	1,65	4,85	9,70	96,00	4,89	A	532,00	A+++	8,50	5,20	215,00
	2.0+2.0+2.0	1,73	1,73	1,73	1,80	5,20	7,00	0,37	1,07	2,22	1,65	4,85	10,05	96,00	4,87	A	534,00	A+++	8,51	5,20	214,00
	2.0+2.0+2.5	1,60	1,60	2,00	1,80	5,20	7,00	0,37	1,06	2,21	1,65	4,81	10,00	96,00	4,94	A	527,00	A+++	8,51	5,20	214,00
	2.0+2.0+3.5	1,39	1,39	2,43	1,90	5,20	7,20	0,39	1,05	2,17	1,75	4,76	9,80	96,00	4,96	A	525,00	A+++	8,50	5,20	214,00
	2.0+2.0+4.2	1,27	1,27	2,66	1,90	5,20	7,20	0,39	1,04	2,15	1,75	4,72	9,70	96,00	5,00	A	520,00	A+++	8,50	5,20	214,00
	2.0+2.0+5.0	1,16	1,16	2,89	2,00	5,20	7,30	0,37	1,03	2,19	1,65	4,67	9,91	96,00	5,05	A	515,00	A++	8,14	5,20	224,00
	2.0+2.5+2.5	1,49	1,86	1,86	1,80	5,20	7,10	0,39	1,05	2,12	1,75	4,76	9,60	96,00	4,98	A	523,00	A+++	8,51	5,20	214,00
	2.0+2.5+3.5	1,30	1,63	2,28	1,90	5,20	7,20	0,39	1,04	2,15	1,75	4,72	9,70	96,00	5,01	A	519,00	A+++	8,50	5,20	215,00
	2.0+2.5+4.2	1,20	1,49	2,51	1,90	5,20	7,20	0,39	1,04	2,14	1,75	4,72	9,65	96,00	5,03	A	517,00	A+++	8,50	5,20	214,00
	2.0+3.5+3.5	1,16	2,02	2,02	1,90	5,20	7,30	0,39	1,04	2,15	1,75	4,72	9,70	96,00	5,02	A	518,00	A+++	8,50	5,20	215,00
	2.5+2.5+2.5	1,73	1,73	1,73	1,90	5,20	7,10	0,39	1,04	2,19	1,75	4,72	9,90	96,00	5,00	A	520,00	A+++	8,50	5,20	215,00
	2.5+2.5+3.5	1,53	1,53	2,14	1,90	5,20	7,20	0,39	1,04	2,16	1,75	4,72	9,75	96,00	5,02	A	518,00	A+++	8,50	5,20	215,00

Notes

1. The total capacity of each connected indoor unit is up to 9.0kW.
2. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
3. These indoor units can only be used in a multi-unit setup.
4. Cooling capacity conditions
   Indoor temperature 27°C DB / 19°C WB
   Outdoor temperature 35°C DB

3D102722

4

4 Combination table

4 - 1 Combination Table

4

3MXM52M

Heating (50Hz 230V)

Outdoor unit	Indoor unit	Heating capacity [kW]			Total capacity [kW]			Power input [kW]			Total current [A]			Power factor [%]	COP	ENERGY LABEL	Seasonal data				
		Room A	Room B	Room C	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.				label	SCOP	Pdesign	AEC	Back-up heater capacity at -10°C
3MXM52M2V1B	1,50	2,30	---	---	1,10	2,30	3,40	0,30	0,57	1,19	1,34	2,55	5,37	96,00	---	---	---	---	---	---	---
	2,00	2,70	---	---	1,10	2,70	3,80	0,30	0,76	1,23	1,34	3,40	5,57	96,00	---	---	---	---	---	---	---
	2,50	3,40	---	---	1,10	3,40	4,00	0,30	1,01	1,28	1,34	4,54	5,78	96,00	---	---	---	---	---	---	---
	3,50	4,20	---	---	1,10	4,20	4,80	0,30	1,42	1,71	1,34	6,39	7,73	96,00	---	---	---	---	---	---	---
	4,20	4,80	---	---	1,10	4,80	5,60	0,30	1,62	2,03	1,34	7,32	9,18	96,00	---	---	---	---	---	---	---
	5,00	---	5,80	---	1,10	5,80	6,80	0,30	2,17	2,60	1,34	9,80	11,76	96,00	---	---	---	---	---	---	---
	1.5+1.5	1,80	1,80	---	1,20	3,60	5,80	0,32	0,67	1,67	1,44	3,04	7,53	96,00	5,42	A	A++	4,60	3,60	1095,00	0,50
	1.5+2.0	1,71	2,29	---	1,20	4,00	5,80	0,32	0,77	1,64	1,44	3,49	7,43	96,00	5,21	A	A++	4,65	3,60	1084,00	0,50
	1.5+2.5	1,69	2,81	---	1,20	4,50	6,90	0,32	0,91	2,37	1,44	4,13	10,71	96,00	4,96	A	A+	4,44	4,20	1325,00	0,70
	1.5+3.5	1,65	3,85	---	1,20	5,50	7,00	0,32	1,22	2,34	1,44	5,53	10,56	96,00	4,53	A	A+	4,30	4,80	1562,00	0,80
	1.5+4.2	1,58	4,42	---	1,20	6,00	7,00	0,32	1,42	2,30	1,44	6,44	10,41	96,00	4,24	A	A+	4,34	4,80	1546,00	0,80
	1.5+5.0	1,57	5,23	---	1,30	6,80	7,20	0,32	1,58	2,31	1,44	7,16	10,42	96,00	4,33	A	A+	4,47	4,80	1501,00	0,70
	2.0+2.0	3,40	3,40	---	1,20	6,80	7,00	0,32	1,59	2,35	1,44	7,21	10,61	96,00	4,28	A	A+	4,27	4,80	1573,00	0,90
	2.0+2.5	3,02	3,78	---	1,20	6,80	7,00	0,32	1,58	2,33	1,44	7,16	10,51	96,00	4,32	A	A+	4,30	4,80	1563,00	0,90
	2.0+3.5	2,47	4,33	---	1,20	6,80	7,10	0,32	1,57	2,30	1,44	7,12	10,41	96,00	4,34	A	A+	4,33	4,80	1552,00	0,80
	2.0+4.2	2,19	4,61	---	1,20	6,80	7,10	0,32	1,56	2,28	1,44	7,07	10,31	96,00	4,36	A	A+	4,36	4,80	1541,00	0,80
	2.0+5.0	1,94	4,86	---	1,40	6,80	7,20	0,32	1,53	2,28	1,44	6,93	10,32	96,00	4,46	A	A+	4,50	4,80	1492,00	0,70
	2.5+2.5	3,40	3,40	---	1,20	6,80	7,00	0,32	1,53	2,35	1,44	6,93	10,62	96,00	4,45	A	A+	4,38	4,80	1533,00	0,90
	2.5+3.5	2,83	3,97	---	1,30	6,80	7,20	0,32	1,53	2,37	1,44	6,93	10,73	96,00	4,46	A	A+	4,41	4,80	1523,00	0,80
	2.5+4.2	2,54	4,26	---	1,30	6,80	7,20	0,32	1,52	2,35	1,44	6,89	10,62	96,00	4,48	A	A+	4,45	4,80	1508,00	0,80
	2.5+5.0	2,27	4,53	---	1,40	6,80	7,40	0,32	1,50	2,33	1,44	6,80	10,52	96,00	4,54	A	A+	4,53	4,80	1482,00	0,70
	3.5+3.5	3,40	3,40	---	1,40	6,80	7,30	0,32	1,52	2,44	1,44	6,89	11,02	96,00	4,50	A	A+	4,40	5,00	1590,00	0,90
	3.5+4.2	3,09	3,71	---	1,40	6,80	7,30	0,32	1,51	2,39	1,44	6,84	10,82	96,00	4,52	A	A+	4,43	5,00	1579,00	0,90
	3.5+5.0	2,80	4,00	---	1,45	6,80	7,50	0,32	1,50	2,37	1,44	6,80	10,72	96,00	4,56	A	A+	4,52	5,00	1548,00	0,80
	4.2+4.2	3,40	3,40	---	1,40	6,80	7,30	0,32	1,50	2,35	1,44	6,80	10,62	96,00	4,55	A	A+	4,46	5,00	1569,00	0,90
	1.5+1.5+1.5	2,27	2,27	2,27	1,30	6,80	8,00	0,32	1,40	2,32	1,44	6,35	10,49	96,00	4,87	A	A++	4,60	5,00	1522,00	0,90
	1.5+1.5+2.0	2,04	2,04	2,72	1,30	6,80	8,00	0,32	1,40	2,30	1,44	6,35	10,39	96,00	4,88	A	A++	4,61	5,00	1517,00	0,90
	1.5+1.5+2.5	1,85	1,85	3,09	1,30	6,80	8,00	0,32	1,39	2,28	1,44	6,30	10,29	96,00	4,91	A	A++	4,63	5,00	1512,00	0,90
	1.5+1.5+3.5	1,57	1,57	3,66	1,40	6,80	8,10	0,32	1,38	2,26	1,44	6,25	10,19	96,00	4,94	A	A++	4,65	5,00	1506,00	0,90
	1.5+1.5+4.2	1,42	1,42	3,97	1,40	6,80	8,10	0,32	1,38	2,24	1,44	6,25	10,14	96,00	4,96	A	A++	4,66	5,00	1500,00	0,90
	1.5+1.5+5.0	1,28	1,28	4,25	1,60	6,80	8,30	0,32	1,32	2,19	1,44	5,98	9,89	96,00	5,18	A	A++	4,83	5,00	1448,00	0,80
	1.5+2.0+2.0	1,85	2,47	2,47	1,30	6,80	8,00	0,32	1,39	2,26	1,44	6,30	10,19	96,00	4,90	A	A++	4,62	5,00	1515,00	0,90
	1.5+2.0+2.5	1,70	2,27	2,83	1,30	6,80	8,00	0,32	1,38	2,22	1,44	6,25	10,04	96,00	4,93	A	A++	4,64	5,00	1509,00	0,90
	1.5+2.0+3.5	1,46	1,94	3,40	1,40	6,80	8,10	0,32	1,37	2,26	1,44	6,21	10,19	96,00	4,97	A	A++	4,65	5,00	1503,00	0,90
	1.5+2.0+4.2	1,32	1,77	3,71	1,40	6,80	8,10	0,32	1,36	2,22	1,44	6,16	10,04	96,00	5,00	A	A++	4,67	5,00	1498,00	0,90
	1.5+2.0+5.0	1,20	1,60	4,00	1,60	6,80	8,30	0,32	1,31	2,17	1,44	5,94	9,79	96,00	5,22	A	A++	4,85	5,00	1443,00	0,80
	1.5+2.5+2.5	1,57	2,62	2,62	1,30	6,80	8,00	0,32	1,38	2,20	1,44	6,25	9,94	96,00	4,95	A	A++	4,64	5,00	1507,00	0,90
	1.5+2.5+3.5	1,36	2,27	3,17	1,40	6,80	8,10	0,32	1,37	2,23	1,44	6,21	10,09	96,00	4,99	A	A++	4,66	5,00	1501,00	0,90
	1.5+2.5+4.2	1,24	2,07	3,48	1,40	6,80	8,10	0,32	1,36	2,20	1,44	6,16	9,94	96,00	5,01	A	A++	4,68	5,00	1495,00	0,90
	1.5+2.5+5.0	1,13	1,89	3,78	1,60	6,80	8,30	0,32	1,30	2,14	1,44	5,89	9,69	96,00	5,26	A	A++	4,86	5,00	1438,00	0,80
	1.5+3.5+3.5	1,20	2,80	2,80	1,30	6,80	8,20	0,32	1,36	2,17	1,44	6,16	9,79	96,00	5,02	A	A++	4,70	5,00	1489,00	0,90
	2.0+2.0+2.0	2,27	2,27	2,27	1,30	6,80	8,00	0,32	1,39	2,21	1,44	6,30	9,99	96,00	4,91	A	A++	4,61	5,00	1516,00	0,90
	2.0+2.0+2.5	2,09	2,09	2,62	1,30	6,80	8,00	0,32	1,38	2,19	1,44	6,25	9,89	96,00	4,95	A	A++	4,63	5,00	1510,00	0,90
	2.0+2.0+3.5	1,81	1,81	3,17	1,40	6,80	8,10	0,32	1,37	2,21	1,44	6,21	9,99	96,00	4,98	A	A++	4,66	5,00	1501,00	0,90
	2.0+2.0+4.2	1,66	1,66	3,48	1,40	6,80	8,10	0,32	1,36	2,18	1,44	6,16	9,84	96,00	5,01	A	A++	4,68	5,00	1496,00	0,90
	2.0+2.0+5.0	1,51	1,51	3,78	1,60	6,80	8,30	0,32	1,29	2,12	1,44	5,85	9,59	96,00	5,30	A	A++	4,88	5,00	1434,00	0,80
	2.0+2.5+2.5	1,94	2,43	2,43	1,30	6,80	8,00	0,32	1,37	2,17	1,44	6,21	9,79	96,00	4,99	A	A++	4,64	5,00	1508,00	0,90
	2.0+2.5+3.5	1,70	2,13	2,98	1,50	6,80	8,10	0,32	1,36	2,19	1,44	6,16	9,89	96,00	5,03	A	A++	4,67	5,00	1499,00	0,90
	2.0+2.5+4.2	1,56	1,95	3,28	1,50	6,80	8,10	0,32	1,35	2,15	1,44	6,12	9,69	96,00	5,07	A	A++	4,68	5,00	1493,00	0,90
	2.0+3.5+3.5	1,51	2,64	2,64	1,50	6,80	8,20	0,32	1,35	2,15	1,44	6,12	9,69	96,00	5,05	A	A++	4,68	5,00	1496,00	0,90
	2.5+2.5+2.5	2,27	2,27	2,27	1,40	6,80	8,00	0,32	1,36	2,15	1,44	6,16	9,69	96,00	5,02	A	A++	4,65	5,00	1505,00	0,90
	2.5+2.5+3.5	2,00	2,00	2,80	1,50	6,80	8,10	0,32	1,35	2,16	1,44	6,12	9,74	96,00	5,05	A	A++	4,68	5,00	1496,00	0,90

Notes

1. The total capacity of each connected indoor unit is up to 9.0kW.
2. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
3. These indoor units can only be used in a multi-unit setup.
4. Heating capacity conditions
   Indoor temperature 20°C DB
   Outdoor temperature 7°C DB / 6°C WB

3D102723

3MXM68M

Cooling (50Hz 230V)

Outdoor unit	Indoor unit	Cooling capacity [kW]			Total capacity [kW]			Power input [kW]			Total current [A]			Power factor [%]
		Room A	Room B	Room C	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	
3MXM68M2V1B	1.5	1,60	---	---	1,52	1,60	2,49	0,40	0,42	0,59	1,82	1,98	2,71	95
	2.0	2,00	---	---	1,66	2,00	2,68	0,42	0,43	0,60	1,91	2,08	2,75	95
	2.5	2,50	---	---	1,74	2,50	3,44	0,44	0,44	0,82	2,00	2,62	3,77	95
	3.5	3,50	---	---	1,93	3,50	4,86	0,46	0,46	1,43	2,09	3,84	6,53	95
	4.2	---	---	4,20	1,93	4,20	5,33	0,46	0,46	1,44	2,09	3,93	6,57	95
	5.0	---	---	5,00	1,94	5,00	6,03	0,44	0,44	2,13	2,00	7,20	9,77	95
	6.0	---	---	6,00	1,94	6,00	6,51	0,44	0,44	2,13	2,00	7,29	9,77	95
	1.5+1.5	1,50	1,50	---	1,95	3,00	4,79	0,40	0,51	1,15	1,81	2,34	5,25	95
	1.5+2.0	1,50	2,00	---	1,95	3,50	4,96	0,40	0,62	1,22	1,81	2,84	5,58	95
	1.5+2.5	1,50	2,50	---	1,95	4,00	5,28	0,40	0,75	1,36	1,81	3,44	6,23	95
	1.5+3.5	1,50	3,50	---	1,95	5,00	6,17	0,39	1,04	1,83	1,77	4,76	8,39	95
	1.5+4.2	1,50	4,20	---	1,95	5,70	6,39	0,39	1,27	1,96	1,77	5,82	8,96	95
	1.5+5.0	1,50	5,00	---	1,95	6,50	7,08	0,38	1,50	2,23	1,73	6,87	10,22	95
	1.5+6.0	1,36	5,44	---	1,96	6,80	7,59	0,37	1,62	2,36	1,68	7,42	10,79	95
	2.0+2.0	2,00	2,00	---	1,95	4,00	5,12	0,40	0,75	1,29	1,81	3,44	5,91	95
	2.0+2.5	2,00	2,50	---	1,95	4,50	5,44	0,40	0,89	1,43	1,81	4,08	6,56	95
	2.0+3.5	2,00	3,50	---	1,95	5,50	6,30	0,39	1,17	1,91	1,77	5,36	8,76	95
	2.0+4.2	2,00	4,20	---	1,95	6,20	6,51	0,39	1,43	2,05	1,77	6,55	9,37	95
	2.0+5.0	1,94	4,86	---	1,95	6,80	7,26	0,38	1,59	2,36	1,73	7,28	10,79	95
	2.0+6.0	1,70	5,10	---	1,96	6,80	7,71	0,37	1,61	2,45	1,68	7,37	11,20	95
	2.5+2.5	2,50	2,50	---	1,95	5,00	6,10	0,41	1,01	1,78	1,89	4,63	8,15	95
	2.5+3.5	2,50	3,50	---	1,95	6,00	6,57	0,40	1,29	2,11	1,81	5,91	9,65	95
	2.5+4.2	2,50	4,20	---	1,95	6,70	6,95	0,40	1,51	2,38	1,81	6,92	10,88	95
	2.5+5.0	2,27	4,53	---	1,95	6,80	7,37	0,37	1,50	2,45	1,68	6,87	11,20	95
	2.5+6.0	2,00	4,80	---	1,96	6,80	7,71	0,35	1,48	2,45	1,60	6,78	11,20	95
	3.5+3.5	3,40	3,40	---	1,95	6,80	7,13	0,38	1,45	2,37	1,73	6,64	10,83	95
	3.5+4.2	3,09	3,71	---	1,95	6,80	7,24	0,38	1,45	2,46	1,73	6,64	11,24	95
	3.5+5.0	2,80	4,00	---	1,95	6,80	7,76	0,35	1,42	2,78	1,60	6,50	12,71	95
	3.5+6.0	2,51	4,29	---	2,26	6,80	8,07	0,40	1,40	2,72	1,81	6,41	12,46	95
	4.2+4.2	---	3,40	3,40	1,95	6,80	7,14	0,38	1,44	2,37	1,73	6,60	10,83	95
	4.2+5.0	---	3,10	3,70	1,95	6,80	7,77	0,35	1,41	2,78	1,60	6,46	12,71	95
	4.2+6.0	---	2,80	4,00	2,26	6,80	8,08	0,40	1,40	2,72	1,81	6,41	12,46	95
	5.0+5.0	---	3,40	3,40	2,34	6,80	8,22	0,43	1,38	2,98	1,98	6,32	13,65	95
	5.0+6.0	---	3,09	3,71	2,47	6,80	8,45	0,44	1,37	2,92	2,02	6,28	13,36	95
	1.5+1.5+1.5	1,50	1,50	1,50	1,96	4,50	6,40	0,39	0,61	1,57	1,77	2,80	7,17	95
	1.5+1.5+2.0	1,44	1,44	1,92	1,96	4,80	6,56	0,39	0,70	1,65	1,77	3,21	7,54	95
	1.5+1.5+2.5	1,36	1,36	2,27	1,96	5,00	6,72	0,39	0,80	1,73	1,77	3,67	7,90	95
	1.5+1.5+3.5	1,50	1,50	3,50	1,96	6,50	7,11	0,38	1,56	1,92	1,73	7,14	8,80	95
	1.5+1.5+4.2	1,42	1,42	3,97	1,96	6,80	7,33	0,38	1,80	2,05	1,73	8,24	9,37	95
	1.5+1.5+5.0	1,28	1,28	4,25	1,96	6,80	7,74	0,36	1,75	2,22	1,64	8,01	10,14	95
	1.5+1.5+6.0	1,13	1,13	4,53	2,31	6,80	7,99	0,40	1,73	2,17	1,85	7,92	9,94	95
	1.5+2.0+2.0	1,50	2,00	2,00	1,96	5,50	6,48	0,39	1,01	1,61	1,77	4,63	7,37	95

Notes

1. The total capacity of each connected indoor unit is up to 11.0kW.
2. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
3. These indoor units can only be used in a multi-unit setup.
4. Cooling capacity conditions
   Indoor temperature 27°C DB / 19°C WB
   Outdoor temperature 35°C DB

3D103339

4 Combination table

4 - 1 Combination Table

3MXM68M

Cooling (50Hz 230V)

Outdoor unit	Indoor unit	Cooling capacity [kW]			Total capacity [kW]			Power input [kW]			Total current [A]			Power factor [%]
		Room A	Room B	Room C	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	
3MXM68M2V1B	1.5+2.0+2.5	1,50	2,00	2,50	1,96	6,00	6,87	0,39	1,32	1,81	1,77	6,05	8,27	95
	1.5+2.0+3.5	1,46	1,94	3,40	1,96	6,80	7,25	0,38	1,80	2,01	1,73	8,24	9,21	95
	1.5+2.0+4.2	1,32	1,77	3,71	1,96	6,80	7,47	0,38	1,79	2,14	1,73	8,20	9,78	95
	1.5+2.0+5.0	1,20	1,60	4,00	1,96	6,80	7,87	0,36	1,74	2,31	1,64	7,97	10,55	95
	1.5+2.0+6.0	1,07	1,43	4,29	2,31	6,80	8,13	0,40	1,72	2,26	1,85	7,88	10,35	95
	1.5+2.5+2.5	1,50	2,50	2,50	1,96	6,50	7,10	0,38	1,63	1,92	1,73	7,46	8,80	95
	1.5+2.5+3.5	1,36	2,27	3,17	1,96	6,80	7,60	0,36	1,79	2,23	1,64	8,20	10,18	95
	1.5+2.5+4.2	1,24	2,07	3,48	1,96	6,80	7,81	0,36	1,78	2,35	1,64	8,15	10,75	95
	1.5+2.5+5.0	1,13	1,89	3,78	1,96	6,80	7,95	0,36	1,74	2,35	1,64	7,97	10,75	95
	1.5+2.5+6.0	1,02	1,70	4,08	2,31	6,80	8,42	0,41	1,71	2,44	1,89	7,83	11,16	95
	1.5+3.5+3.5	1,20	2,80	2,80	1,96	6,80	7,94	0,37	1,77	2,45	1,68	8,11	11,20	95
	1.5+3.5+4.2	1,11	2,59	3,10	1,96	6,80	8,13	0,37	1,76	2,58	1,68	8,06	11,81	95
	1.5+3.5+5.0	1,02	2,38	3,40	1,96	6,80	8,46	0,33	1,72	2,72	1,52	7,88	12,46	95
	1.5+3.5+6.0	0,93	2,16	3,71	2,31	6,80	8,56	0,41	1,70	2,53	1,89	7,79	11,57	95
	1.5+4.2+4.2	1,03	2,88	2,88	1,96	6,80	8,26	0,37	1,75	2,68	1,68	8,01	12,26	95
	1.5+4.2+5.0	0,95	2,67	3,18	1,96	6,80	8,53	0,33	1,71	2,77	1,52	7,83	12,67	95
	2.0+2.0+2.0	2,00	2,00	2,00	1,96	6,00	6,64	0,39	1,34	1,68	1,77	6,14	7,70	95
	2.0+2.0+2.5	2,00	2,00	2,50	1,96	6,50	7,03	0,39	1,63	1,89	1,77	7,46	8,64	95
	2.0+2.0+3.5	1,81	1,81	3,17	1,96	6,80	7,40	0,38	1,79	2,09	1,73	8,20	9,57	95
	2.0+2.0+4.2	1,66	1,66	3,48	1,96	6,80	7,61	0,38	1,78	2,23	1,73	8,15	10,18	95
	2.0+2.0+5.0	1,51	1,51	3,78	1,96	6,80	8,01	0,36	1,74	2,39	1,64	7,97	10,96	95
	2.0+2.0+6.0	1,36	1,36	4,08	2,31	6,80	8,27	0,40	1,71	2,35	1,85	7,83	10,75	95
	2.0+2.5+2.5	1,94	2,43	2,43	1,96	6,80	7,24	0,38	1,77	2,01	1,73	8,11	9,21	95
	2.0+2.5+3.5	1,70	2,13	2,98	1,96	6,80	7,74	0,36	1,76	2,31	1,64	8,06	10,55	95
	2.0+2.5+4.2	1,56	1,95	3,28	1,96	6,80	7,94	0,36	1,75	2,45	1,64	8,01	11,20	95
	2.0+2.5+5.0	1,43	1,79	3,58	1,96	6,80	8,08	0,36	1,71	2,44	1,64	7,83	11,16	95
	2.0+2.5+6.0	1,30	1,62	3,89	2,31	6,80	8,55	0,41	1,69	2,53	1,89	7,74	11,57	95
	2.0+3.5+3.5	1,51	2,64	2,64	1,96	6,80	8,07	0,37	1,74	2,54	1,68	7,97	11,61	95
	2.0+3.5+4.2	1,40	2,45	2,94	1,96	6,80	8,25	0,37	1,74	2,68	1,68	7,97	12,26	95
	2.0+3.5+5.0	1,30	2,27	3,24	2,28	6,80	8,58	0,40	1,69	2,82	1,85	7,74	12,91	95
	2.0+4.2+4.2	1,31	2,75	2,75	1,96	6,80	8,37	0,37	1,73	2,77	1,68	7,92	12,67	95
	2.5+2.5+2.5	2,27	2,27	2,27	1,96	6,80	7,53	0,38	1,76	2,18	1,73	8,06	9,98	95
	2.5+2.5+3.5	2,00	2,00	2,80	1,96	6,80	7,94	0,36	1,72	2,45	1,64	7,88	11,20	95
	2.5+2.5+4.2	1,85	1,85	3,10	1,96	6,80	8,12	0,36	1,71	2,58	1,64	7,83	11,81	95
	2.5+2.5+5.0	1,70	1,70	3,40	2,28	6,80	8,45	0,40	1,67	2,72	1,85	7,65	12,46	95
	2.5+2.5+6.0	1,55	1,55	3,71	2,42	6,80	8,74	0,40	1,65	2,67	1,85	7,56	12,22	95
	2.5+3.5+3.5	1,79	2,51	2,51	2,27	6,80	8,30	0,40	1,70	2,72	1,85	7,79	12,46	95
	2.5+3.5+4.2	1,67	2,33	2,80	2,27	6,80	8,43	0,40	1,69	2,82	1,85	7,74	12,91	95
	2.5+3.5+5.0	1,55	2,16	3,09	2,48	6,80	8,74	0,42	1,65	2,96	1,94	7,56	13,56	95
	2.5+4.2+4.2	1,56	2,62	2,62	2,27	6,80	8,49	0,40	1,68	2,87	1,85	7,69	13,12	95
	3.5+3.5+3.5	2,27	2,27	2,27	2,38	6,80	8,59	0,40	1,68	2,96	1,81	7,69	13,56	95

Notes

1. The total capacity of each connected indoor unit is up to 11.0kW.
2. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
3. These indoor units can only be used in a multi-unit setup.
4. Cooling capacity conditions
   Indoor temperature 27°C DB / 19°C WB
   Outdoor temperature 35°C DB

3D103340

3MXM68M

Heating (50Hz 230V)

Outdoor unit	Indoor unit	Heating capacity [kW]			Total capacity [kW]			Power input [kW]			Total current [A]			Power factor [%]
		Room A	Room B	Room C	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	
3MXM68M2V1B	1,5	1,5	---	---	1,47	2,70	4,08	0,42	0,73	1,22	1,91	3,35	5,59	95
	2,0	2,0	---	---	1,48	2,72	4,09	0,43	0,74	1,23	1,95	3,39	5,64	95
	2,5	2,5	---	---	1,44	3,40	4,30	0,42	1,03	1,33	1,91	4,72	6,08	95
	3,5	3,5	---	---	1,45	4,30	4,70	0,40	1,42	1,56	1,82	6,50	7,15	95
	4,2	4,2	---	---	1,44	4,32	4,69	0,40	1,41	1,56	1,82	6,46	7,15	95
	5,0	---	5,00	---	1,66	5,60	5,94	0,39	1,84	1,90	1,78	8,43	8,70	95
	6,0	---	6,00	---	1,88	7,90	8,91	0,37	2,65	2,64	1,69	12,13	12,08	95
	1.5+1.5	2,62	2,62	---	1,65	5,30	7,38	0,36	1,19	1,83	1,63	5,45	8,38	95
	1.5+2.0	2,43	3,23	---	1,65	5,70	7,76	0,36	1,31	1,99	1,63	6,00	9,09	95
	1.5+2.5	2,28	3,80	---	1,65	6,10	7,95	0,36	1,43	2,06	1,63	6,55	9,43	95
	1.5+3.5	2,08	4,84	---	1,80	6,90	8,50	0,37	1,69	2,35	1,68	7,74	10,74	95
	1.5+4.2	1,98	5,53	---	1,80	7,50	8,85	0,37	1,90	2,57	1,68	8,70	11,75	95
	1.5+5.0	1,89	6,29	---	2,18	8,20	10,38	0,45	2,13	2,91	2,06	9,75	13,31	95
	1.5+6.0	1,72	6,88	---	2,46	8,60	10,58	0,48	2,28	2,67	2,19	10,44	12,21	95
	2.0+2.0	3,25	3,25	---	1,65	6,50	7,95	0,36	1,37	2,07	1,63	6,28	9,47	95
	2.0+2.5	3,04	3,81	---	1,65	6,90	8,12	0,36	1,52	2,14	1,63	6,96	9,81	95
	2.0+3.5	2,71	4,74	---	1,80	7,50	8,67	0,37	1,75	2,43	1,68	8,01	11,12	95
	2.0+4.2	2,58	5,42	---	1,80	8,00	9,03	0,37	1,98	2,66	1,68	9,07	12,17	95
	2.0+5.0	2,46	6,14	---	2,18	8,60	10,56	0,45	2,26	3,00	2,06	10,35	13,73	95
	2.0+6.0	2,15	6,45	---	2,46	8,60	10,75	0,48	2,24	2,74	2,19	10,26	12,55	95
	2.5+2.5	3,60	3,60	---	1,65	7,20	8,49	0,36	1,62	2,36	1,63	7,42	10,78	95
	2.5+3.5	3,29	4,61	---	1,89	7,90	9,03	0,38	1,91	2,66	1,72	8,75	12,17	95
	2.5+4.2	3,10	5,20	---	1,89	8,30	9,29	0,38	2,11	2,82	1,72	9,66	12,93	95
	2.5+5.0	2,87	5,73	---	2,27	8,60	10,68	0,46	2,24	3,09	2,11	10,26	14,15	95
	2.5+6.0	2,53	6,07	---	2,55	8,60	10,88	0,50	2,22	2,77	2,28	10,17	12,67	95
	3.5+3.5	4,30	4,30	---	2,17	8,60	9,38	0,42	2,26	2,86	1,94	10,35	13,09	95
	3.5+4.2	3,91	4,69	---	2,17	8,60	9,47	0,42	2,26	2,91	1,94	10,35	13,31	95
	3.5+5.0	3,54	5,06	---	2,56	8,60	10,90	0,51	2,22	3,13	2,32	10,17	14,32	95
	3.5+6.0	3,17	5,43	---	2,74	8,60	11,01	0,52	2,21	2,76	2,37	10,12	12,63	95
	4.2+4.2	---	4,30	4,30	2,17	8,60	9,56	0,42	2,22	2,94	1,94	10,17	13,47	95
	4.2+5.0	---	3,93	4,67	2,56	8,60	10,91	0,51	2,21	3,19	2,32	10,12	14,61	95
	4.2+6.0	---	3,54	5,06	2,74	8,60	11,02	0,51	2,20	2,79	2,32	10,07	12,76	95
	5.0+5.0	---	4,30	4,30	2,94	8,60	11,10	0,59	2,17	3,11	2,71	9,94	14,23	95
	5.0+6.0	---	3,91	4,69	3,14	8,60	11,09	0,60	2,15	2,72	2,75	9,84	12,46	95
	1.5+1.5+1.5	2,17	2,17	2,17	2,01	6,50	9,92	0,41	1,33	2,26	1,89	6,09	10,36	95
	1.5+1.5+2.0	2,08	2,08	2,77	2,01	6,90	10,10	0,41	1,46	2,34	1,89	6,69	10,69	95
	1.5+1.5+2.5	2,00	2,00	3,34	2,10	7,40	10,18	0,42	1,64	2,37	1,94	7,51	10,86	95
	1.5+1.5+3.5	1,89	1,89	4,40	2,31	8,20	10,29	0,44	1,87	2,49	2,02	8,56	11,41	95
	1.5+1.5+4.2	1,79	1,79	5,02	2,31	8,60	10,29	0,44	2,03	2,49	2,02	9,30	11,41	95
	1.5+1.5+5.0	1,61	1,61	5,38	2,71	8,60	10,46	0,55	2,01	2,57	2,50	9,20	11,75	95
	1.5+1.5+6.0	1,43	1,43	5,73	2,93	8,60	10,59	0,55	1,99	2,31	2,50	9,11	10,57	95
	1.5+2.0+2.0	2	2,67	2,67	2,01	8,60	10,26	0,41	2,05	2,41	1,89	9,39	11,03	95

Notes

1. The total capacity of each connected indoor unit is up to 11.0kW.
2. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
3. These indoor units can only be used in a multi-unit setup.
4. Heating capacity conditions
   Indoor temperature 20°C DB
   Outdoor temperature 7°C DB / 6°C WB

3D103341

4 Combination table

4 - 1 Combination Table

3MXM68M

Heating (50Hz 230V)

Outdoor unit	Indoor unit	Heating capacity [kW]			Total capacity [kW]			Power input [kW]			Total current [A]			Power factor [%]
		Room A	Room B	Room C	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.	
3MXM68M2V1B	1.5+2.0+2.5	1,94	2,59	3,23	2,10	8,60	10,36	0,42	2,04	2,44	1,94	9,34	11,16	95
	1.5+2.0+3.5	1,84	2,46	4,3	2,31	8,60	10,45	0,44	2,02	2,58	2,02	9,25	11,79	95
	1.5+2.0+4.2	1,68	2,23	4,69	2,31	8,60	10,46	0,44	2,01	2,57	2,02	9,20	11,75	95
	1.5+2.0+5.0	1,52	2,02	5,06	2,71	8,60	10,88	0,55	2,00	2,64	2,50	9,16	12,08	95
	1.5+2.0+6.0	1,36	1,81	5,43	2,93	8,60	10,89	0,55	1,98	2,38	2,50	9,07	10,91	95
	1.5+2.5+2.5	1,89	3,15	3,15	2,20	8,60	10,47	0,45	2,03	2,44	2,06	9,30	11,16	95
	1.5+2.5+3.5	1,72	2,87	4,01	2,40	8,60	10,58	0,47	2,02	2,57	2,15	9,25	11,75	95
	1.5+2.5+4.2	1,57	2,62	4,4	2,41	8,60	10,58	0,47	2,00	2,57	2,15	9,16	11,75	95
	1.5+2.5+5.0	1,43	2,39	4,78	2,81	8,60	11,00	0,56	1,99	2,64	2,58	9,11	12,08	95
	1.5+2.5+6.0	1,29	2,15	5,16	3,02	8,60	10,77	0,57	1,97	2,38	2,62	9,02	10,91	95
	1.5+3.5+3.5	1,52	3,54	3,54	2,69	8,60	10,59	0,55	1,99	2,57	2,50	9,11	11,75	95
	1.5+3.5+4.2	1,4	3,27	3,93	2,69	8,60	10,59	0,55	1,98	2,56	2,50	9,07	11,71	95
	1.5+3.5+5.0	1,29	3,01	4,3	3,00	8,60	10,93	0,62	1,97	2,59	2,84	9,02	11,87	95
	1.5+3.5+6.0	1,17	2,74	4,69	2,93	8,60	10,78	0,55	1,96	2,37	2,50	8,98	10,86	95
	1.5+4.2+4.2	1,3	3,65	3,65	2,69	8,60	10,68	0,55	1,98	2,59	2,50	9,07	11,87	95
	1.5+4.2+5.0	1,21	3,38	4,02	3,00	8,60	10,99	0,62	1,96	2,67	2,84	8,98	12,21	95
	2.0+2.0+2.0	2,63	2,63	2,63	2,01	7,80	10,44	0,41	1,72	2,48	1,89	7,88	11,37	95
	2.0+2.0+2.5	2,54	2,54	3,17	2,10	8,20	10,52	0,42	1,83	2,52	1,94	8,38	11,54	95
	2.0+2.0+3.5	2,29	2,29	4,02	2,31	8,60	10,63	0,44	2,04	2,65	2,02	9,34	12,13	95
	2.0+2.0+4.2	2,1	2,1	4,4	2,31	8,60	10,63	0,44	2,02	2,65	2,02	9,25	12,13	95
	2.0+2.0+5.0	1,91	1,91	4,78	2,71	8,60	10,82	0,55	2,00	2,72	2,50	9,16	12,46	95
	2.0+2.0+6.0	1,72	1,72	5,16	2,93	8,60	10,95	0,55	1,99	2,46	2,50	9,11	11,24	95
	2.0+2.5+2.5	2,46	3,07	3,07	2,20	8,60	10,54	0,43	1,97	2,61	1,98	9,02	11,96	95
	2.0+2.5+3.5	2,15	2,69	3,76	2,40	8,60	10,63	0,46	2,02	2,65	2,11	9,25	12,13	95
	2.0+2.5+4.2	1,98	2,47	4,15	2,41	8,60	10,64	0,46	2,01	2,64	2,11	9,20	12,08	95
	2.0+2.5+5.0	1,81	2,26	4,53	2,81	8,60	11,06	0,56	1,98	2,75	2,58	9,07	12,59	95
	2.0+2.5+6.0	1,64	2,05	4,91	3,02	8,60	11,07	0,56	1,98	2,43	2,58	9,07	11,12	95
	2.0+3.5+3.5	1,92	3,34	3,34	2,69	8,60	10,76	0,52	2,00	2,70	2,37	9,16	12,34	95
	2.0+3.5+4.2	1,77	3,1	3,72	2,69	8,60	10,76	0,52	1,99	2,69	2,37	9,11	12,29	95
	2.0+3.5+5.0	1,64	2,87	4,09	3,00	8,60	11,11	0,58	1,98	2,82	2,67	9,07	12,88	95
	2.0+4.2+4.2	1,65	3,47	3,47	2,69	8,60	10,77	0,52	1,97	2,69	2,37	9,02	12,29	95
	2.5+2.5+2.5	2,86	2,86	2,86	2,31	8,60	10,65	0,45	1,99	2,64	2,06	9,11	12,08	95
	2.5+2.5+3.5	2,53	2,53	3,54	2,50	8,60	10,87	0,48	1,99	2,72	2,19	9,11	12,46	95
	2.5+2.5+4.2	2,34	2,34	3,93	2,50	8,60	10,88	0,48	1,97	2,72	2,19	9,02	12,46	95
	2.5+2.5+5.0	2,15	2,15	4,3	2,91	8,60	11,07	0,58	1,96	2,78	2,67	8,98	12,72	95
	2.5+2.5+6.0	1,95	1,95	4,7	3,12	8,60	11,08	0,58	1,94	2,43	2,67	8,88	11,12	95
	2.5+3.5+3.5	2,26	3,17	3,17	2,78	8,60	11,00	0,53	1,96	2,72	2,41	8,98	12,46	95
	2.5+3.5+4.2	2,11	2,95	3,54	2,79	8,60	11,01	0,53	1,96	2,71	2,41	8,98	12,42	95
	2.5+3.5+5.0	1,95	2,74	3,91	3,19	8,60	11,08	0,60	1,90	2,74	2,75	8,70	12,55	95
	2.5+4.2+4.2	1,97	3,31	3,31	2,79	8,60	11,01	0,53	1,95	2,71	2,41	8,93	12,42	95
	3.5+3.5+3.5	2,86	2,86	2,86	2,98	8,60	11,06	0,57	1,94	2,79	2,62	8,88	12,76	95

Notes

1. The total capacity of each connected indoor unit is up to 11.0kW.
2. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
3. These indoor units can only be used in a multi-unit setup.
4. Heating capacity conditions
   Indoor temperature 20°C DB
   Outdoor temperature 7°C DB / 6°C WB

3D103341

5 Capacity tables

5 - 1 Cooling Capacity Tables

3MXM40M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB] 14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1,5	22,0	1,99	0,27	2,35	0,34	2,48	0,35	2,54	0,36	2,74	0,38	2,87	0,39
	25,0	1,99	0,31	2,27	0,36	2,40	0,37	2,46	0,38	2,66	0,40	2,79	0,41
	32,0	1,95	0,41	2,08	0,42	2,21	0,43	2,28	0,44	2,48	0,45	2,61	0,46
	35,0	1,87	0,43	2,00	0,44	2,13	0,45	**2,20**	**0,46**	2,40	0,48	2,53	0,49
	40,0	1,74	0,48	1,87	0,49	2,00	0,50	2,07	0,51	2,26	0,52	2,39	0,54
	43,0	1,66	0,51	1,79	0,52	1,92	0,53	1,99	0,54	2,18	0,55	2,32	0,56
	46,0	1,58	0,54	1,71	0,55	1,84	0,56	1,91	0,57	2,11	0,58	2,24	0,59
2,0	22,0	2,69	0,52	3,05	0,59	3,18	0,60	3,24	0,61	3,44	0,63	3,57	0,64
	25,0	2,69	0,56	2,97	0,61	3,10	0,62	3,16	0,63	3,36	0,65	3,49	0,66
	32,0	2,65	0,66	2,78	0,67	2,91	0,68	2,98	0,69	3,18	0,70	3,31	0,71
	35,0	2,57	0,68	2,70	0,69	2,83	0,70	**2,90**	**0,71**	3,10	0,73	3,23	0,74
	40,0	2,44	0,73	2,57	0,74	2,70	0,75	2,77	0,76	2,96	0,77	3,09	0,79
	43,0	2,36	0,76	2,49	0,77	2,62	0,78	2,69	0,79	2,88	0,80	3,02	0,81
	46,0	2,28	0,79	2,41	0,80	2,54	0,81	2,61	0,82	2,81	0,83	2,94	0,84
2,5	22,0	2,89	0,63	3,25	0,70	3,38	0,71	3,44	0,72	3,64	0,74	3,77	0,75
	25,0	2,89	0,67	3,17	0,72	3,30	0,73	3,36	0,74	3,56	0,76	3,69	0,77
	32,0	2,85	0,77	2,98	0,78	3,11	0,79	3,18	0,80	3,38	0,81	3,51	0,82
	35,0	2,77	0,79	2,90	0,80	3,03	0,81	**3,10**	**0,82**	3,30	0,84	3,43	0,85
	40,0	2,64	0,84	2,77	0,85	2,90	0,86	2,97	0,87	3,16	0,88	3,29	0,90
	43,0	2,56	0,87	2,69	0,88	2,82	0,89	2,89	0,90	3,08	0,91	3,22	0,92
	46,0	2,48	0,90	2,61	0,91	2,74	0,92	2,81	0,93	3,01	0,94	3,14	0,95
3,5	22,0	2,92	0,57	3,60	0,74	4,34	0,94	4,61	1,01	4,89	1,04	5,09	1,06
	25,0	2,92	0,62	3,60	0,80	4,34	1,02	4,49	1,05	4,78	1,08	4,97	1,10
	32,0	2,92	0,75	3,60	0,97	4,12	1,14	4,22	1,15	4,51	1,18	4,70	1,20
	35,0	2,92	0,81	3,60	1,06	4,00	1,18	**4,10**	**1,19**	4,39	1,22	4,58	1,24
	40,0	2,92	0,94	3,60	1,23	3,81	1,26	3,91	1,27	4,19	1,30	4,39	1,32
	43,0	2,92	1,04	3,60	1,29	3,69	1,31	3,79	1,32	4,08	1,35	4,27	1,37
	46,0	2,92	1,14	3,38	1,34	3,58	1,36	3,67	1,37	3,96	1,40	4,15	1,42
1.5+1.5	22,0	3,50	0,50	4,51	0,83	4,78	0,86	4,92	0,88	5,33	0,92	5,61	0,95
	25,0	3,50	0,60	4,34	0,89	4,62	0,92	4,76	0,93	5,17	0,98	5,44	1,01
	32,0	3,50	0,90	3,95	1,03	4,23	1,06	4,37	1,08	4,78	1,12	5,05	1,15
	35,0	3,50	1,06	3,79	1,10	4,06	1,13	**4,20**	**1,14**	4,61	1,19	4,89	1,22
	40,0	3,24	1,18	3,51	1,21	3,79	1,24	3,92	1,26	4,33	1,31	4,61	1,34
	43,0	3,07	1,26	3,34	1,29	3,62	1,32	3,76	1,33	4,17	1,38	4,44	1,41
	46,0	2,87	1,30	3,10	1,30	3,34	1,30	3,45	1,30	3,79	1,30	4,00	1,30
1.5+2.0	22,0	3,50	0,48	4,51	0,81	4,78	0,84	4,92	0,86	5,33	0,90	5,61	0,93
	25,0	3,50	0,58	4,34	0,87	4,62	0,90	4,76	0,91	5,17	0,96	5,44	0,99
	32,0	3,50	0,88	3,95	1,01	4,23	1,04	4,37	1,06	4,78	1,10	5,05	1,13
	35,0	3,50	1,04	3,79	1,08	4,06	1,11	**4,20**	**1,12**	4,61	1,17	4,89	1,20
	40,0	3,24	1,16	3,51	1,19	3,79	1,22	3,92	1,24	4,33	1,29	4,61	1,32
	43,0	3,07	1,24	3,34	1,27	3,62	1,30	3,76	1,31	4,17	1,36	4,44	1,39
	46,0	2,87	1,28	3,10	1,28	3,34	1,28	3,45	1,28	3,79	1,28	4,00	1,28

①	②	Indoor air temperature [°C WB] 14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+2.5	22,0	3,50	0,46	4,51	0,79	4,78	0,82	4,92	0,84	5,33	0,88	5,61	0,91
	25,0	3,50	0,56	4,34	0,85	4,62	0,88	4,76	0,89	5,17	0,94	5,44	0,97
	32,0	3,50	0,86	3,95	0,99	4,23	1,02	4,37	1,04	4,78	1,08	5,05	1,11
	35,0	3,50	1,02	3,79	1,06	4,06	1,09	**4,20**	**1,10**	4,61	1,15	4,89	1,18
	40,0	3,24	1,14	3,51	1,17	3,79	1,20	3,92	1,22	4,33	1,27	4,61	1,30
	43,0	3,07	1,22	3,34	1,25	3,62	1,28	3,76	1,29	4,17	1,34	4,44	1,37
	46,0	2,87	1,26	3,10	1,26	3,34	1,26	3,45	1,26	3,79	1,26	4,00	1,26
1.5+3.5	22,0	3,59	0,43	4,52	0,74	4,81	0,78	4,96	0,79	5,39	0,84	5,67	0,88
	25,0	3,59	0,55	4,35	0,81	4,64	0,84	4,78	0,86	5,21	0,90	5,50	0,94
	32,0	3,59	0,89	3,94	0,96	4,23	0,99	4,37	1,01	4,81	1,06	5,09	1,09
	35,0	3,48	1,00	3,77	1,03	4,06	1,07	**4,20**	**1,08**	4,63	1,13	4,92	1,16
	40,0	3,19	1,13	3,48	1,16	3,77	1,19	3,91	1,21	4,34	1,26	4,63	1,29
	43,0	3,02	1,21	3,30	1,24	3,59	1,27	3,74	1,29	4,17	1,34	4,45	1,37
	46,0	2,65	1,08	2,88	1,08	3,11	1,08	3,23	1,08	3,56	1,08	3,77	1,08
2.0+2.0	22,0	3,80	0,45	4,81	0,78	5,08	0,81	5,22	0,83	5,63	0,87	5,91	0,90
	25,0	3,80	0,55	4,64	0,84	4,92	0,87	5,06	0,88	5,47	0,93	5,74	0,96
	32,0	3,80	0,85	4,25	0,98	4,53	1,01	4,67	1,03	5,08	1,07	5,35	1,10
	35,0	3,80	1,01	4,09	1,05	4,36	1,08	**4,50**	**1,09**	4,91	1,14	5,19	1,17
	40,0	3,54	1,13	3,81	1,16	4,09	1,19	4,22	1,21	4,63	1,26	4,91	1,29
	43,0	3,37	1,21	3,64	1,24	3,92	1,27	4,06	1,28	4,47	1,33	4,74	1,36
	46,0	3,17	1,25	3,40	1,25	3,64	1,25	3,75	1,25	4,09	1,25	4,30	1,25
2.0+2.5	22,0	3,80	0,43	4,81	0,76	5,08	0,79	5,22	0,81	5,63	0,85	5,91	0,88
	25,0	3,80	0,53	4,64	0,82	4,92	0,85	5,06	0,86	5,47	0,91	5,74	0,94
	32,0	3,80	0,83	4,25	0,96	4,53	0,99	4,67	1,01	5,08	1,05	5,35	1,08
	35,0	3,80	0,99	4,09	1,03	4,36	1,06	**4,50**	**1,07**	4,91	1,12	5,19	1,15
	40,0	3,54	1,11	3,81	1,14	4,09	1,17	4,22	1,19	4,63	1,24	4,91	1,27
	43,0	3,37	1,19	3,64	1,22	3,92	1,25	4,06	1,26	4,47	1,31	4,74	1,34
	46,0	3,17	1,23	3,40	1,23	3,64	1,23	3,75	1,23	4,09	1,23	4,30	1,23
2.0+3.5	22,0	3,89	0,38	4,82	0,69	5,11	0,73	5,26	0,74	5,69	0,79	5,97	0,83
	25,0	3,89	0,50	4,65	0,76	4,94	0,79	5,08	0,81	5,51	0,85	5,80	0,89
	32,0	3,89	0,84	4,24	0,91	4,53	0,94	4,67	0,96	5,11	1,01	5,39	1,04
	35,0	3,78	0,95	4,07	0,98	4,36	1,02	**4,50**	**1,03**	4,93	1,08	5,22	1,11
	40,0	3,49	1,08	3,78	1,11	4,07	1,14	4,21	1,16	4,64	1,21	4,93	1,24
	43,0	3,32	1,16	3,60	1,19	3,89	1,22	4,04	1,24	4,47	1,29	4,75	1,32
	46,0	2,95	1,03	3,18	1,03	3,41	1,03	3,53	1,03	3,86	1,03	4,07	1,03
2.5+2.5	22,0	3,80	0,41	4,81	0,74	5,08	0,77	5,22	0,79	5,63	0,83	5,91	0,86
	25,0	3,80	0,51	4,64	0,80	4,92	0,83	5,06	0,84	5,47	0,89	5,74	0,92
	32,0	3,80	0,81	4,25	0,94	4,53	0,97	4,67	0,99	5,08	1,03	5,35	1,06
	35,0	3,80	0,97	4,09	1,01	4,36	1,04	**4,50**	**1,05**	4,91	1,10	5,19	1,13
	40,0	3,54	1,09	3,81	1,12	4,09	1,15	4,22	1,17	4,63	1,22	4,91	1,25
	43,0	3,37	1,17	3,64	1,20	3,92	1,23	4,06	1,24	4,47	1,29	4,74	1,32
	46,0	3,17	1,21	3,40	1,21	3,64	1,21	3,75	1,21	4,09	1,21	4,30	1,21

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols
TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C DB]

3D102795

3MXM40M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB] 14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.5+3.5	22,0	3,89	0,36	4,82	0,67	5,11	0,71	5,26	0,72	5,69	0,77	5,97	0,81
	25,0	3,89	0,48	4,65	0,74	4,94	0,77	5,08	0,79	5,51	0,83	5,80	0,87
	32,0	3,89	0,82	4,24	0,89	4,53	0,92	4,67	0,94	5,11	0,99	5,39	1,02
	35,0	3,78	0,93	4,07	0,96	4,36	1,00	**4,50**	**1,01**	4,93	1,06	5,22	1,09
	40,0	3,49	1,06	3,78	1,09	4,07	1,12	4,21	1,14	4,64	1,19	4,93	1,22
	43,0	3,32	1,14	3,60	1,17	3,89	1,20	4,04	1,22	4,47	1,27	4,75	1,30
	46,0	2,95	1,01	3,18	1,01	3,41	1,01	3,53	1,01	3,86	1,01	4,07	1,01
3.5+3.5	22,0	4,10	0,38	4,83	0,63	5,13	0,66	5,27	0,68	5,72	0,73	6,01	0,77
	25,0	4,10	0,52	4,65	0,69	4,95	0,73	5,10	0,75	5,54	0,80	5,83	0,84
	32,0	3,94	0,82	4,24	0,86	4,53	0,90	4,68	0,91	5,12	0,97	5,42	1,00
	35,0	3,76	0,90	4,06	0,94	4,35	0,97	**4,50**	**0,99**	4,94	1,05	5,24	1,08
	40,0	3,46	1,04	3,76	1,08	4,05	1,11	4,20	1,13	4,64	1,18	4,94	1,22
	43,0	3,29	1,13	3,58	1,16	3,88	1,20	4,02	1,22	4,47	1,27	4,76	1,31
	46,0	2,79	0,81	3,01	0,81	3,23	0,81	3,34	0,81	3,66	0,81	3,87	0,81
1.5+1.5+1.5	22,0	4,64	0,60	4,97	0,63	5,29	0,66	5,45	0,68	5,94	0,73	6,26	0,77
	25,0	4,44	0,66	4,77	0,69	5,09	0,73	5,26	0,75	5,74	0,80	6,07	0,83
	32,0	3,99	0,82	4,31	0,86	4,63	0,89	4,80	0,91	5,28	0,96	5,61	0,99
	35,0	3,79	0,90	4,11	0,93	4,44	0,97	**4,60**	**0,98**	5,09	1,03	5,41	1,07
	40,0	3,46	1,03	3,79	1,06	4,11	1,10	4,27	1,11	4,76	1,17	5,08	1,20
	43,0	3,26	1,11	3,59	1,15	3,91	1,18	4,08	1,20	4,56	1,25	4,89	1,29
	46,0	2,73	0,89	2,98	0,89	3,23	0,89	3,35	0,89	3,70	0,89	3,93	0,89
1.5+1.5+2.0	22,0	4,64	0,58	4,97	0,61	5,29	0,64	5,45	0,66	5,94	0,71	6,27	0,75
	25,0	4,44	0,64	4,77	0,67	5,09	0,71	5,26	0,73	5,75	0,78	6,07	0,81
	32,0	3,98	0,80	4,31	0,84	4,63	0,87	4,80	0,89	5,29	0,94	5,61	0,97
	35,0	3,79	0,88	4,11	0,91	4,44	0,95	**4,60**	**0,96**	5,09	1,01	5,41	1,05
	40,0	3,46	1,01	3,78	1,04	4,11	1,08	4,27	1,09	4,76	1,15	5,08	1,18
	43,0	3,26	1,09	3,59	1,13	3,91	1,16	4,07	1,19	4,56	1,23	4,89	1,27
	46,0	2,72	0,87	2,98	0,87	3,22	0,87	3,35	0,87	3,70	0,87	3,93	0,87
1.5+1.5+2.5	22,0	4,64	0,56	4,97	0,59	5,29	0,62	5,45	0,64	5,94	0,69	6,27	0,73
	25,0	4,44	0,62	4,77	0,65	5,09	0,69	5,26	0,71	5,75	0,76	6,07	0,79
	32,0	3,98	0,78	4,31	0,82	4,63	0,85	4,80	0,87	5,29	0,92	5,61	0,95
	35,0	3,79	0,86	4,11	0,89	4,44	0,93	**4,60**	**0,94**	5,09	0,99	5,41	1,03
	40,0	3,46	0,99	3,78	1,02	4,11	1,06	4,27	1,07	4,76	1,13	5,08	1,16
	43,0	3,26	1,07	3,59	1,11	3,91	1,14	4,07	1,17	4,56	1,21	4,89	1,25
	46,0	2,72	0,85	2,98	0,85	3,22	0,85	3,35	0,85	3,70	0,85	3,93	0,85
1.5+1.5+3.5	22,0	4,64	0,50	4,98	0,53	5,32	0,57	5,48	0,59	5,99	0,64	6,32	0,68
	25,0	4,44	0,56	4,78	0,60	5,11	0,64	5,28	0,65	5,78	0,71	6,12	0,74
	32,0	3,96	0,73	4,30	0,77	4,64	0,81	4,80	0,82	5,31	0,88	5,64	0,91
	35,0	3,76	0,81	4,10	0,85	4,43	0,88	**4,60**	**0,90**	5,10	0,96	5,44	0,99
	40,0	3,42	0,95	3,76	0,99	4,09	1,02	4,26	1,04	4,76	1,10	5,10	1,13
	43,0	3,22	1,04	3,55	1,07	3,89	1,11	4,06	1,13	4,56	1,18	4,90	1,22
	46,0	2,57	0,71	2,82	0,71	3,06	0,71	3,18	0,71	3,54	0,71	3,77	0,71

①	②	Indoor air temperature [°C WB] 14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+2.0+2.0	22,0	4,64	0,54	4,97	0,57	5,29	0,60	5,46	0,62	5,94	0,67	6,27	0,71
	25,0	4,44	0,60	4,77	0,63	5,10	0,67	5,26	0,69	5,75	0,74	6,07	0,77
	32,0	3,98	0,76	4,31	0,80	4,63	0,83	4,80	0,85	5,29	0,90	5,61	0,93
	35,0	3,79	0,84	4,11	0,87	4,44	0,91	**4,60**	**0,92**	5,09	0,97	5,41	1,01
	40,0	3,46	0,97	3,78	1,00	4,11	1,04	4,27	1,05	4,76	1,11	5,09	1,14
	43,0	3,26	1,05	3,58	1,08	3,91	1,12	4,07	1,14	4,56	1,19	4,89	1,23
	46,0	2,72	0,83	2,97	0,83	3,22	0,83	3,34	0,83	3,70	0,83	3,93	0,83
1.5+2.0+2.5	22,0	4,64	0,53	4,97	0,56	5,29	0,59	5,45	0,61	5,94	0,66	6,26	0,70
	25,0	4,44	0,59	4,77	0,62	5,09	0,66	5,26	0,68	5,74	0,73	6,07	0,76
	32,0	3,99	0,75	4,31	0,79	4,63	0,82	4,80	0,84	5,28	0,89	5,61	0,92
	35,0	3,79	0,83	4,11	0,86	4,44	0,90	**4,60**	**0,91**	5,09	0,96	5,41	1,00
	40,0	3,46	0,96	3,79	0,99	4,11	1,03	4,27	1,04	4,76	1,10	5,08	1,13
	43,0	3,26	1,04	3,59	1,08	3,91	1,11	4,08	1,13	4,56	1,18	4,89	1,22
	46,0	2,73	0,82	2,98	0,82	3,23	0,82	3,35	0,82	3,70	0,82	3,93	0,82
1.5+2.0+3.5	22,0	4,64	0,51	4,97	0,54	5,29	0,57	5,45	0,59	5,94	0,64	6,26	0,68
	25,0	4,44	0,57	4,77	0,60	5,09	0,64	5,26	0,66	5,74	0,71	6,07	0,74
	32,0	3,99	0,73	4,31	0,77	4,63	0,80	4,80	0,82	5,28	0,87	5,61	0,90
	35,0	3,79	0,81	4,11	0,84	4,44	0,88	**4,60**	**0,89**	5,09	0,94	5,41	0,98
	40,0	3,46	0,94	3,79	0,97	4,11	1,01	4,27	1,02	4,76	1,08	5,08	1,11
	43,0	3,26	1,02	3,59	1,06	3,91	1,09	4,08	1,11	4,56	1,16	4,89	1,20
	46,0	2,73	0,80	2,98	0,80	3,23	0,80	3,35	0,80	3,70	0,80	3,93	0,80
1.5+2.5+2.5	22,0	4,64	0,49	4,97	0,52	5,29	0,55	5,45	0,57	5,94	0,62	6,27	0,66
	25,0	4,44	0,55	4,77	0,58	5,09	0,62	5,26	0,64	5,75	0,69	6,07	0,72
	32,0	3,98	0,71	4,31	0,75	4,63	0,78	4,80	0,80	5,29	0,85	5,61	0,88
	35,0	3,79	0,79	4,11	0,82	4,44	0,86	**4,60**	**0,87**	5,09	0,92	5,41	0,96
	40,0	3,46	0,92	3,78	0,95	4,11	0,99	4,27	1,00	4,76	1,06	5,08	1,09
	43,0	3,26	1,00	3,59	1,04	3,91	1,07	4,07	1,10	4,56	1,14	4,89	1,18
	46,0	2,72	0,78	2,98	0,78	3,22	0,78	3,35	0,78	3,70	0,78	3,93	0,78
2.0+2.0+2.0	22,0	4,64	0,47	4,97	0,50	5,29	0,53	5,45	0,55	5,94	0,60	6,27	0,64
	25,0	4,44	0,53	4,77	0,56	5,09	0,60	5,26	0,62	5,75	0,67	6,07	0,70
	32,0	3,98	0,69	4,31	0,73	4,63	0,76	4,80	0,78	5,29	0,83	5,61	0,86
	35,0	3,79	0,77	4,11	0,80	4,44	0,84	**4,60**	**0,85**	5,09	0,90	5,41	0,94
	40,0	3,46	0,90	3,78	0,93	4,11	0,97	4,27	0,98	4,76	1,04	5,08	1,07
	43,0	3,26	0,98	3,59	1,02	3,91	1,05	4,07	1,08	4,56	1,12	4,89	1,16
	46,0	2,72	0,76	2,98	0,76	3,22	0,76	3,35	0,76	3,70	0,76	3,93	0,76
2.0+2.0+2.5	22,0	4,64	0,53	4,98	0,56	5,32	0,60	5,48	0,62	5,99	0,67	6,32	0,71
	25,0	4,44	0,59	4,78	0,63	5,11	0,67	5,28	0,68	5,78	0,74	6,12	0,77
	32,0	3,96	0,76	4,30	0,80	4,64	0,84	4,80	0,85	5,31	0,91	5,64	0,94
	35,0	3,76	0,84	4,10	0,88	4,43	0,91	**4,60**	**0,93**	5,10	0,99	5,44	1,02
	40,0	3,42	0,98	3,76	1,02	4,09	1,05	4,26	1,07	4,76	1,13	5,10	1,16
	43,0	3,22	1,07	3,55	1,10	3,89	1,14	4,06	1,16	4,56	1,21	4,90	1,25
	46,0	2,57	0,74	2,82	0,74	3,06	0,74	3,18	0,74	3,54	0,74	3,77	0,74

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols
TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C DB]

3D102798

5 Capacity tables

5 - 1 Cooling Capacity Tables

5

3MXM40M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	22,0	4,64	0,43	4,97	0,46	5,29	0,49	5,45	0,51	5,94	0,56	6,26	0,60
	25,0	4,44	0,49	4,77	0,52	5,09	0,56	5,26	0,58	5,74	0,63	6,07	0,66
	32,0	3,99	0,65	4,31	0,69	4,63	0,72	4,80	0,74	5,28	0,79	5,61	0,82
2.0+2.5+2.5	35,0	3,79	0,73	4,11	0,76	4,44	0,80	**4,60**	**0,81**	5,09	0,86	5,41	0,90
	40,0	3,46	0,86	3,79	0,89	4,11	0,93	4,27	0,94	4,76	1,00	5,08	1,03
	43,0	3,26	0,94	3,59	0,98	3,91	1,01	4,08	1,03	4,56	1,08	4,89	1,12
	46,0	2,73	0,72	2,98	0,72	3,23	0,72	3,35	0,72	3,70	0,72	3,93	0,72

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0,2.5 kW class
   Wall-mounted FTXM-M series

Symbols
TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C DB]

3D102799

3MXM52M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	22,0	2,19	0,44	2,55	0,51	2,68	0,52	2,74	0,53	2,94	0,55	3,07	0,56
	25,0	2,19	0,48	2,47	0,53	2,60	0,54	2,66	0,55	2,86	0,57	2,99	0,58
	32,0	2,15	0,58	2,28	0,59	2,41	0,60	2,48	0,61	2,68	0,62	2,81	0,63
1,5	35,0	2,07	0,60	2,20	0,61	2,33	0,62	**2,40**	**0,63**	2,60	0,65	2,73	0,66
	40,0	1,94	0,65	2,07	0,66	2,20	0,67	2,27	0,68	2,46	0,69	2,59	0,71
	43,0	1,86	0,68	1,99	0,69	2,12	0,70	2,19	0,71	2,38	0,72	2,52	0,73
	46,0	1,78	0,71	1,91	0,72	2,04	0,73	2,11	0,74	2,31	0,75	2,44	0,76
	22,0	2,79	0,59	3,15	0,66	3,28	0,67	3,34	0,68	3,54	0,70	3,67	0,71
	25,0	2,79	0,63	3,07	0,68	3,20	0,69	3,26	0,70	3,46	0,72	3,59	0,73
	32,0	2,75	0,73	2,88	0,74	3,01	0,75	3,08	0,76	3,28	0,77	3,41	0,78
2,0	35,0	2,67	0,75	2,80	0,76	2,93	0,77	**3,00**	**0,78**	3,20	0,80	3,33	0,81
	40,0	2,54	0,80	2,67	0,81	2,80	0,82	2,87	0,83	3,06	0,84	3,19	0,86
	43,0	2,46	0,83	2,59	0,84	2,72	0,85	2,79	0,86	2,98	0,87	3,12	0,88
	46,0	2,38	0,86	2,51	0,87	2,64	0,88	2,71	0,89	2,91	0,90	3,04	0,91
	22,0	2,99	0,68	3,35	0,75	3,48	0,76	3,54	0,77	3,74	0,79	3,87	0,80
	25,0	2,99	0,72	3,27	0,77	3,40	0,78	3,46	0,79	3,66	0,81	3,79	0,82
	32,0	2,95	0,82	3,08	0,83	3,21	0,84	3,28	0,85	3,48	0,86	3,61	0,87
2,5	35,0	2,87	0,84	3,00	0,85	3,13	0,86	**3,20**	**0,87**	3,40	0,89	3,53	0,90
	40,0	2,74	0,89	2,87	0,90	3,00	0,91	3,07	0,92	3,26	0,93	3,39	0,95
	43,0	2,66	0,92	2,79	0,93	2,92	0,94	2,99	0,95	3,18	0,96	3,32	0,97
	46,0	2,58	0,95	2,71	0,96	2,84	0,97	2,91	0,98	3,11	0,99	3,24	1,00
	22,0	3,02	0,68	3,70	0,85	4,44	1,05	4,71	1,12	4,99	1,15	5,19	1,17
	25,0	3,02	0,73	3,70	0,91	4,44	1,13	4,59	1,16	4,88	1,19	5,07	1,21
	32,0	3,02	0,86	3,70	1,08	4,22	1,25	4,32	1,26	4,61	1,29	4,80	1,31
3,5	35,0	3,02	0,92	3,70	1,17	4,10	1,29	**4,20**	**1,30**	4,49	1,33	4,68	1,35
	40,0	3,02	1,05	3,70	1,34	3,91	1,37	4,01	1,38	4,29	1,41	4,49	1,43
	43,0	3,02	1,15	3,70	1,40	3,79	1,42	3,89	1,43	4,18	1,46	4,37	1,48
	46,0	3,02	1,25	3,48	1,45	3,68	1,47	3,77	1,48	4,06	1,51	4,25	1,53
	22,0	3,42	0,87	4,10	1,04	4,84	1,24	5,11	1,31	5,39	1,34	5,59	1,36
	25,0	3,42	0,92	4,10	1,10	4,84	1,32	4,99	1,35	5,28	1,38	5,47	1,40
	32,0	3,42	1,05	4,10	1,27	4,62	1,44	4,72	1,45	5,01	1,48	5,20	1,50
4,2	35,0	3,42	1,11	4,10	1,36	4,50	1,48	**4,60**	**1,49**	4,89	1,52	5,08	1,54
	40,0	3,42	1,24	4,10	1,53	4,31	1,56	4,41	1,57	4,69	1,60	4,89	1,62
	43,0	3,42	1,34	4,10	1,59	4,19	1,61	4,29	1,62	4,58	1,65	4,77	1,67
	46,0	3,42	1,44	3,88	1,64	4,08	1,66	4,17	1,67	4,46	1,70	4,65	1,72
	22,0	3,68	0,92	4,52	1,18	5,43	1,49	5,90	1,68	6,43	1,80	6,68	1,83
	25,0	3,68	0,98	4,52	1,27	5,43	1,61	5,90	1,81	6,28	1,86	6,52	1,89
	32,0	3,68	1,17	4,52	1,51	5,43	1,95	5,55	1,96	5,92	2,01	6,17	2,04
5,0	35,0	3,68	1,26	4,52	1,64	5,28	2,02	**5,40**	**2,03**	5,77	2,08	6,02	2,11
	40,0	3,68	1,45	4,52	1,91	5,02	2,14	5,15	2,16	5,52	2,21	5,77	2,24
	43,0	3,68	1,58	4,52	2,10	4,87	2,22	5,00	2,24	5,37	2,28	5,62	2,32
	46,0	3,68	1,74	4,33	2,07	4,53	2,07	4,63	2,07	4,93	2,07	5,12	2,07

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	22,0	4,00	0,68	5,01	1,01	5,28	1,04	5,42	1,06	5,83	1,10	6,11	1,13
	25,0	4,00	0,78	4,84	1,07	5,12	1,10	5,26	1,11	5,67	1,16	5,94	1,19
	32,0	4,00	1,08	4,45	1,21	4,73	1,24	4,87	1,26	5,28	1,30	5,55	1,33
1.5+1.5	35,0	4,00	1,24	4,29	1,28	4,56	1,31	**4,70**	**1,32**	5,11	1,37	5,39	1,40
	40,0	3,74	1,36	4,01	1,39	4,29	1,42	4,42	1,44	4,83	1,49	5,11	1,52
	43,0	3,57	1,44	3,84	1,47	4,12	1,50	4,26	1,51	4,67	1,56	4,94	1,59
	46,0	3,37	1,48	3,60	1,48	3,84	1,48	3,95	1,48	4,29	1,48	4,50	1,48
	22,0	4,00	0,66	5,01	0,99	5,28	1,02	5,42	1,04	5,83	1,08	6,11	1,11
	25,0	4,00	0,76	4,84	1,05	5,12	1,08	5,26	1,09	5,67	1,14	5,94	1,17
	32,0	4,00	1,06	4,45	1,19	4,73	1,22	4,87	1,24	5,28	1,28	5,55	1,31
1.5+2.0	35,0	4,00	1,22	4,29	1,26	4,56	1,29	**4,70**	**1,30**	5,11	1,35	5,39	1,38
	40,0	3,74	1,34	4,01	1,37	4,29	1,40	4,42	1,42	4,83	1,47	5,11	1,50
	43,0	3,57	1,42	3,84	1,45	4,12	1,48	4,26	1,49	4,67	1,54	4,94	1,57
	46,0	3,37	1,46	3,60	1,46	3,84	1,46	3,95	1,46	4,29	1,46	4,50	1,46
	22,0	4,30	1,28	5,31	1,61	5,58	1,64	5,72	1,66	6,13	1,70	6,41	1,73
	25,0	4,30	1,38	5,14	1,67	5,42	1,70	5,56	1,71	5,97	1,76	6,24	1,79
	32,0	4,30	1,68	4,75	1,81	5,03	1,84	5,17	1,86	5,58	1,90	5,85	1,93
1.5+2.5	35,0	4,30	1,84	4,59	1,88	4,86	1,91	**5,00**	**1,92**	5,41	1,97	5,69	2,00
	40,0	4,04	1,96	4,31	1,99	4,59	2,02	4,72	2,04	5,13	2,09	5,41	2,12
	43,0	3,87	2,04	4,14	2,07	4,42	2,10	4,56	2,11	4,97	2,16	5,24	2,19
	46,0	3,67	2,08	3,90	2,08	4,14	2,08	4,25	2,08	4,59	2,08	4,80	2,08
	22,0	5,39	1,52	6,32	1,83	6,61	1,87	6,76	1,88	7,19	1,93	7,47	1,97
	25,0	5,39	1,64	6,15	1,90	6,44	1,93	6,58	1,95	7,01	1,99	7,30	2,03
	32,0	5,39	1,98	5,74	2,05	6,03	2,08	6,17	2,10	6,61	2,15	6,89	2,18
1.5+3.5	35,0	5,28	2,09	5,57	2,12	5,86	2,16	**6,00**	**2,17**	6,43	2,22	6,72	2,25
	40,0	4,99	2,22	5,28	2,25	5,57	2,28	5,71	2,30	6,14	2,35	6,43	2,38
	43,0	4,82	2,30	5,10	2,33	5,39	2,36	5,54	2,38	5,97	2,43	6,25	2,46
	46,0	4,45	2,17	4,68	2,17	4,91	2,17	5,03	2,17	5,36	2,17	5,57	2,17
	22,0	5,49	1,61	6,42	1,92	6,71	1,96	6,86	1,97	7,29	2,02	7,57	2,06
	25,0	5,49	1,73	6,25	1,99	6,54	2,02	6,68	2,04	7,11	2,08	7,40	2,12
	32,0	5,49	2,07	5,84	2,14	6,13	2,17	6,27	2,19	6,71	2,24	6,99	2,27
1.5+4.2	35,0	5,38	2,18	5,67	2,21	5,96	2,25	**6,10**	**2,26**	6,53	2,31	6,82	2,34
	40,0	5,09	2,31	5,38	2,34	5,67	2,37	5,81	2,39	6,24	2,44	6,53	2,47
	43,0	4,92	2,39	5,20	2,42	5,49	2,45	5,64	2,47	6,07	2,52	6,35	2,55
	46,0	4,55	2,26	4,78	2,26	5,01	2,26	5,13	2,26	5,46	2,26	5,67	2,26
	22,0	6,14	1,81	6,64	1,93	6,93	1,97	7,08	1,98	7,53	2,03	7,83	2,07
	25,0	6,14	1,95	6,46	1,99	6,75	2,03	6,90	2,05	7,35	2,10	7,65	2,13
	32,0	5,74	2,12	6,03	2,16	6,33	2,19	6,48	2,21	6,93	2,26	7,23	2,29
1.5+5.0	35,0	5,55	2,20	5,85	2,23	6,15	2,27	**6,30**	**2,28**	6,75	2,33	7,05	2,37
	40,0	5,25	2,33	5,55	2,36	5,85	2,40	6,00	2,41	6,45	2,47	6,74	2,50
	43,0	5,07	2,41	5,37	2,45	5,67	2,48	5,82	2,50	6,27	2,55	6,56	2,58
	46,0	4,62	2,20	4,86	2,20	5,09	2,20	5,20	2,20	5,53	2,20	5,75	2,20

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols
TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C DB]

3D102783

5 Capacity tables

5 - 1 Cooling Capacity Tables

5

3MXM52M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB] 14°C TC kW	14°C PI kW	16°C TC kW	16°C PI kW	18°C TC kW	18°C PI kW	19°C TC kW	19°C PI kW	22°C TC kW	22°C PI kW	24°C TC kW	24°C PI kW
2.0+2.0	22,0	5,30	1,61	6,31	1,94	6,58	1,97	6,72	1,99	7,13	2,03	7,41	2,06
	25,0	5,30	1,71	6,14	2,00	6,42	2,03	6,56	2,04	6,97	2,09	7,24	2,12
	32,0	5,30	2,01	5,75	2,14	6,03	2,17	6,17	2,19	6,58	2,23	6,85	2,26
	35,0	5,30	2,17	5,59	2,21	5,86	2,24	**6,00**	**2,25**	6,41	2,30	6,69	2,33
	40,0	5,04	2,29	5,31	2,32	5,59	2,35	5,72	2,37	6,13	2,42	6,41	2,45
	43,0	4,87	2,37	5,14	2,40	5,42	2,43	5,56	2,44	5,97	2,49	6,24	2,52
	46,0	4,67	2,41	4,90	2,41	5,14	2,41	5,25	2,41	5,59	2,41	5,80	2,41
2.0+2.5	22,0	5,50	1,57	6,51	1,90	6,78	1,93	6,92	1,95	7,33	1,99	7,61	2,02
	25,0	5,50	1,67	6,34	1,96	6,62	1,99	6,76	2,00	7,17	2,05	7,44	2,08
	32,0	5,50	1,97	5,95	2,10	6,23	2,13	6,37	2,15	6,78	2,19	7,05	2,22
	35,0	5,50	2,13	5,79	2,17	6,06	2,20	**6,20**	**2,21**	6,61	2,26	6,89	2,29
	40,0	5,24	2,25	5,51	2,28	5,79	2,31	5,92	2,33	6,33	2,38	6,61	2,41
	43,0	5,07	2,33	5,34	2,36	5,62	2,39	5,76	2,40	6,17	2,45	6,44	2,48
	46,0	4,87	2,37	5,10	2,37	5,34	2,37	5,45	2,37	5,79	2,37	6,00	2,37
2.0+3.5	22,0	5,69	1,65	6,62	1,96	6,91	2,00	7,06	2,01	7,49	2,06	7,77	2,10
	25,0	5,69	1,77	6,45	2,03	6,74	2,06	6,88	2,08	7,31	2,12	7,60	2,16
	32,0	5,69	2,11	6,04	2,18	6,33	2,21	6,47	2,23	6,91	2,28	7,19	2,31
	35,0	5,58	2,22	5,87	2,25	6,16	2,29	**6,30**	**2,30**	6,73	2,35	7,02	2,38
	40,0	5,29	2,35	5,58	2,38	5,87	2,41	6,01	2,43	6,44	2,48	6,73	2,51
	43,0	5,12	2,43	5,40	2,46	5,69	2,49	5,84	2,51	6,27	2,56	6,55	2,59
	46,0	4,75	2,30	4,98	2,30	5,21	2,30	5,33	2,30	5,66	2,30	5,87	2,30
2.0+4.2	22,0	5,69	1,60	6,62	1,91	6,91	1,95	7,06	1,96	7,49	2,01	7,77	2,05
	25,0	5,69	1,72	6,45	1,98	6,74	2,01	6,88	2,03	7,31	2,07	7,60	2,11
	32,0	5,69	2,06	6,04	2,13	6,33	2,16	6,47	2,18	6,91	2,23	7,19	2,26
	35,0	5,58	2,17	5,87	2,20	6,16	2,24	**6,30**	**2,25**	6,73	2,30	7,02	2,33
	40,0	5,29	2,30	5,58	2,33	5,87	2,36	6,01	2,38	6,44	2,43	6,73	2,46
	43,0	5,12	2,38	5,40	2,41	5,69	2,44	5,84	2,46	6,27	2,51	6,55	2,54
	46,0	4,75	2,25	4,98	2,25	5,21	2,25	5,33	2,25	5,66	2,25	5,87	2,25
2.0+5.0	22,0	6,34	1,72	6,84	1,84	7,13	1,88	7,28	1,89	7,73	1,94	8,03	1,98
	25,0	6,34	1,86	6,66	1,90	6,95	1,94	7,10	1,96	7,55	2,01	7,85	2,04
	32,0	5,94	2,03	6,23	2,07	6,53	2,10	6,68	2,12	7,13	2,17	7,43	2,20
	35,0	5,75	2,11	6,05	2,14	6,35	2,18	**6,50**	**2,19**	6,95	2,24	7,25	2,28
	40,0	5,45	2,24	5,75	2,27	6,05	2,31	6,20	2,32	6,65	2,38	6,94	2,41
	43,0	5,27	2,32	5,57	2,36	5,87	2,39	6,02	2,41	6,47	2,46	6,76	2,49
	46,0	4,82	2,11	5,06	2,11	5,29	2,11	5,40	2,11	5,73	2,11	5,95	2,11
2.5+2.5	22,0	5,60	1,70	6,61	2,03	6,88	2,06	7,02	2,08	7,43	2,12	7,71	2,15
	25,0	5,60	1,80	6,44	2,09	6,72	2,12	6,86	2,13	7,27	2,18	7,54	2,21
	32,0	5,60	2,10	6,05	2,23	6,33	2,26	6,47	2,28	6,88	2,32	7,15	2,35
	35,0	5,60	2,26	5,89	2,30	6,16	2,33	**6,30**	**2,34**	6,71	2,39	6,99	2,42
	40,0	5,34	2,38	5,61	2,41	5,89	2,44	6,02	2,46	6,43	2,51	6,71	2,54
	43,0	5,17	2,46	5,44	2,49	5,72	2,52	5,86	2,53	6,27	2,58	6,54	2,61
	46,0	4,97	2,50	5,20	2,50	5,44	2,50	5,55	2,50	5,89	2,50	6,10	2,50

①	②	Indoor air temperature [°C WB] 14°C TC kW	14°C PI kW	16°C TC kW	16°C PI kW	18°C TC kW	18°C PI kW	19°C TC kW	19°C PI kW	22°C TC kW	22°C PI kW	24°C TC kW	24°C PI kW
2.5+3.5	22,0	5,69	1,63	6,62	1,94	6,91	1,98	7,06	1,99	7,49	2,04	7,77	2,08
	25,0	5,69	1,75	6,45	2,01	6,74	2,04	6,88	2,06	7,31	2,10	7,60	2,14
	32,0	5,69	2,09	6,04	2,16	6,33	2,19	6,47	2,21	6,91	2,26	7,19	2,29
	35,0	5,58	2,20	5,87	2,23	6,16	2,27	**6,30**	**2,28**	6,73	2,33	7,02	2,36
	40,0	5,29	2,33	5,58	2,36	5,87	2,39	6,01	2,41	6,44	2,46	6,73	2,49
	43,0	5,12	2,41	5,40	2,44	5,69	2,47	5,84	2,49	6,27	2,54	6,55	2,57
	46,0	4,75	2,28	4,98	2,28	5,21	2,28	5,33	2,28	5,66	2,28	5,87	2,28
2.5+4.2	22,0	5,79	1,65	6,72	1,96	7,01	2,00	7,16	2,01	7,59	2,06	7,87	2,10
	25,0	5,79	1,77	6,55	2,03	6,84	2,06	6,98	2,08	7,41	2,12	7,70	2,16
	32,0	5,79	2,11	6,14	2,18	6,43	2,21	6,57	2,23	7,01	2,28	7,29	2,31
	35,0	5,68	2,22	5,97	2,25	6,26	2,29	**6,40**	**2,30**	6,83	2,35	7,12	2,38
	40,0	5,39	2,35	5,68	2,38	5,97	2,41	6,11	2,43	6,54	2,48	6,83	2,51
	43,0	5,22	2,43	5,50	2,46	5,79	2,49	5,94	2,51	6,37	2,56	6,65	2,59
	46,0	4,85	2,30	5,08	2,30	5,31	2,30	5,43	2,30	5,76	2,30	5,97	2,30
2.5+5.0	22,0	6,34	1,67	6,84	1,79	7,13	1,83	7,28	1,84	7,73	1,89	8,03	1,93
	25,0	6,34	1,81	6,66	1,85	6,95	1,89	7,10	1,91	7,55	1,96	7,85	1,99
	32,0	5,94	1,98	6,23	2,02	6,53	2,05	6,68	2,07	7,13	2,12	7,43	2,15
	35,0	5,75	2,06	6,05	2,09	6,35	2,13	**6,50**	**2,14**	6,95	2,19	7,25	2,23
	40,0	5,45	2,19	5,75	2,22	6,05	2,26	6,20	2,27	6,65	2,33	6,94	2,36
	43,0	5,27	2,27	5,57	2,31	5,87	2,34	6,02	2,36	6,47	2,41	6,76	2,44
	46,0	4,82	2,06	5,06	2,06	5,29	2,06	5,40	2,06	5,73	2,06	5,95	2,06
3.5+3.5	22,0	6,00	1,67	6,73	1,92	7,03	1,95	7,17	1,97	7,62	2,02	7,91	2,06
	25,0	6,00	1,81	6,55	1,98	6,85	2,02	7,00	2,04	7,44	2,09	7,73	2,13
	32,0	5,84	2,11	6,14	2,15	6,43	2,19	6,58	2,20	7,02	2,26	7,32	2,29
	35,0	5,66	2,19	5,96	2,23	6,25	2,26	**6,40**	**2,28**	6,84	2,34	7,14	2,37
	40,0	5,36	2,33	5,66	2,37	5,95	2,40	6,10	2,42	6,54	2,47	6,84	2,51
	43,0	5,19	2,42	5,48	2,45	5,78	2,49	5,92	2,51	6,37	2,56	6,66	2,60
	46,0	4,69	2,10	4,91	2,10	5,13	2,10	5,24	2,10	5,56	2,10	5,77	2,10
3.5+4.2	22,0	6,00	1,65	6,73	1,90	7,03	1,93	7,17	1,95	7,62	2,00	7,91	2,04
	25,0	6,00	1,79	6,55	1,96	6,85	2,00	7,00	2,02	7,44	2,07	7,73	2,11
	32,0	5,84	2,09	6,14	2,13	6,43	2,17	6,58	2,18	7,02	2,24	7,32	2,27
	35,0	5,66	2,17	5,96	2,21	6,25	2,24	**6,40**	**2,26**	6,84	2,32	7,14	2,35
	40,0	5,36	2,31	5,66	2,35	5,95	2,38	6,10	2,40	6,54	2,45	6,84	2,49
	43,0	5,19	2,40	5,48	2,43	5,78	2,47	5,92	2,49	6,37	2,54	6,66	2,58
	46,0	4,69	2,08	4,91	2,08	5,13	2,08	5,24	2,08	5,56	2,08	5,77	2,08
3.5+5.0	22,0	6,64	1,82	6,94	1,85	7,24	1,88	7,39	1,90	7,83	1,95	8,13	1,98
	25,0	6,46	1,88	6,76	1,91	7,05	1,95	7,20	1,96	7,65	2,01	7,95	2,05
	32,0	6,03	2,04	6,33	2,07	6,63	2,10	6,78	2,12	7,23	2,17	7,53	2,20
	35,0	5,85	2,11	6,15	2,14	6,45	2,18	**6,60**	**2,19**	7,05	2,24	7,35	2,28
	40,0	5,55	2,24	5,85	2,27	6,15	2,30	6,30	2,32	6,75	2,37	7,05	2,40
	43,0	5,37	2,32	5,67	2,35	5,97	2,39	6,12	2,40	6,56	2,45	6,86	2,49
	46,0	4,96	2,17	5,20	2,17	5,44	2,17	5,55	2,17	5,89	2,17	6,11	2,17

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0, 2.5, 3.5, 4.2, 5.0 kW class
   Wall mounted FTXM-M series

Symbols
- TC: Total capacity [kW]
- PI: Power input [kW]
- ① Indoor unit combinations
- ② Outdoor air temperature [°CDB]

3D102784

3MXM52M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB] 14°C TC kW	14°C PI kW	16°C TC kW	16°C PI kW	18°C TC kW	18°C PI kW	19°C TC kW	19°C PI kW	22°C TC kW	22°C PI kW	24°C TC kW	24°C PI kW
4.2+4.2	22,0	6,10	1,63	6,83	1,88	7,13	1,91	7,27	1,93	7,72	1,98	8,01	2,02
	25,0	6,10	1,77	6,65	1,94	6,95	1,98	7,10	2,00	7,54	2,05	7,83	2,09
	32,0	5,94	2,07	6,24	2,11	6,53	2,15	6,68	2,16	7,12	2,22	7,42	2,25
	35,0	5,76	2,15	6,06	2,19	6,35	2,22	**6,50**	**2,24**	6,94	2,30	7,24	2,33
	40,0	5,46	2,29	5,76	2,33	6,05	2,36	6,20	2,38	6,64	2,43	6,94	2,47
	43,0	5,29	2,38	5,58	2,41	5,88	2,45	6,02	2,47	6,47	2,52	6,76	2,56
	46,0	4,79	2,06	5,01	2,06	5,23	2,06	5,34	2,06	5,66	2,06	5,87	2,06
1.5+1.5+1.5	22,0	6,74	1,90	7,07	1,93	7,39	1,96	7,55	1,98	8,04	2,03	8,36	2,07
	25,0	6,54	1,96	6,87	1,99	7,19	2,03	7,36	2,05	7,84	2,10	8,17	2,13
	32,0	6,09	2,12	6,41	2,16	6,73	2,19	6,90	2,21	7,38	2,26	7,71	2,29
	35,0	5,89	2,20	6,21	2,23	6,54	2,27	**6,70**	**2,28**	7,19	2,33	7,51	2,37
	40,0	5,56	2,33	5,89	2,36	6,21	2,40	6,37	2,41	6,86	2,47	7,18	2,50
	43,0	5,36	2,41	5,69	2,45	6,01	2,48	6,18	2,50	6,66	2,55	6,99	2,59
	46,0	4,83	2,19	5,08	2,19	5,33	2,19	5,45	2,19	5,80	2,19	6,03	2,19
1.5+1.5+2.0	22,0	6,74	1,88	7,07	1,91	7,39	1,94	7,55	1,96	8,04	2,01	8,36	2,05
	25,0	6,54	1,94	6,87	1,97	7,19	2,01	7,36	2,03	7,84	2,08	8,17	2,11
	32,0	6,09	2,10	6,41	2,14	6,73	2,17	6,90	2,19	7,38	2,24	7,71	2,27
	35,0	5,89	2,18	6,21	2,21	6,54	2,25	**6,70**	**2,26**	7,19	2,31	7,51	2,35
	40,0	5,56	2,31	5,89	2,34	6,21	2,38	6,37	2,39	6,86	2,45	7,18	2,48
	43,0	5,36	2,39	5,69	2,43	6,01	2,46	6,18	2,48	6,66	2,53	6,99	2,57
	46,0	4,83	2,17	5,08	2,17	5,33	2,17	5,45	2,17	5,80	2,17	6,03	2,17
1.5+1.5+2.5	22,0	6,74	1,85	7,07	1,88	7,39	1,91	7,55	1,93	8,04	1,98	8,36	2,02
	25,0	6,54	1,91	6,87	1,94	7,19	1,98	7,36	2,00	7,84	2,05	8,17	2,08
	32,0	6,09	2,07	6,41	2,11	6,73	2,14	6,90	2,16	7,38	2,21	7,71	2,24
	35,0	5,89	2,15	6,21	2,18	6,54	2,22	**6,70**	**2,23**	7,19	2,28	7,51	2,32
	40,0	5,56	2,28	5,89	2,31	6,21	2,35	6,37	2,36	6,86	2,42	7,18	2,45
	43,0	5,36	2,36	5,69	2,40	6,01	2,43	6,18	2,45	6,66	2,50	6,99	2,54
	46,0	4,83	2,14	5,08	2,14	5,33	2,14	5,45	2,14	5,80	2,14	6,03	2,14
1.5+1.5+3.5	22,0	6,84	1,90	7,17	1,93	7,49	1,96	7,65	1,98	8,14	2,03	8,47	2,07
	25,0	6,64	1,96	6,97	1,99	7,29	2,03	7,46	2,05	7,95	2,10	8,27	2,13
	32,0	6,18	2,12	6,51	2,16	6,83	2,19	7,00	2,21	7,49	2,26	7,81	2,29
	35,0	5,99	2,20	6,31	2,23	6,64	2,27	**6,80**	**2,28**	7,29	2,33	7,61	2,37
	40,0	5,66	2,33	5,98	2,36	6,31	2,40	6,47	2,41	6,96	2,47	7,28	2,50
	43,0	5,46	2,41	5,79	2,45	6,11	2,48	6,27	2,51	6,76	2,55	7,09	2,59
	46,0	4,92	2,19	5,18	2,19	5,42	2,19	5,55	2,19	5,90	2,19	6,13	2,19
1.5+1.5+4.2	22,0	6,84	1,88	7,17	1,91	7,49	1,94	7,65	1,96	8,14	2,01	8,47	2,05
	25,0	6,64	1,94	6,97	1,97	7,29	2,01	7,46	2,03	7,95	2,08	8,27	2,11
	32,0	6,18	2,10	6,51	2,14	6,83	2,17	7,00	2,19	7,49	2,24	7,81	2,27
	35,0	5,99	2,18	6,31	2,21	6,64	2,25	**6,80**	**2,26**	7,29	2,31	7,61	2,35
	40,0	5,66	2,31	5,98	2,34	6,31	2,38	6,47	2,39	6,96	2,45	7,28	2,48
	43,0	5,46	2,39	5,79	2,43	6,11	2,46	6,27	2,49	6,76	2,53	7,09	2,57
	46,0	4,92	2,17	5,18	2,17	5,42	2,17	5,55	2,17	5,90	2,17	6,13	2,17

①	②	Indoor air temperature [°C WB] 14°C TC kW	14°C PI kW	16°C TC kW	16°C PI kW	18°C TC kW	18°C PI kW	19°C TC kW	19°C PI kW	22°C TC kW	22°C PI kW	24°C TC kW	24°C PI kW
1.5+1.5+5.0	22,0	7,14	1,77	7,48	1,80	7,82	1,84	7,98	1,86	8,49	1,91	8,82	1,95
	25,0	6,94	1,83	7,28	1,87	7,61	1,91	7,78	1,92	8,28	1,98	8,62	2,01
	32,0	6,46	2,00	6,80	2,04	7,14	2,08	7,30	2,09	7,81	2,15	8,14	2,18
	35,0	6,26	2,08	6,60	2,12	6,93	2,15	**7,10**	**2,17**	7,60	2,23	7,94	2,26
	40,0	5,92	2,22	6,26	2,26	6,59	2,29	6,76	2,31	7,26	2,37	7,60	2,40
	43,0	5,72	2,31	6,05	2,34	6,39	2,38	6,56	2,40	7,06	2,45	7,40	2,49
	46,0	5,07	1,98	5,32	1,98	5,56	1,98	5,68	1,98	6,04	1,98	6,27	1,98
1.5+2.0+2.0	22,0	6,74	1,83	7,07	1,86	7,39	1,89	7,55	1,91	8,04	1,96	8,36	2,00
	25,0	6,54	1,89	6,87	1,92	7,19	1,96	7,36	1,98	7,84	2,03	8,17	2,06
	32,0	6,09	2,05	6,41	2,09	6,73	2,12	6,90	2,14	7,38	2,19	7,71	2,22
	35,0	5,89	2,13	6,21	2,16	6,54	2,20	**6,70**	**2,21**	7,19	2,26	7,51	2,30
	40,0	5,56	2,26	5,89	2,29	6,21	2,33	6,37	2,34	6,86	2,40	7,18	2,43
	43,0	5,36	2,34	5,69	2,38	6,01	2,41	6,18	2,43	6,66	2,48	6,99	2,52
	46,0	4,83	2,12	5,08	2,12	5,33	2,12	5,45	2,12	5,80	2,12	6,03	2,12
1.5+2.0+2.5	22,0	6,74	1,81	7,07	1,84	7,39	1,87	7,55	1,89	8,04	1,94	8,36	1,98
	25,0	6,54	1,87	6,87	1,90	7,19	1,94	7,36	1,96	7,84	2,01	8,17	2,04
	32,0	6,09	2,03	6,41	2,07	6,73	2,10	6,90	2,12	7,38	2,17	7,71	2,20
	35,0	5,89	2,11	6,21	2,14	6,54	2,18	**6,70**	**2,19**	7,19	2,24	7,51	2,28
	40,0	5,56	2,24	5,89	2,27	6,21	2,31	6,37	2,32	6,86	2,38	7,18	2,41
	43,0	5,36	2,32	5,69	2,36	6,01	2,39	6,18	2,41	6,66	2,46	6,99	2,50
	46,0	4,83	2,10	5,08	2,10	5,33	2,10	5,45	2,10	5,80	2,10	6,03	2,10
1.5+2.0+3.5	22,0	6,84	1,85	7,17	1,88	7,49	1,91	7,65	1,93	8,14	1,98	8,47	2,02
	25,0	6,64	1,91	6,97	1,94	7,29	1,98	7,46	2,00	7,95	2,05	8,27	2,08
	32,0	6,18	2,07	6,51	2,11	6,83	2,14	7,00	2,16	7,49	2,21	7,81	2,24
	35,0	5,99	2,15	6,31	2,18	6,64	2,22	**6,80**	**2,23**	7,29	2,28	7,61	2,32
	40,0	5,66	2,28	5,98	2,31	6,31	2,35	6,47	2,36	6,96	2,42	7,28	2,45
	43,0	5,46	2,36	5,79	2,40	6,11	2,43	6,27	2,46	6,76	2,50	7,09	2,54
	46,0	4,92	2,14	5,18	2,14	5,42	2,14	5,55	2,14	5,90	2,14	6,13	2,14
1.5+2.0+4.2	22,0	6,84	1,81	7,17	1,84	7,49	1,87	7,65	1,89	8,14	1,94	8,47	1,98
	25,0	6,64	1,87	6,97	1,90	7,29	1,94	7,46	1,96	7,95	2,01	8,27	2,04
	32,0	6,18	2,03	6,51	2,07	6,83	2,10	7,00	2,12	7,49	2,17	7,81	2,20
	35,0	5,99	2,11	6,31	2,14	6,64	2,18	**6,80**	**2,19**	7,29	2,24	7,61	2,28
	40,0	5,66	2,24	5,98	2,27	6,31	2,31	6,47	2,32	6,96	2,38	7,28	2,41
	43,0	5,46	2,32	5,79	2,36	6,11	2,39	6,27	2,42	6,76	2,46	7,09	2,50
	46,0	4,92	2,10	5,18	2,10	5,42	2,10	5,55	2,10	5,90	2,10	6,13	2,10
1.5+2.0+5.0	22,0	7,24	1,75	7,58	1,78	7,92	1,82	8,08	1,84	8,59	1,89	8,92	1,93
	25,0	7,04	1,81	7,38	1,85	7,71	1,89	7,88	1,90	8,38	1,96	8,72	1,99
	32,0	6,56	1,98	6,90	2,02	7,24	2,06	7,40	2,07	7,91	2,13	8,24	2,16
	35,0	6,36	2,06	6,70	2,10	7,03	2,13	**7,20**	**2,15**	7,70	2,21	8,04	2,24
	40,0	6,02	2,20	6,36	2,24	6,69	2,27	6,86	2,29	7,36	2,35	7,70	2,38
	43,0	5,82	2,29	6,15	2,32	6,49	2,36	6,66	2,38	7,16	2,43	7,50	2,47
	46,0	5,17	1,96	5,42	1,96	5,66	1,96	5,78	1,96	6,14	1,96	6,37	1,96

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols
- TC: Total capacity [kW]
- PI: Power input [kW]
- ① Indoor unit combinations
- ② Outdoor air temperature [°C DB]

3D102783

5 Capacity tables

5 - 1 Cooling Capacity Tables

3MXM52M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+2.5+2.5	22,0	6,74	1,79	7,07	1,82	7,39	1,85	7,55	1,87	8,04	1,92	8,36	1,96
	25,0	6,54	1,85	6,87	1,88	7,19	1,92	7,36	1,94	7,84	1,99	8,17	2,02
	32,0	6,09	2,01	6,41	2,05	6,73	2,08	6,90	2,10	7,38	2,15	7,71	2,18
	35,0	5,89	2,09	6,21	2,12	6,54	2,16	**6,70**	**2,17**	7,19	2,22	7,51	2,26
	40,0	5,56	2,22	5,89	2,25	6,21	2,29	6,37	2,30	6,86	2,36	7,18	2,39
	43,0	5,36	2,30	5,69	2,34	6,01	2,37	6,18	2,39	6,66	2,44	6,99	2,48
	46,0	4,83	2,08	5,08	2,08	5,33	2,08	5,45	2,08	5,80	2,08	6,03	2,08
1.5+2.5+3.5	22,0	6,84	1,83	7,17	1,86	7,49	1,89	7,65	1,91	8,14	1,96	8,47	2,00
	25,0	6,64	1,89	6,97	1,92	7,29	1,96	7,46	1,98	7,95	2,03	8,27	2,06
	32,0	6,18	2,05	6,51	2,09	6,83	2,12	7,00	2,14	7,49	2,19	7,81	2,22
	35,0	5,99	2,13	6,31	2,16	6,64	2,20	**6,80**	**2,21**	7,29	2,26	7,61	2,30
	40,0	5,66	2,26	5,98	2,29	6,31	2,33	6,47	2,34	6,96	2,40	7,28	2,43
	43,0	5,46	2,34	5,79	2,38	6,11	2,41	6,27	2,44	6,76	2,48	7,09	2,52
	46,0	4,92	2,12	5,18	2,12	5,42	2,12	5,55	2,12	5,90	2,12	6,13	2,12
1.5+2.5+4.2	22,0	6,84	1,81	7,17	1,84	7,49	1,87	7,65	1,89	8,14	1,94	8,47	1,98
	25,0	6,64	1,87	6,97	1,90	7,29	1,94	7,46	1,96	7,95	2,01	8,27	2,04
	32,0	6,18	2,03	6,51	2,07	6,83	2,10	7,00	2,12	7,49	2,17	7,81	2,20
	35,0	5,99	2,11	6,31	2,14	6,64	2,18	**6,80**	**2,19**	7,29	2,24	7,61	2,28
	40,0	5,66	2,24	5,98	2,27	6,31	2,31	6,47	2,32	6,96	2,38	7,28	2,41
	43,0	5,46	2,32	5,79	2,36	6,11	2,39	6,27	2,42	6,76	2,46	7,09	2,50
	46,0	4,92	2,10	5,18	2,10	5,42	2,10	5,55	2,10	5,90	2,10	6,13	2,10
1.5+2.5+5.0	22,0	7,34	1,77	7,68	1,80	8,02	1,84	8,18	1,86	8,69	1,91	9,02	1,95
	25,0	7,14	1,83	7,48	1,87	7,81	1,91	7,98	1,92	8,48	1,98	8,82	2,01
	32,0	6,66	2,00	7,00	2,04	7,34	2,08	7,50	2,09	8,01	2,15	8,34	2,18
	35,0	6,46	2,08	6,80	2,12	7,13	2,15	**7,30**	**2,17**	7,80	2,23	8,14	2,26
	40,0	6,12	2,22	6,46	2,26	6,79	2,29	6,96	2,31	7,46	2,37	7,80	2,40
	43,0	5,92	2,31	6,25	2,34	6,59	2,38	6,76	2,40	7,26	2,45	7,60	2,49
	46,0	5,27	1,98	5,52	1,98	5,76	1,98	5,88	1,98	6,24	1,98	6,47	1,98
1.5+3.5+3.5	22,0	7,34	1,77	7,67	1,80	7,99	1,83	8,16	1,85	8,64	1,90	8,97	1,94
	25,0	7,14	1,83	7,47	1,86	7,80	1,90	7,96	1,92	8,45	1,97	8,77	2,00
	32,0	6,68	1,99	7,01	2,03	7,33	2,06	7,50	2,08	7,99	2,13	8,31	2,16
	35,0	6,49	2,07	6,81	2,10	7,14	2,14	**7,30**	**2,15**	7,79	2,20	8,11	2,24
	40,0	6,16	2,20	6,48	2,23	6,81	2,27	6,97	2,28	7,46	2,34	7,79	2,37
	43,0	5,96	2,28	6,28	2,32	6,61	2,35	6,77	2,37	7,26	2,42	7,59	2,46
	46,0	5,42	2,06	5,67	2,06	5,92	2,06	6,04	2,06	6,40	2,06	6,63	2,06
2.0+2.0+2.0	22,0	7,04	1,84	7,37	1,87	7,69	1,90	7,85	1,92	8,34	1,97	8,66	2,01
	25,0	6,84	1,90	7,17	1,93	7,49	1,97	7,66	1,99	8,14	2,04	8,47	2,07
	32,0	6,39	2,06	6,71	2,10	7,03	2,13	7,20	2,15	7,68	2,20	8,01	2,23
	35,0	6,19	2,14	6,51	2,17	6,84	2,21	**7,00**	**2,22**	7,49	2,27	7,81	2,31
	40,0	5,86	2,27	6,19	2,30	6,51	2,34	6,67	2,35	7,16	2,41	7,48	2,44
	43,0	5,66	2,35	5,99	2,39	6,31	2,42	6,48	2,44	6,96	2,49	7,29	2,53
	46,0	5,13	2,13	5,38	2,13	5,63	2,13	5,75	2,13	6,10	2,13	6,33	2,13

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.0+2.0+2.5	22,0	7,04	1,83	7,37	1,86	7,69	1,89	7,85	1,91	8,34	1,96	8,66	2,00
	25,0	6,84	1,89	7,17	1,92	7,49	1,96	7,66	1,98	8,14	2,03	8,47	2,06
	32,0	6,39	2,05	6,71	2,09	7,03	2,12	7,20	2,14	7,68	2,19	8,01	2,22
	35,0	6,19	2,13	6,51	2,16	6,84	2,20	**7,00**	**2,21**	7,49	2,26	7,81	2,30
	40,0	5,86	2,26	6,19	2,29	6,51	2,33	6,67	2,34	7,16	2,40	7,48	2,43
	43,0	5,66	2,34	5,99	2,38	6,31	2,41	6,48	2,43	6,96	2,48	7,29	2,52
	46,0	5,13	2,12	5,38	2,12	5,63	2,12	5,75	2,12	6,10	2,12	6,33	2,12
2.0+2.0+3.5	22,0	7,24	1,79	7,57	1,82	7,89	1,85	8,05	1,87	8,54	1,92	8,87	1,96
	25,0	7,04	1,85	7,37	1,88	7,69	1,92	7,86	1,94	8,35	1,99	8,67	2,02
	32,0	6,58	2,01	6,91	2,05	7,23	2,08	7,40	2,10	7,89	2,15	8,21	2,18
	35,0	6,39	2,09	6,71	2,12	7,04	2,16	**7,20**	**2,17**	7,69	2,22	8,01	2,26
	40,0	6,06	2,22	6,38	2,25	6,71	2,29	6,87	2,30	7,36	2,36	7,68	2,39
	43,0	5,86	2,30	6,19	2,34	6,51	2,37	6,67	2,40	7,16	2,44	7,49	2,48
	46,0	5,32	2,08	5,58	2,08	5,82	2,08	5,95	2,08	6,30	2,08	6,53	2,08
2.0+2.0+4.2	22,0	7,24	1,77	7,57	1,80	7,89	1,83	8,05	1,85	8,54	1,90	8,87	1,94
	25,0	7,04	1,83	7,37	1,86	7,69	1,90	7,86	1,92	8,35	1,97	8,67	2,00
	32,0	6,58	1,99	6,91	2,03	7,23	2,06	7,40	2,08	7,89	2,13	8,21	2,16
	35,0	6,39	2,07	6,71	2,10	7,04	2,14	**7,20**	**2,15**	7,69	2,20	8,01	2,24
	40,0	6,06	2,20	6,38	2,23	6,71	2,27	6,87	2,28	7,36	2,34	7,68	2,37
	43,0	5,86	2,28	6,19	2,32	6,51	2,35	6,67	2,38	7,16	2,42	7,49	2,46
	46,0	5,32	2,06	5,58	2,06	5,82	2,06	5,95	2,06	6,30	2,06	6,53	2,06
2.0+2.0+5.0	22,0	7,34	1,79	7,68	1,82	8,02	1,86	8,18	1,88	8,69	1,93	9,02	1,97
	25,0	7,14	1,85	7,48	1,89	7,81	1,93	7,98	1,94	8,48	2,00	8,82	2,03
	32,0	6,66	2,02	7,00	2,06	7,34	2,10	7,50	2,11	8,01	2,17	8,34	2,20
	35,0	6,46	2,10	6,80	2,14	7,13	2,17	**7,30**	**2,19**	7,80	2,25	8,14	2,28
	40,0	6,12	2,24	6,46	2,28	6,79	2,31	6,96	2,33	7,46	2,39	7,80	2,42
	43,0	5,92	2,33	6,25	2,36	6,59	2,40	6,76	2,42	7,26	2,47	7,60	2,51
	46,0	5,27	2,00	5,52	2,00	5,76	2,00	5,88	2,00	6,24	2,00	6,47	2,00
2.0+2.5+2.5	22,0	7,14	1,74	7,47	1,77	7,79	1,80	7,95	1,82	8,44	1,87	8,76	1,91
	25,0	6,94	1,80	7,27	1,83	7,59	1,87	7,76	1,89	8,24	1,94	8,57	1,97
	32,0	6,49	1,96	6,81	2,00	7,13	2,03	7,30	2,05	7,78	2,10	8,11	2,13
	35,0	6,29	2,04	6,61	2,07	6,94	2,11	**7,10**	**2,12**	7,59	2,17	7,91	2,21
	40,0	5,96	2,17	6,29	2,20	6,61	2,24	6,77	2,25	7,26	2,31	7,58	2,34
	43,0	5,76	2,25	6,09	2,29	6,41	2,32	6,58	2,34	7,06	2,39	7,39	2,43
	46,0	5,23	2,03	5,48	2,03	5,73	2,03	5,85	2,03	6,20	2,03	6,43	2,03
2.0+2.5+3.5	22,0	7,24	1,77	7,57	1,80	7,89	1,83	8,05	1,85	8,54	1,90	8,87	1,94
	25,0	7,04	1,83	7,37	1,86	7,69	1,90	7,86	1,92	8,35	1,97	8,67	2,00
	32,0	6,58	1,99	6,91	2,03	7,23	2,06	7,40	2,08	7,89	2,13	8,21	2,16
	35,0	6,39	2,07	6,71	2,10	7,04	2,14	**7,20**	**2,15**	7,69	2,20	8,01	2,24
	40,0	6,06	2,20	6,38	2,23	6,71	2,27	6,87	2,28	7,36	2,34	7,68	2,37
	43,0	5,86	2,28	6,19	2,32	6,51	2,35	6,67	2,38	7,16	2,42	7,49	2,46
	46,0	5,32	2,06	5,58	2,06	5,82	2,06	5,95	2,06	6,30	2,06	6,53	2,06

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols
TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C DB]

3D102786

3MXM52M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.0+2.5+4.2	22,0	7,24	1,76	7,57	1,79	7,89	1,82	8,05	1,84	8,54	1,89	8,87	1,93
	25,0	7,04	1,82	7,37	1,85	7,69	1,89	7,86	1,91	8,35	1,96	8,67	1,99
	32,0	6,58	1,98	6,91	2,02	7,23	2,05	7,40	2,07	7,89	2,12	8,21	2,15
	35,0	6,39	2,06	6,71	2,09	7,04	2,13	**7,20**	**2,14**	7,69	2,19	8,01	2,23
	40,0	6,06	2,19	6,38	2,22	6,71	2,26	6,87	2,27	7,36	2,33	7,68	2,36
	43,0	5,86	2,27	6,19	2,31	6,51	2,34	6,67	2,36	7,16	2,41	7,49	2,45
	46,0	5,32	2,05	5,58	2,05	5,82	2,05	5,95	2,05	6,30	2,05	6,53	2,05
2.0+3.5+3.5	22,0	7,34	1,77	7,67	1,80	7,99	1,83	8,16	1,85	8,64	1,90	8,97	1,94
	25,0	7,14	1,83	7,47	1,86	7,80	1,90	7,96	1,92	8,45	1,97	8,77	2,00
	32,0	6,68	1,99	7,01	2,03	7,33	2,06	7,50	2,08	7,99	2,13	8,31	2,16
	35,0	6,49	2,07	6,81	2,10	7,14	2,14	**7,30**	**2,15**	7,79	2,20	8,11	2,24
	40,0	6,16	2,20	6,48	2,23	6,81	2,27	6,97	2,28	7,46	2,34	7,79	2,37
	43,0	5,96	2,28	6,28	2,32	6,61	2,35	6,77	2,37	7,26	2,42	7,59	2,46
	46,0	5,42	2,06	5,67	2,06	5,92	2,06	6,04	2,06	6,40	2,06	6,63	2,06
2.5+2.5+2.5	22,0	7,14	1,81	7,47	1,84	7,79	1,87	7,95	1,89	8,44	1,94	8,76	1,98
	25,0	6,94	1,87	7,27	1,90	7,59	1,94	7,76	1,96	8,24	2,01	8,57	2,04
	32,0	6,49	2,03	6,81	2,07	7,13	2,10	7,30	2,12	7,78	2,17	8,11	2,20
	35,0	6,29	2,11	6,61	2,14	6,94	2,18	**7,10**	**2,19**	7,59	2,24	7,91	2,28
	40,0	5,96	2,24	6,29	2,27	6,61	2,31	6,77	2,32	7,26	2,38	7,58	2,41
	43,0	5,76	2,32	6,09	2,36	6,41	2,39	6,58	2,41	7,06	2,46	7,39	2,50
	46,0	5,23	2,10	5,48	2,10	5,73	2,10	5,85	2,10	6,20	2,10	6,43	2,10
2.5+2.5+3.5	22,0	7,24	1,78	7,57	1,81	7,89	1,84	8,05	1,86	8,54	1,91	8,87	1,95
	25,0	7,04	1,84	7,37	1,87	7,69	1,91	7,86	1,93	8,35	1,98	8,67	2,01
	32,0	6,58	2,00	6,91	2,04	7,23	2,07	7,40	2,09	7,89	2,14	8,21	2,17
	35,0	6,39	2,08	6,71	2,11	7,04	2,15	**7,20**	**2,16**	7,69	2,21	8,01	2,25
	40,0	6,06	2,21	6,38	2,24	6,71	2,28	6,87	2,29	7,36	2,35	7,68	2,38
	43,0	5,86	2,29	6,19	2,33	6,51	2,36	6,67	2,39	7,16	2,43	7,49	2,47
	46,0	5,32	2,07	5,58	2,07	5,82	2,07	5,95	2,07	6,30	2,07	6,53	2,07

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0,2.5,3.5,4.2 kW class
   Wall-mounted FTXM-M series

Symbols
TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C DB]

3D102787

5 Capacity tables

5 - 1 Cooling Capacity Tables

3MXM52M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.0+2.5+4.2	-15,0	5,64	1,80	5,53	1,82	5,42	1,84	5,36	1,85	5,31	1,86	5,19	1,88
	-10,0	6,54	1,89	6,43	1,91	6,32	1,93	6,27	1,94	6,21	1,95	6,10	1,97
	-5,0	7,45	1,98	7,34	2,00	7,23	2,02	7,17	2,03	7,12	2,04	7,01	2,05
	0,0	8,35	2,07	8,24	2,08	8,13	2,10	8,10	2,11	8,02	2,12	7,91	2,14
	6,0	9,44	2,17	9,33	2,19	9,22	2,21	9,16	2,22	9,11	2,23	9,00	2,25
	10,0	10,17	2,24	10,06	2,26	9,94	2,28	9,89	2,29	9,83	2,30	9,72	2,32
	15,0	11,07	2,33	10,96	2,35	10,85	2,37	10,79	2,38	10,74	2,39	10,63	2,41
2.0+3.5+3.5	-15,0	5,72	1,84	5,61	1,86	5,50	1,88	5,45	1,89	5,39	1,90	5,28	1,92
	-10,0	6,63	1,93	6,52	1,95	6,41	1,97	6,36	1,98	6,30	1,99	6,19	2,01
	-5,0	7,54	2,02	7,43	2,04	7,32	2,06	7,26	2,07	7,21	2,08	7,10	2,09
	0,0	8,45	2,11	8,34	2,12	8,23	2,14	8,20	2,15	8,12	2,16	8,01	2,18
	6,0	9,54	2,21	9,43	2,23	9,32	2,25	9,26	2,26	9,21	2,27	9,10	2,29
	10,0	10,27	2,28	10,16	2,30	10,05	2,32	9,99	2,33	9,94	2,34	9,82	2,36
	15,0	11,18	2,37	11,07	2,39	10,96	2,41	10,90	2,42	10,85	2,43	10,73	2,45
2.5+2.5+2.5	-15,0	5,57	1,76	5,46	1,78	5,35	1,80	5,30	1,81	5,24	1,82	5,13	1,84
	-10,0	6,48	1,85	6,37	1,87	6,26	1,89	6,21	1,90	6,15	1,91	6,04	1,93
	-5,0	7,39	1,94	7,28	1,96	7,17	1,98	7,11	1,99	7,06	2,00	6,95	2,01
	0,0	8,30	2,03	8,19	2,04	8,08	2,06	8,00	2,07	7,97	2,08	7,86	2,10
	6,0	9,39	2,13	9,28	2,15	9,17	2,17	9,11	2,18	9,06	2,19	8,95	2,21
	10,0	10,12	2,20	10,01	2,22	9,90	2,24	9,84	2,25	9,79	2,26	9,67	2,28
	15,0	11,03	2,29	10,92	2,31	10,81	2,33	10,75	2,34	10,70	2,35	10,58	2,37
2.5+2.5+3.5	-15,0	5,78	1,76	5,66	1,78	5,55	1,80	5,49	1,80	5,43	1,81	5,32	1,83
	-10,0	6,71	1,84	6,60	1,86	6,48	1,88	6,42	1,89	6,37	1,90	6,25	1,92
	-5,0	7,64	1,93	7,53	1,95	7,42	1,97	7,36	1,98	7,30	1,99	7,19	2,01
	0,0	8,58	2,02	8,46	2,04	8,35	2,06	8,10	2,09	8,24	2,07	8,12	2,09
	6,0	9,70	2,12	9,58	2,14	9,47	2,16	9,41	2,17	9,36	2,18	9,24	2,20
	10,0	10,45	2,19	10,33	2,21	10,22	2,23	10,16	2,24	10,10	2,25	9,99	2,27
	15,0	11,38	2,28	11,27	2,30	11,15	2,32	11,09	2,33	11,04	2,34	10,92	2,35

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0,2.5,3.5 kW class
   Wall-mounted FTXM-M series

Symbols
TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C WB]

3D102792A

5 Capacity tables

5 - 1 Cooling Capacity Tables

5

3MXM68M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	22,0	2,51	0,48	2,63	0,49	2,75	0,50	2,81	0,50	2,99	0,52	3,11	0,53
	25,0	2,43	0,50	2,55	0,51	2,67	0,52	2,73	0,52	2,92	0,54	3,04	0,55
	32,0	2,26	0,54	2,38	0,55	2,50	0,56	2,56	0,57	2,75	0,58	2,87	0,59
1,5	35,0	2,19	0,57	2,31	0,58	2,43	0,59	**2,49**	**0,59**	2,67	0,61	2,79	0,62
	40,0	2,06	0,60	2,19	0,61	2,31	0,62	2,37	0,63	2,55	0,64	2,67	0,65
	43,0	1,99	0,63	2,11	0,64	2,23	0,65	2,29	0,65	2,48	0,67	2,60	0,68
	46,0	1,92	0,65	2,04	0,66	2,16	0,67	2,22	0,68	2,40	0,69	2,52	0,70
	22,0	2,70	0,49	2,82	0,50	2,94	0,51	3,00	0,51	3,18	0,53	3,30	0,54
	25,0	2,62	0,51	2,74	0,52	2,86	0,53	2,92	0,53	3,11	0,55	3,23	0,56
	32,0	2,45	0,55	2,57	0,56	2,69	0,57	2,75	0,58	2,94	0,59	3,06	0,60
2,0	35,0	2,38	0,58	2,50	0,59	2,62	0,60	**2,68**	**0,60**	2,86	0,62	2,98	0,63
	40,0	2,25	0,61	2,38	0,62	2,50	0,63	2,56	0,64	2,74	0,65	2,86	0,66
	43,0	2,18	0,64	2,30	0,65	2,42	0,66	2,48	0,66	2,67	0,68	2,79	0,69
	46,0	2,11	0,66	2,23	0,67	2,35	0,68	2,41	0,69	2,59	0,70	2,71	0,71
	22,0	3,46	0,71	3,58	0,72	3,70	0,73	3,76	0,73	3,94	0,75	4,06	0,76
	25,0	3,38	0,73	3,50	0,74	3,62	0,75	3,68	0,75	3,87	0,77	3,99	0,78
	32,0	3,21	0,77	3,33	0,78	3,45	0,79	3,51	0,80	3,70	0,81	3,82	0,82
2,5	35,0	3,14	0,80	3,26	0,81	3,38	0,82	**3,44**	**0,82**	3,62	0,84	3,74	0,85
	40,0	3,01	0,83	3,14	0,84	3,26	0,85	3,32	0,86	3,50	0,87	3,62	0,88
	43,0	2,94	0,86	3,06	0,87	3,18	0,88	3,24	0,88	3,43	0,90	3,55	0,91
	46,0	2,87	0,88	2,99	0,89	3,11	0,90	3,17	0,91	3,35	0,92	3,47	0,93
	22,0	3,48	0,70	4,25	0,90	5,08	1,13	5,44	1,23	5,77	1,26	5,98	1,29
	25,0	3,48	0,75	4,25	0,96	5,08	1,21	5,30	1,27	5,63	1,31	5,85	1,33
	32,0	3,48	0,90	4,25	1,16	4,88	1,37	4,99	1,38	5,32	1,42	5,54	1,44
3,5	35,0	3,48	0,97	4,25	1,26	4,75	1,42	**4,86**	**1,43**	5,19	1,47	5,41	1,49
	40,0	3,48	1,12	4,25	1,45	4,53	1,51	4,64	1,52	4,97	1,56	5,19	1,58
	43,0	3,48	1,22	4,18	1,54	4,40	1,57	4,51	1,58	4,83	1,61	5,05	1,64
	46,0	3,48	1,34	4,04	1,60	4,26	1,63	4,37	1,64	4,70	1,67	4,92	1,70
	22,0	3,95	0,71	4,72	0,91	5,55	1,14	5,91	1,24	6,24	1,27	6,45	1,30
	25,0	3,95	0,76	4,72	0,97	5,55	1,22	5,77	1,28	6,10	1,32	6,32	1,34
	32,0	3,95	0,91	4,72	1,17	5,35	1,38	5,46	1,39	5,79	1,43	6,01	1,45
4,2	35,0	3,95	0,98	4,72	1,27	5,22	1,43	**5,33**	**1,44**	5,66	1,48	5,88	1,50
	40,0	3,95	1,13	4,72	1,46	5,00	1,52	5,11	1,53	5,44	1,57	5,66	1,59
	43,0	3,95	1,23	4,65	1,55	4,87	1,58	4,98	1,59	5,30	1,62	5,52	1,65
	46,0	3,95	1,35	4,51	1,61	4,73	1,64	4,84	1,65	5,17	1,68	5,39	1,71
	22,0	4,45	1,02	5,44	1,34	6,50	1,75	6,75	1,83	7,15	1,87	7,43	1,91
	25,0	4,45	1,10	5,44	1,45	6,44	1,87	6,58	1,89	6,99	1,94	7,26	1,98
	32,0	4,45	1,32	5,44	1,77	6,06	2,04	6,20	2,06	6,60	2,11	6,88	2,14
5,0	35,0	4,45	1,44	5,44	1,95	5,89	2,11	**6,03**	**2,13**	6,44	2,19	6,71	2,22
	40,0	4,45	1,68	5,44	2,21	5,62	2,25	5,75	2,27	6,16	2,32	6,44	2,36
	43,0	4,45	1,86	5,13	2,24	5,37	2,24	5,49	2,24	5,83	2,24	6,05	2,24
	46,0	4,23	1,73	4,42	1,73	4,60	1,73	4,69	1,73	4,96	1,73	5,13	1,73

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	22,0	4,93	1,02	5,92	1,34	6,98	1,75	7,23	1,83	7,63	1,87	7,91	1,91
	25,0	4,93	1,10	5,92	1,45	6,92	1,87	7,06	1,89	7,47	1,94	7,74	1,98
	32,0	4,93	1,32	5,92	1,77	6,54	2,04	6,68	2,06	7,08	2,11	7,36	2,14
6,0	35,0	4,93	1,44	5,92	1,95	6,37	2,11	**6,51**	**2,13**	6,92	2,19	7,19	2,22
	40,0	4,93	1,68	5,92	2,21	6,10	2,25	6,23	2,27	6,64	2,32	6,92	2,36
	43,0	4,93	1,86	5,61	2,24	5,85	2,24	5,97	2,24	6,31	2,24	6,53	2,24
	46,0	4,71	1,73	4,90	1,73	5,08	1,73	5,17	1,73	5,44	1,73	5,61	1,73
	22,0	4,82	0,89	5,05	0,91	5,28	0,94	5,40	0,95	5,74	0,98	5,98	1,01
	25,0	4,68	0,93	4,91	0,96	5,14	0,98	5,26	0,99	5,60	1,03	5,84	1,05
	32,0	4,35	1,04	4,58	1,07	4,81	1,09	4,93	1,10	5,28	1,14	5,51	1,16
1.5+1.5	35,0	4,21	1,09	4,44	1,12	4,67	1,14	**4,79**	**1,15**	5,14	1,19	5,37	1,21
	40,0	3,98	1,18	4,21	1,21	4,44	1,23	4,56	1,24	4,90	1,28	5,13	1,30
	43,0	3,84	1,24	4,07	1,26	4,30	1,29	4,42	1,30	4,76	1,33	4,99	1,36
	46,0	3,70	1,30	3,93	1,32	4,16	1,34	4,28	1,36	4,62	1,39	4,85	1,41
	22,0	4,99	0,96	5,22	0,98	5,45	1,01	5,57	1,02	5,91	1,05	6,15	1,08
	25,0	4,85	1,00	5,08	1,03	5,31	1,05	5,43	1,06	5,77	1,10	6,01	1,12
	32,0	4,52	1,11	4,75	1,14	4,98	1,16	5,10	1,17	5,45	1,21	5,68	1,23
1.5+2.0	35,0	4,38	1,16	4,61	1,19	4,84	1,21	**4,96**	**1,22**	5,31	1,26	5,54	1,28
	40,0	4,15	1,25	4,38	1,28	4,61	1,30	4,73	1,31	5,07	1,35	5,30	1,37
	43,0	4,01	1,31	4,24	1,33	4,47	1,36	4,59	1,37	4,93	1,40	5,16	1,43
	46,0	3,87	1,37	4,10	1,39	4,33	1,41	4,45	1,43	4,79	1,46	5,02	1,48
	22,0	5,31	1,10	5,54	1,12	5,77	1,15	5,89	1,16	6,23	1,19	6,47	1,22
	25,0	5,17	1,14	5,40	1,17	5,63	1,19	5,75	1,20	6,09	1,24	6,33	1,26
	32,0	4,84	1,25	5,07	1,28	5,30	1,30	5,42	1,31	5,77	1,35	6,00	1,37
1.5+2.5	35,0	4,70	1,30	4,93	1,33	5,16	1,35	**5,28**	**1,36**	5,63	1,40	5,86	1,42
	40,0	4,47	1,39	4,70	1,42	4,93	1,44	5,05	1,45	5,39	1,49	5,62	1,51
	43,0	4,33	1,45	4,56	1,47	4,79	1,50	4,91	1,51	5,25	1,54	5,48	1,57
	46,0	4,19	1,51	4,42	1,53	4,65	1,55	4,77	1,57	5,11	1,60	5,34	1,62
	22,0	6,21	1,45	6,49	1,48	6,78	1,52	6,92	1,53	7,35	1,58	7,63	1,62
	25,0	6,03	1,52	6,32	1,54	6,60	1,58	6,75	1,60	7,17	1,65	7,46	1,68
	32,0	5,63	1,67	5,92	1,71	6,20	1,74	6,34	1,76	6,77	1,81	7,05	1,84
1.5+3.5	35,0	5,46	1,75	5,74	1,78	6,03	1,82	**6,17**	**1,83**	6,60	1,88	6,88	1,92
	40,0	5,17	1,88	5,46	1,91	5,74	1,95	5,88	1,96	6,31	2,02	6,59	2,05
	43,0	5,00	1,96	5,27	1,99	5,52	1,99	5,64	1,99	6,00	1,99	6,24	1,99
	46,0	4,28	1,48	4,48	1,48	4,67	1,48	4,77	1,48	5,05	1,48	5,53	1,48
	22,0	6,43	1,58	6,71	1,61	7,00	1,65	7,14	1,66	7,57	1,71	7,85	1,75
	25,0	6,25	1,65	6,54	1,67	6,82	1,71	6,97	1,73	7,39	1,78	7,68	1,81
	32,0	5,85	1,80	6,14	1,84	6,42	1,87	6,56	1,89	6,99	1,94	7,27	1,97
1.5+4.2	35,0	5,68	1,88	5,96	1,91	6,25	1,95	**6,39**	**1,96**	6,82	2,01	7,10	2,05
	40,0	5,39	2,01	5,68	2,04	5,96	2,08	6,10	2,09	6,53	2,15	6,81	2,18
	43,0	5,22	2,09	5,49	2,12	5,74	2,12	5,86	2,12	6,22	2,12	6,46	2,12
	46,0	4,50	1,61	4,70	1,61	4,89	1,61	4,99	1,61	5,27	1,61	5,75	1,61

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C DB]

3D103831

5 Capacity tables

5 - 1 Cooling Capacity Tables

3MXM68M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+5.0	22,0	7,12	1,76	7,45	1,80	7,78	1,84	7,94	1,86	8,43	1,93	8,76	1,97
	25,0	6,92	1,84	7,25	1,88	7,58	1,91	7,74	1,94	8,24	2,01	8,56	2,05
	32,0	6,46	2,03	6,79	2,08	7,11	2,12	7,28	2,14	7,77	2,20	8,10	2,25
	35,0	6,26	2,13	6,59	2,17	6,92	2,21	7,08	2,23	7,57	2,30	7,90	2,34
	40,0	5,93	2,29	6,26	2,33	6,59	2,37	6,74	2,39	7,18	2,39	7,46	2,39
	43,0	5,39	1,89	5,64	1,89	5,89	1,89	6,01	1,89	6,37	1,89	6,60	1,89
	46,0	4,61	1,38	4,80	1,38	5,00	1,38	5,09	1,38	5,47	1,38	5,55	1,38
1.5+6.0	22,0	7,63	1,89	7,96	1,93	8,29	1,97	8,45	1,99	8,94	2,06	9,27	2,10
	25,0	7,43	1,97	7,76	2,01	8,09	2,04	8,25	2,07	8,75	2,14	9,07	2,18
	32,0	6,97	2,16	7,30	2,21	7,62	2,25	7,79	2,27	8,28	2,33	8,61	2,38
	35,0	6,77	2,26	7,10	2,30	7,43	2,34	7,59	2,36	8,08	2,43	8,41	2,47
	40,0	6,44	2,42	6,77	2,46	7,10	2,50	7,25	2,52	7,69	2,52	7,97	2,52
	43,0	5,90	2,02	6,15	2,02	6,40	2,02	6,52	2,02	6,88	2,02	7,11	2,02
	46,0	5,12	1,51	5,31	1,51	5,51	1,51	5,60	1,51	5,98	1,51	6,06	1,51
2.0+2.0	22,0	5,15	1,03	5,38	1,05	5,61	1,08	5,73	1,09	6,07	1,12	6,31	1,15
	25,0	5,01	1,07	5,24	1,10	5,47	1,12	5,59	1,13	5,93	1,17	6,17	1,19
	32,0	4,68	1,18	4,91	1,21	5,14	1,23	5,26	1,24	5,61	1,28	5,84	1,30
	35,0	4,54	1,23	4,77	1,26	5,00	1,28	5,12	1,29	5,47	1,33	5,70	1,35
	40,0	4,31	1,32	4,54	1,35	4,77	1,37	4,89	1,38	5,23	1,42	5,46	1,44
	43,0	4,17	1,38	4,40	1,40	4,63	1,43	4,75	1,44	5,09	1,47	5,32	1,50
	46,0	4,03	1,44	4,26	1,46	4,49	1,48	4,61	1,50	4,95	1,53	5,18	1,55
2.0+2.5	22,0	5,47	1,17	5,70	1,19	5,93	1,22	6,05	1,23	6,39	1,26	6,63	1,29
	25,0	5,33	1,21	5,56	1,24	5,79	1,26	5,91	1,27	6,25	1,31	6,49	1,33
	32,0	5,00	1,32	5,23	1,35	5,46	1,37	5,58	1,38	5,93	1,42	6,16	1,44
	35,0	4,86	1,37	5,09	1,40	5,32	1,42	5,44	1,43	5,79	1,47	6,02	1,49
	40,0	4,63	1,46	4,86	1,49	5,09	1,51	5,21	1,52	5,55	1,56	5,78	1,58
	43,0	4,49	1,52	4,72	1,54	4,95	1,57	5,07	1,58	5,41	1,61	5,64	1,64
	46,0	4,35	1,58	4,58	1,60	4,81	1,62	4,93	1,64	5,27	1,67	5,50	1,69
2.0+3.5	22,0	6,34	1,53	6,62	1,56	6,91	1,60	7,05	1,61	7,48	1,66	7,76	1,70
	25,0	6,16	1,60	6,45	1,62	6,73	1,66	6,88	1,68	7,30	1,73	7,59	1,76
	32,0	5,76	1,75	6,05	1,79	6,33	1,82	6,47	1,84	6,90	1,89	7,18	1,92
	35,0	5,59	1,83	5,87	1,86	6,16	1,90	6,30	1,91	6,73	1,96	7,01	2,00
	40,0	5,30	1,96	5,59	1,99	5,87	2,03	6,01	2,04	6,44	2,10	6,72	2,13
	43,0	5,13	2,04	5,40	2,07	5,65	2,07	5,77	2,07	6,13	2,07	6,37	2,07
	46,0	4,41	1,56	4,61	1,56	4,80	1,56	4,90	1,56	5,18	1,56	5,66	1,56
2.0+4.2	22,0	6,55	1,67	6,83	1,70	7,12	1,74	7,26	1,75	7,69	1,80	7,97	1,84
	25,0	6,37	1,74	6,66	1,76	6,94	1,80	7,09	1,82	7,51	1,87	7,80	1,90
	32,0	5,97	1,89	6,26	1,93	6,54	1,96	6,68	1,98	7,11	2,03	7,39	2,06
	35,0	5,80	1,97	6,08	2,00	6,37	2,04	6,51	2,05	6,94	2,10	7,22	2,14
	40,0	5,51	2,10	5,80	2,13	6,08	2,17	6,22	2,18	6,65	2,24	6,93	2,27
	43,0	5,34	2,18	5,61	2,21	5,86	2,21	5,98	2,21	6,34	2,21	6,58	2,21
	46,0	4,62	1,70	4,82	1,70	5,01	1,70	5,11	1,70	5,39	1,70	5,87	1,70

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.0+5.0	22,0	7,30	1,89	7,63	1,93	7,96	1,97	8,12	1,99	8,61	2,06	8,94	2,10
	25,0	7,10	1,97	7,43	2,01	7,76	2,04	7,92	2,07	8,42	2,14	8,74	2,18
	32,0	6,64	2,16	6,97	2,21	7,29	2,25	7,46	2,27	7,95	2,33	8,28	2,38
	35,0	6,44	2,26	6,77	2,30	7,10	2,34	7,26	2,36	7,75	2,43	8,08	2,47
	40,0	6,11	2,42	6,44	2,46	6,77	2,50	6,92	2,52	7,36	2,52	7,64	2,52
	43,0	5,57	2,02	5,82	2,02	6,07	2,02	6,19	2,02	6,55	2,02	6,78	2,02
	46,0	4,79	1,51	4,98	1,51	5,18	1,51	5,27	1,51	5,65	1,51	5,73	1,51
2.0+6.0	22,0	7,75	1,98	8,08	2,02	8,41	2,06	8,57	2,08	9,06	2,15	9,39	2,19
	25,0	7,55	2,06	7,88	2,10	8,21	2,13	8,37	2,16	8,87	2,23	9,19	2,27
	32,0	7,09	2,25	7,42	2,30	7,74	2,34	7,91	2,36	8,40	2,42	8,73	2,47
	35,0	6,89	2,35	7,22	2,39	7,55	2,43	7,71	2,45	8,20	2,52	8,53	2,56
	40,0	6,56	2,51	6,89	2,55	7,22	2,59	7,37	2,61	7,81	2,61	8,09	2,61
	43,0	6,02	2,11	6,27	2,11	6,52	2,11	6,64	2,11	7,00	2,11	7,23	2,11
	46,0	5,24	1,60	5,43	1,60	5,63	1,60	5,72	1,60	6,10	1,60	6,18	1,60
2.5+2.5	22,0	6,13	1,52	6,36	1,54	6,59	1,57	6,71	1,58	7,05	1,61	7,29	1,64
	25,0	5,99	1,56	6,22	1,59	6,45	1,61	6,57	1,62	6,91	1,66	7,15	1,68
	32,0	5,66	1,67	5,89	1,70	6,12	1,72	6,24	1,73	6,59	1,77	6,82	1,79
	35,0	5,52	1,72	5,75	1,75	5,98	1,77	6,10	1,78	6,45	1,82	6,68	1,84
	40,0	5,29	1,81	5,52	1,84	5,75	1,86	5,87	1,87	6,21	1,91	6,44	1,93
	43,0	5,15	1,87	5,38	1,89	5,61	1,92	5,73	1,93	6,07	1,96	6,30	1,99
	46,0	5,01	1,93	5,24	1,95	5,47	1,97	5,59	1,99	5,93	2,02	6,16	2,04
2.5+3.5	22,0	6,61	1,73	6,89	1,76	7,18	1,80	7,32	1,81	7,75	1,86	8,03	1,90
	25,0	6,43	1,80	6,72	1,82	7,00	1,86	7,15	1,88	7,57	1,93	7,86	1,96
	32,0	6,03	1,95	6,32	1,99	6,60	2,02	6,74	2,04	7,17	2,09	7,45	2,12
	35,0	5,86	2,03	6,14	2,06	6,43	2,10	6,57	2,11	7,00	2,16	7,28	2,20
	40,0	5,57	2,16	5,86	2,19	6,14	2,23	6,28	2,24	6,71	2,30	6,99	2,33
	43,0	5,40	2,24	5,67	2,27	5,92	2,27	6,04	2,27	6,40	2,27	6,64	2,27
	46,0	4,68	1,76	4,88	1,76	5,07	1,76	5,17	1,76	5,45	1,76	5,93	1,76
2.5+4.2	22,0	6,99	2,00	7,27	2,03	7,56	2,07	7,70	2,08	8,13	2,13	8,41	2,17
	25,0	6,81	2,07	7,10	2,09	7,38	2,13	7,53	2,15	7,95	2,20	8,24	2,23
	32,0	6,41	2,22	6,70	2,26	6,98	2,29	7,12	2,31	7,55	2,36	7,83	2,39
	35,0	6,24	2,30	6,52	2,33	6,81	2,37	6,95	2,38	7,38	2,43	7,66	2,47
	40,0	5,95	2,43	6,24	2,46	6,52	2,50	6,66	2,51	7,09	2,57	7,37	2,60
	43,0	5,78	2,51	6,05	2,54	6,30	2,54	6,42	2,54	6,78	2,54	7,02	2,54
	46,0	5,06	2,03	5,26	2,03	5,45	2,03	5,55	2,03	5,83	2,03	6,31	2,03
2.5+5.0	22,0	7,41	1,98	7,74	2,02	8,07	2,06	8,23	2,08	8,72	2,15	9,05	2,19
	25,0	7,21	2,06	7,54	2,10	7,87	2,13	8,03	2,16	8,53	2,23	8,85	2,27
	32,0	6,75	2,25	7,08	2,30	7,40	2,34	7,57	2,36	8,06	2,42	8,39	2,47
	35,0	6,55	2,35	6,88	2,39	7,21	2,43	7,37	2,45	7,86	2,52	8,19	2,56
	40,0	6,22	2,51	6,55	2,55	6,88	2,59	7,03	2,61	7,47	2,61	7,75	2,61
	43,0	5,68	2,11	5,93	2,11	6,18	2,11	6,30	2,11	6,66	2,11	6,89	2,11
	46,0	4,90	1,60	5,09	1,60	5,29	1,60	5,38	1,60	5,76	1,60	5,84	1,60

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C DB]

3D103838

5 Capacity tables

5 - 1 Cooling Capacity Tables

5

3MXM68M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.5+6.0	22,0	7,75	1,98	8,08	2,02	8,41	2,06	8,57	2,08	9,06	2,15	9,39	2,19
	25,0	7,55	2,06	7,88	2,10	8,21	2,13	8,37	2,16	8,87	2,23	9,19	2,27
	32,0	7,09	2,25	7,42	2,30	7,74	2,34	7,91	2,36	8,40	2,42	8,73	2,47
	35,0	6,89	2,35	7,22	2,39	7,55	2,43	7,71	2,45	8,20	2,52	8,53	2,56
	40,0	6,56	2,51	6,89	2,55	7,22	2,59	7,37	2,61	7,81	2,61	8,09	2,61
	43,0	6,02	2,11	6,27	2,11	6,52	2,11	6,64	2,11	7,00	2,11	7,23	2,11
	46,0	5,24	1,60	5,43	1,60	5,63	1,60	5,72	1,60	6,10	1,60	6,18	1,60
3.5+3.5	22,0	6,90	1,79	7,49	1,94	7,82	1,98	7,98	2,00	8,46	2,07	8,78	2,11
	25,0	6,90	1,93	7,30	2,02	7,62	2,06	7,78	2,08	8,26	2,14	8,59	2,19
	32,0	6,52	2,17	6,84	2,22	7,16	2,26	7,33	2,28	7,81	2,34	8,13	2,39
	35,0	6,32	2,27	6,65	2,31	6,97	2,35	7,13	2,37	7,61	2,44	7,94	2,48
	40,0	6,00	2,43	6,32	2,47	6,64	2,51	6,79	2,52	7,22	2,52	7,50	2,52
	43,0	5,48	2,02	5,73	2,02	5,97	2,02	6,09	2,02	6,44	2,02	6,67	2,02
	46,0	4,72	1,51	4,92	1,51	5,11	1,51	5,20	1,51	5,47	1,51	5,65	1,51
3.5+4.2	22,0	7,01	1,88	7,60	2,03	7,93	2,07	8,09	2,09	8,57	2,16	8,89	2,20
	25,0	7,01	2,02	7,41	2,11	7,73	2,15	7,89	2,17	8,37	2,23	8,70	2,28
	32,0	6,63	2,26	6,95	2,31	7,27	2,35	7,44	2,37	7,92	2,43	8,24	2,48
	35,0	6,43	2,36	6,76	2,40	7,08	2,44	7,24	2,46	7,72	2,53	8,05	2,57
	40,0	6,11	2,52	6,43	2,56	6,75	2,60	6,90	2,61	7,33	2,61	7,61	2,61
	43,0	5,59	2,11	5,84	2,11	6,08	2,11	6,20	2,11	6,55	2,11	6,78	2,11
	46,0	4,83	1,60	5,03	1,60	5,22	1,60	5,31	1,60	5,58	1,60	5,76	1,60
3.5+5.0	22,0	7,80	2,22	8,16	2,27	8,51	2,32	8,68	2,35	9,21	2,42	9,56	2,47
	25,0	7,59	2,32	7,94	2,37	8,29	2,42	8,47	2,44	8,99	2,52	9,35	2,57
	32,0	7,10	2,55	7,45	2,60	7,80	2,65	7,97	2,67	8,50	2,75	8,85	2,80
	35,0	6,88	2,66	7,23	2,71	7,58	2,76	7,76	2,78	8,29	2,86	8,64	2,91
	40,0	6,41	2,47	6,71	2,47	7,00	2,47	7,15	2,47	7,57	2,47	7,85	2,47
	43,0	5,83	1,97	6,08	1,97	6,32	1,97	6,44	1,97	6,78	1,97	7,01	1,97
	46,0	5,04	1,46	5,23	1,46	5,42	1,46	5,51	1,46	5,78	1,46	5,96	1,46
3.5+6.0	22,0	8,11	2,16	8,47	2,21	8,82	2,26	8,99	2,29	9,52	2,36	9,87	2,41
	25,0	7,90	2,26	8,25	2,31	8,60	2,36	8,78	2,38	9,30	2,46	9,66	2,51
	32,0	7,41	2,49	7,76	2,54	8,11	2,59	8,28	2,61	8,81	2,69	9,16	2,74
	35,0	7,19	2,60	7,54	2,65	7,89	2,70	8,07	2,72	8,60	2,80	8,95	2,85
	40,0	6,72	2,41	7,02	2,41	7,31	2,41	7,46	2,41	7,88	2,41	8,16	2,41
	43,0	6,14	1,91	6,39	1,91	6,63	1,91	6,75	1,91	7,09	1,91	7,32	1,91
	46,0	5,35	1,40	5,54	1,40	5,73	1,40	5,82	1,40	6,09	1,40	6,27	1,40
4.2+4.2	22,0	6,91	1,79	7,50	1,94	7,83	1,98	7,99	2,00	8,47	2,07	8,79	2,11
	25,0	6,91	1,93	7,31	2,02	7,63	2,06	7,79	2,08	8,27	2,14	8,60	2,19
	32,0	6,53	2,17	6,85	2,22	7,17	2,26	7,34	2,28	7,82	2,34	8,14	2,39
	35,0	6,33	2,27	6,66	2,31	6,98	2,35	7,14	2,37	7,62	2,44	7,95	2,48
	40,0	6,01	2,43	6,33	2,47	6,65	2,51	6,80	2,52	7,23	2,52	7,51	2,52
	43,0	5,49	2,02	5,74	2,02	5,98	2,02	6,10	2,02	6,45	2,02	6,68	2,02
	46,0	4,73	1,51	4,93	1,51	5,12	1,51	5,21	1,51	5,48	1,51	5,66	1,51

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
4.2+5.0	22,0	7,81	2,22	8,17	2,27	8,52	2,32	8,69	2,35	9,22	2,42	9,57	2,47
	25,0	7,60	2,32	7,95	2,37	8,30	2,42	8,48	2,44	9,00	2,52	9,36	2,57
	32,0	7,11	2,55	7,46	2,60	7,81	2,65	7,98	2,67	8,51	2,75	8,86	2,80
	35,0	6,89	2,66	7,24	2,71	7,59	2,76	7,77	2,78	8,30	2,86	8,65	2,91
	40,0	6,42	2,47	6,72	2,47	7,01	2,47	7,16	2,47	7,58	2,47	7,86	2,47
	43,0	5,84	1,97	6,09	1,97	6,33	1,97	6,45	1,97	6,79	1,97	7,02	1,97
	46,0	5,05	1,46	5,24	1,46	5,43	1,46	5,52	1,46	5,79	1,46	5,97	1,46
4.2+6.0	22,0	8,12	2,16	8,48	2,21	8,83	2,26	9,00	2,29	9,53	2,36	9,88	2,41
	25,0	7,91	2,26	8,26	2,31	8,61	2,36	8,79	2,38	9,31	2,46	9,67	2,51
	32,0	7,42	2,49	7,77	2,54	8,12	2,59	8,29	2,61	8,82	2,69	9,17	2,74
	35,0	7,20	2,60	7,55	2,65	7,90	2,70	8,08	2,72	8,61	2,80	8,96	2,85
	40,0	6,73	2,41	7,03	2,41	7,32	2,41	7,47	2,41	7,89	2,41	8,17	2,41
	43,0	6,15	1,91	6,40	1,91	6,64	1,91	6,76	1,91	7,10	1,91	7,33	1,91
	46,0	5,36	1,40	5,55	1,40	5,74	1,40	5,83	1,40	6,10	1,40	6,28	1,40
5.0+5.0	22,0	8,27	2,38	8,64	2,44	9,01	2,49	9,20	2,52	9,75	2,60	10,12	2,65
	25,0	8,04	2,48	8,41	2,54	8,78	2,59	8,97	2,62	9,53	2,70	9,90	2,75
	32,0	7,52	2,73	7,89	2,79	8,26	2,84	8,45	2,87	9,00	2,95	9,37	3,00
	35,0	7,29	2,85	7,66	2,90	8,03	2,96	8,22	2,98	8,78	3,06	9,15	3,12
	40,0	6,74	2,44	7,04	2,44	7,34	2,44	7,49	2,44	7,92	2,44	8,20	2,44
	43,0	6,12	1,94	6,37	1,94	6,61	1,94	6,73	1,94	7,08	1,94	7,31	1,94
	46,0	5,28	1,43	5,47	1,43	5,66	1,43	5,76	1,43	6,03	1,43	6,21	1,43
5.0+6.0	22,0	8,50	2,32	8,87	2,38	9,24	2,43	9,43	2,46	9,98	2,54	10,35	2,59
	25,0	8,27	2,42	8,64	2,48	9,01	2,53	9,20	2,56	9,76	2,64	10,13	2,69
	32,0	7,75	2,67	8,12	2,73	8,49	2,78	8,68	2,81	9,23	2,89	9,60	2,94
	35,0	7,52	2,79	7,89	2,84	8,26	2,90	8,45	2,92	9,01	3,00	9,38	3,06
	40,0	6,97	2,38	7,27	2,38	7,57	2,38	7,72	2,38	8,15	2,38	8,43	2,38
	43,0	6,35	1,88	6,60	1,88	6,84	1,88	6,96	1,88	7,31	1,88	7,54	1,88
	46,0	5,51	1,37	5,70	1,37	5,89	1,37	5,99	1,37	6,26	1,37	6,44	1,37
1.5+1.5+1.5	22,0	6,44	1,23	6,74	1,26	7,04	1,29	7,19	1,31	7,64	1,35	7,94	1,38
	25,0	6,26	1,29	6,56	1,32	6,86	1,35	7,01	1,36	7,46	1,41	7,76	1,44
	32,0	5,83	1,43	6,13	1,46	6,43	1,49	6,58	1,51	7,03	1,55	7,33	1,58
	35,0	5,65	1,50	5,95	1,53	6,25	1,56	6,40	1,57	6,85	1,62	7,15	1,65
	40,0	4,35	1,61	5,65	1,64	5,95	1,67	6,10	1,69	6,55	1,73	6,85	1,76
	43,0	4,17	1,69	5,47	1,72	5,77	1,75	5,91	1,76	6,36	1,81	6,66	1,84
	46,0	3,60	1,48	4,83	1,48	5,05	1,48	5,16	1,48	5,47	1,48	5,68	1,48
1.5+1.5+2.0	22,0	6,60	1,31	6,90	1,34	7,20	1,37	7,35	1,39	7,80	1,43	8,10	1,46
	25,0	6,42	1,37	6,72	1,40	7,02	1,43	7,17	1,44	7,62	1,49	7,92	1,52
	32,0	5,99	1,51	6,29	1,54	6,59	1,57	6,74	1,59	7,19	1,63	7,49	1,66
	35,0	5,81	1,58	6,11	1,61	6,41	1,64	6,56	1,65	7,01	1,70	7,31	1,73
	40,0	4,51	1,69	5,81	1,72	6,11	1,75	6,26	1,77	6,71	1,81	7,01	1,84
	43,0	4,33	1,77	5,63	1,80	5,93	1,83	6,07	1,84	6,52	1,89	6,82	1,92
	46,0	3,76	1,56	4,99	1,56	5,21	1,56	5,32	1,56	5,63	1,56	5,84	1,56

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols
TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C DB]

3D103877

5 Capacity tables

5 - 1 Cooling Capacity Tables

5

3MXM68M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+1.5+2.5	22,0	6,76	1,39	7,06	1,42	7,36	1,45	7,51	1,47	7,96	1,51	8,26	1,54
	25,0	6,58	1,45	6,88	1,48	7,18	1,51	7,33	1,52	7,78	1,57	8,08	1,60
	32,0	6,15	1,59	6,45	1,62	6,75	1,65	6,90	1,67	7,35	1,71	7,65	1,74
	35,0	5,97	1,66	6,27	1,69	6,57	1,72	**6,72**	**1,73**	7,17	1,78	7,47	1,81
	40,0	4,67	1,77	5,97	1,80	6,27	1,83	6,42	1,85	6,87	1,89	7,17	1,92
	43,0	4,49	1,85	5,79	1,88	6,09	1,91	6,23	1,92	6,68	1,97	6,98	2,00
	46,0	3,92	1,64	5,15	1,64	5,37	1,64	5,48	1,64	5,79	1,64	6,00	1,64
1.5+1.5+3.5	22,0	7,15	1,50	7,49	1,54	7,82	1,58	7,99	1,60	8,49	1,65	8,82	1,69
	25,0	6,95	1,57	7,28	1,61	7,62	1,65	7,79	1,66	8,29	1,72	8,62	1,76
	32,0	6,48	1,75	6,81	1,78	7,15	1,82	7,31	1,84	7,81	1,90	8,15	1,93
	35,0	6,27	1,83	6,61	1,87	6,94	1,90	**7,11**	**1,92**	7,61	1,98	7,95	2,02
	40,0	5,94	1,97	6,27	2,01	6,61	2,05	6,77	2,07	7,27	2,12	7,61	2,16
	43,0	5,55	1,88	5,83	1,88	6,10	1,88	6,23	1,88	6,61	1,88	6,87	1,88
	46,0	4,66	1,37	4,87	1,37	5,08	1,37	5,18	1,37	5,49	1,37	5,68	1,37
1.5+1.5+4.2	22,0	7,37	1,63	7,71	1,67	8,04	1,71	8,21	1,73	8,71	1,78	9,04	1,82
	25,0	7,17	1,70	7,50	1,74	7,84	1,78	8,01	1,79	8,51	1,85	8,84	1,89
	32,0	6,70	1,88	7,03	1,91	7,37	1,95	7,53	1,97	8,03	2,03	8,37	2,06
	35,0	6,49	1,96	6,83	2,00	7,16	2,03	**7,33**	**2,05**	7,83	2,11	8,17	2,15
	40,0	6,16	2,10	6,49	2,14	6,83	2,18	6,99	2,20	7,49	2,25	7,83	2,29
	43,0	5,77	2,01	6,05	2,01	6,32	2,01	6,45	2,01	6,83	2,01	7,09	2,01
	46,0	4,88	1,50	5,09	1,50	5,30	1,50	5,40	1,50	5,71	1,50	5,90	1,50
1.5+1.5+5.0	22,0	7,79	1,74	8,15	1,78	8,51	1,83	8,69	1,85	9,23	1,91	9,59	1,96
	25,0	7,57	1,82	7,93	1,86	8,29	1,91	8,47	1,93	9,01	1,99	9,38	2,04
	32,0	7,06	2,02	7,42	2,06	7,78	2,11	7,96	2,13	8,50	2,19	8,86	2,24
	35,0	6,84	2,12	7,20	2,16	7,56	2,20	**7,74**	**2,22**	8,28	2,29	8,64	2,33
	40,0	6,47	2,28	6,83	2,32	7,17	2,34	7,33	2,34	7,79	2,34	8,10	2,34
	43,0	5,79	1,84	6,06	1,84	6,32	1,84	6,45	1,84	6,84	1,84	7,08	1,84
	46,0	4,88	1,33	5,09	1,33	5,30	1,33	5,40	1,33	5,69	1,33	5,89	1,33
1.5+1.5+6.0	22,0	8,04	1,69	8,40	1,73	8,76	1,78	8,94	1,80	9,48	1,86	9,84	1,91
	25,0	7,82	1,77	8,18	1,81	8,54	1,86	8,72	1,88	9,26	1,94	9,63	1,99
	32,0	7,31	1,97	7,67	2,01	8,03	2,06	8,21	2,08	8,75	2,14	9,11	2,19
	35,0	7,09	2,07	7,45	2,11	7,81	2,15	**7,99**	**2,17**	8,53	2,24	8,89	2,28
	40,0	6,72	2,23	7,08	2,27	7,42	2,29	7,58	2,29	8,04	2,29	8,35	2,29
	43,0	6,04	1,79	6,31	1,79	6,57	1,79	6,70	1,79	7,09	1,79	7,33	1,79
	46,0	5,13	1,28	5,34	1,28	5,55	1,28	5,65	1,28	5,94	1,28	6,14	1,28
1.5+2.0+2.0	22,0	6,52	1,27	6,82	1,30	7,12	1,33	7,27	1,35	7,72	1,39	8,02	1,42
	25,0	6,34	1,33	6,64	1,36	6,94	1,39	7,09	1,40	7,54	1,45	7,84	1,48
	32,0	5,91	1,47	6,21	1,50	6,51	1,53	6,66	1,55	7,11	1,59	7,41	1,62
	35,0	5,73	1,54	6,03	1,57	6,33	1,60	**6,48**	**1,61**	6,93	1,66	7,23	1,69
	40,0	4,43	1,65	5,73	1,68	6,03	1,71	6,18	1,73	6,63	1,77	6,93	1,80
	43,0	4,25	1,73	5,55	1,76	5,85	1,79	5,99	1,80	6,44	1,85	6,74	1,88
	46,0	3,68	1,52	4,91	1,52	5,13	1,52	5,24	1,52	5,55	1,52	5,76	1,52

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+2.0+2.5	22,0	6,91	1,47	7,21	1,50	7,51	1,53	7,66	1,55	8,11	1,59	8,41	1,62
	25,0	6,73	1,53	7,03	1,56	7,33	1,59	7,48	1,60	7,93	1,65	8,23	1,68
	32,0	6,30	1,67	6,60	1,70	6,90	1,73	7,05	1,75	7,50	1,79	7,80	1,82
	35,0	6,12	1,74	6,42	1,77	6,72	1,80	**6,87**	**1,81**	7,32	1,86	7,62	1,89
	40,0	4,82	1,85	6,12	1,88	6,42	1,91	6,57	1,93	7,02	1,97	7,32	2,00
	43,0	4,64	1,93	5,94	1,96	6,24	1,99	6,38	2,00	6,83	2,05	7,13	2,08
	46,0	4,07	1,72	5,30	1,72	5,52	1,72	5,63	1,72	5,94	1,72	6,15	1,72
1.5+2.0+3.5	22,0	7,29	1,59	7,63	1,63	7,96	1,67	8,13	1,69	8,63	1,74	8,96	1,78
	25,0	7,09	1,66	7,42	1,70	7,76	1,74	7,93	1,75	8,43	1,81	8,76	1,85
	32,0	6,62	1,84	6,95	1,87	7,29	1,91	7,45	1,93	7,95	1,99	8,29	2,02
	35,0	6,41	1,92	6,75	1,96	7,08	1,99	**7,25**	**2,01**	7,75	2,07	8,09	2,11
	40,0	6,08	2,06	6,41	2,10	6,75	2,14	6,91	2,16	7,41	2,21	7,75	2,25
	43,0	5,69	1,97	5,97	1,97	6,24	1,97	6,37	1,97	6,75	1,97	7,01	1,97
	46,0	4,80	1,46	5,01	1,46	5,22	1,46	5,32	1,46	5,63	1,46	5,82	1,46
1.5+2.0+4.2	22,0	7,51	1,72	7,85	1,76	8,18	1,80	8,35	1,82	8,85	1,87	9,18	1,91
	25,0	7,31	1,79	7,64	1,83	7,98	1,87	8,15	1,88	8,65	1,94	8,98	1,98
	32,0	6,84	1,97	7,17	2,00	7,51	2,04	7,67	2,06	8,17	2,12	8,51	2,15
	35,0	6,63	2,05	6,97	2,09	7,30	2,12	**7,47**	**2,14**	7,97	2,20	8,31	2,24
	40,0	6,30	2,19	6,63	2,23	6,97	2,27	7,13	2,29	7,63	2,34	7,97	2,38
	43,0	5,91	2,10	6,19	2,10	6,46	2,10	6,59	2,10	6,97	2,10	7,23	2,10
	46,0	5,02	1,59	5,23	1,59	5,44	1,59	5,54	1,59	5,85	1,59	6,04	1,59
1.5+2.0+5.0	22,0	7,92	1,83	8,28	1,87	8,64	1,92	8,82	1,94	9,36	2,00	9,72	2,05
	25,0	7,70	1,91	8,06	1,95	8,42	2,00	8,60	2,02	9,14	2,08	9,51	2,13
	32,0	7,19	2,11	7,55	2,15	7,91	2,20	8,09	2,22	8,63	2,28	8,99	2,33
	35,0	6,97	2,21	7,33	2,25	7,69	2,29	**7,87**	**2,31**	8,41	2,38	8,77	2,42
	40,0	6,60	2,37	6,96	2,41	7,30	2,43	7,46	2,43	7,92	2,43	8,23	2,43
	43,0	5,92	1,93	6,19	1,93	6,45	1,93	6,58	1,93	6,97	1,93	7,21	1,93
	46,0	5,01	1,42	5,22	1,42	5,43	1,42	5,53	1,42	5,82	1,42	6,02	1,42
1.5+2.0+6.0	22,0	8,18	1,78	8,54	1,82	8,90	1,87	9,08	1,89	9,62	1,95	9,98	2,00
	25,0	7,96	1,86	8,32	1,90	8,68	1,95	8,86	1,97	9,40	2,03	9,77	2,08
	32,0	7,45	2,06	7,81	2,10	8,17	2,15	8,35	2,17	8,89	2,23	9,25	2,28
	35,0	7,23	2,16	7,59	2,20	7,95	2,24	**8,13**	**2,26**	8,67	2,33	9,03	2,37
	40,0	6,86	2,32	7,22	2,36	7,56	2,38	7,72	2,38	8,18	2,38	8,49	2,38
	43,0	6,18	1,88	6,45	1,88	6,71	1,88	6,84	1,88	7,23	1,88	7,47	1,88
	46,0	5,27	1,37	5,48	1,37	5,69	1,37	5,79	1,37	6,08	1,37	6,28	1,37
1.5+2.5+2.5	22,0	7,14	1,58	7,44	1,61	7,74	1,64	7,89	1,66	8,34	1,70	8,64	1,73
	25,0	6,96	1,64	7,26	1,67	7,56	1,70	7,71	1,71	8,16	1,76	8,46	1,79
	32,0	6,53	1,78	6,83	1,81	7,13	1,84	7,28	1,86	7,73	1,90	8,03	1,93
	35,0	6,35	1,85	6,65	1,88	6,95	1,91	**7,10**	**1,92**	7,55	1,97	7,85	2,00
	40,0	5,05	1,96	6,35	1,99	6,65	2,02	6,80	2,04	7,25	2,08	7,55	2,11
	43,0	4,87	2,04	6,17	2,07	6,47	2,10	6,61	2,11	7,06	2,16	7,36	2,19
	46,0	4,30	1,83	5,53	1,83	5,75	1,83	5,86	1,83	6,17	1,83	6,38	1,83

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C DB]

3D103879

5 Capacity tables

5 - 1 Cooling Capacity Tables

5

3MXM68M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+2.5+3.5	22,0	7,64	1,81	7,98	1,85	8,31	1,89	8,48	1,91	8,98	1,96	9,31	2,00
	25,0	7,44	1,88	7,77	1,92	8,11	1,96	8,28	1,97	8,78	2,03	9,11	2,07
	32,0	6,97	2,06	7,30	2,09	7,64	2,13	7,80	2,15	8,30	2,21	8,64	2,24
	35,0	6,76	2,14	7,10	2,18	7,43	2,21	**7,60**	**2,23**	8,10	2,29	8,44	2,33
	40,0	6,43	2,28	6,76	2,32	7,10	2,36	7,26	2,38	7,76	2,43	8,10	2,47
	43,0	6,04	2,19	6,32	2,19	6,59	2,19	6,72	2,19	7,10	2,19	7,36	2,19
	46,0	5,15	1,68	5,36	1,68	5,57	1,68	5,67	1,68	5,98	1,68	6,17	1,68
1.5+2.5+4.2	22,0	7,85	1,93	8,19	1,97	8,52	2,01	8,69	2,03	9,19	2,08	9,52	2,12
	25,0	7,65	2,00	7,98	2,04	8,32	2,08	8,49	2,09	8,99	2,15	9,32	2,19
	32,0	7,18	2,18	7,51	2,21	7,85	2,25	8,01	2,27	8,51	2,33	8,85	2,36
	35,0	6,97	2,26	7,31	2,30	7,64	2,33	**7,81**	**2,35**	8,31	2,41	8,65	2,45
	40,0	6,64	2,40	6,97	2,44	7,31	2,48	7,47	2,50	7,97	2,55	8,31	2,59
	43,0	6,25	2,31	6,53	2,31	6,80	2,31	6,93	2,31	7,31	2,31	7,57	2,31
	46,0	5,36	1,80	5,57	1,80	5,78	1,80	5,88	1,80	6,19	1,80	6,38	1,80
1.5+2.5+5.0	22,0	8,00	1,87	8,36	1,91	8,72	1,96	8,90	1,98	9,44	2,04	9,80	2,09
	25,0	7,78	1,95	8,14	1,99	8,50	2,04	8,68	2,06	9,22	2,12	9,59	2,17
	32,0	7,27	2,15	7,63	2,19	7,99	2,24	8,17	2,26	8,71	2,32	9,07	2,37
	35,0	7,05	2,25	7,41	2,29	7,77	2,33	**7,95**	**2,35**	8,49	2,42	8,85	2,46
	40,0	6,68	2,41	7,04	2,45	7,38	2,47	7,54	2,47	8,00	2,47	8,31	2,47
	43,0	6,00	1,97	6,27	1,97	6,53	1,97	6,66	1,97	7,05	1,97	7,29	1,97
	46,0	5,09	1,46	5,30	1,46	5,51	1,46	5,61	1,46	5,90	1,46	6,10	1,46
1.5+2.5+6.0	22,0	8,47	1,96	8,83	2,00	9,19	2,05	9,37	2,07	9,91	2,13	10,27	2,18
	25,0	8,25	2,04	8,61	2,08	8,97	2,13	9,15	2,15	9,69	2,21	10,06	2,26
	32,0	7,74	2,24	8,10	2,28	8,46	2,33	8,64	2,35	9,18	2,41	9,54	2,46
	35,0	7,52	2,34	7,88	2,38	8,24	2,42	**8,42**	**2,44**	8,96	2,51	9,32	2,55
	40,0	7,15	2,50	7,51	2,54	7,85	2,56	8,01	2,56	8,47	2,56	8,78	2,56
	43,0	6,47	2,06	6,74	2,06	7,00	2,06	7,13	2,06	7,52	2,06	7,76	2,06
	46,0	5,56	1,55	5,77	1,55	5,98	1,55	6,08	1,55	6,37	1,55	6,57	1,55
1.5+3.5+3.5	22,0	7,99	1,94	8,35	1,99	8,72	2,03	8,90	2,06	9,44	2,12	9,81	2,17
	25,0	7,77	2,03	8,13	2,07	8,49	2,12	8,68	2,14	9,22	2,21	9,59	2,25
	32,0	7,25	2,24	7,61	2,29	7,98	2,33	8,16	2,35	8,71	2,42	9,07	2,47
	35,0	7,03	2,34	7,39	2,38	7,76	2,43	**7,94**	**2,45**	8,49	2,52	8,85	2,57
	40,0	6,60	2,41	6,92	2,41	7,24	2,41	7,39	2,41	7,85	2,41	8,14	2,41
	43,0	5,91	1,91	6,17	1,91	6,43	1,91	6,56	1,91	6,93	1,91	7,17	1,91
	46,0	5,03	1,40	5,23	1,40	5,43	1,40	5,53	1,40	5,82	1,40	6,01	1,40
1.5+3.5+4.2	22,0	8,18	2,07	8,54	2,12	8,91	2,16	9,09	2,19	9,63	2,25	10,00	2,30
	25,0	7,96	2,16	8,32	2,20	8,68	2,25	8,87	2,27	9,41	2,34	9,78	2,38
	32,0	7,44	2,37	7,80	2,42	8,17	2,46	8,35	2,48	8,90	2,55	9,26	2,60
	35,0	7,22	2,47	7,58	2,51	7,95	2,56	**8,13**	**2,58**	8,68	2,65	9,04	2,70
	40,0	6,79	2,54	7,11	2,54	7,43	2,54	7,58	2,54	8,04	2,54	8,33	2,54
	43,0	6,10	2,04	6,36	2,04	6,62	2,04	6,75	2,04	7,12	2,04	7,36	2,04
	46,0	5,22	1,53	5,42	1,53	5,62	1,53	5,72	1,53	6,01	1,53	6,20	1,53

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+3.5+5.0	22,0	8,51	2,16	8,90	2,21	9,28	2,26	9,48	2,28	10,06	2,36	10,45	2,41
	25,0	8,27	2,25	8,66	2,30	9,05	2,35	9,24	2,38	9,82	2,45	10,21	2,50
	32,0	7,73	2,49	8,11	2,54	8,50	2,59	8,69	2,61	9,28	2,69	9,66	2,74
	35,0	7,49	2,60	7,88	2,65	8,27	2,70	**8,46**	**2,72**	9,04	2,80	9,43	2,85
	40,0	6,89	2,36	7,21	2,36	7,52	2,36	7,68	2,36	8,13	2,36	8,42	2,36
	43,0	6,18	1,86	6,44	1,86	6,70	1,86	6,83	1,86	7,20	1,86	7,44	1,86
	46,0	5,27	1,35	5,48	1,35	5,68	1,35	5,77	1,35	6,06	1,35	6,25	1,35
1.5+3.5+6.0	22,0	8,61	1,97	9,00	2,02	9,38	2,07	9,58	2,09	10,16	2,17	10,55	2,22
	25,0	8,37	2,06	8,76	2,11	9,15	2,16	9,34	2,19	9,92	2,26	10,31	2,31
	32,0	7,83	2,30	8,21	2,35	8,60	2,40	8,79	2,42	9,38	2,50	9,76	2,55
	35,0	7,59	2,41	7,98	2,46	8,37	2,51	**8,56**	**2,53**	9,14	2,61	9,53	2,66
	40,0	6,99	2,17	7,31	2,17	7,62	2,17	7,78	2,17	8,23	2,17	8,52	2,17
	43,0	6,28	1,67	6,54	1,67	6,80	1,67	6,93	1,67	7,30	1,67	7,54	1,67
	46,0	5,37	1,16	5,58	1,16	5,78	1,16	5,87	1,16	6,16	1,16	6,35	1,16
1.5+4.2+4.2	22,0	8,31	2,17	8,67	2,22	9,04	2,26	9,22	2,29	9,76	2,35	10,13	2,40
	25,0	8,09	2,26	8,45	2,30	8,81	2,35	9,00	2,37	9,54	2,44	9,91	2,48
	32,0	7,57	2,47	7,93	2,52	8,30	2,56	8,48	2,58	9,03	2,65	9,39	2,70
	35,0	7,35	2,57	7,71	2,61	8,08	2,66	**8,26**	**2,68**	8,81	2,75	9,17	2,80
	40,0	6,92	2,64	7,24	2,64	7,56	2,64	7,71	2,64	8,17	2,64	8,46	2,64
	43,0	6,23	2,14	6,49	2,14	6,75	2,14	6,88	2,14	7,25	2,14	7,49	2,14
	46,0	5,35	1,63	5,55	1,63	5,75	1,63	5,85	1,63	6,14	1,63	6,33	1,63
1.5+4.2+5.0	22,0	8,58	2,21	8,97	2,26	9,35	2,31	9,55	2,33	10,13	2,41	10,52	2,46
	25,0	8,34	2,30	8,73	2,35	9,12	2,40	9,31	2,43	9,89	2,50	10,28	2,55
	32,0	7,80	2,54	8,18	2,59	8,57	2,64	8,76	2,66	9,35	2,74	9,73	2,79
	35,0	7,56	2,65	7,95	2,70	8,34	2,75	**8,53**	**2,77**	9,11	2,85	9,50	2,90
	40,0	6,96	2,41	7,28	2,41	7,59	2,41	7,75	2,41	8,20	2,41	8,49	2,41
	43,0	6,25	1,91	6,51	1,91	6,77	1,91	6,90	1,91	7,27	1,91	7,51	1,91
	46,0	5,34	1,40	5,55	1,40	5,75	1,40	5,84	1,40	6,13	1,40	6,32	1,40
2.0+2.0+2.0	22,0	6,68	1,34	6,98	1,37	7,28	1,40	7,43	1,42	7,88	1,46	8,18	1,49
	25,0	6,50	1,40	6,80	1,43	7,10	1,46	7,25	1,47	7,70	1,52	8,00	1,55
	32,0	6,07	1,54	6,37	1,57	6,67	1,60	6,82	1,62	7,27	1,66	7,57	1,69
	35,0	5,89	1,61	6,19	1,64	6,49	1,67	**6,64**	**1,68**	7,09	1,73	7,39	1,76
	40,0	4,59	1,72	5,89	1,75	6,19	1,78	6,34	1,80	6,79	1,84	7,09	1,87
	43,0	4,41	1,80	5,71	1,83	6,01	1,86	6,15	1,87	6,60	1,92	6,90	1,95
	46,0	3,84	1,59	5,07	1,59	5,29	1,59	5,40	1,59	5,71	1,59	5,92	1,59
2.0+2.0+2.5	22,0	7,07	1,55	7,37	1,58	7,67	1,61	7,82	1,63	8,27	1,67	8,57	1,70
	25,0	6,89	1,61	7,19	1,64	7,49	1,67	7,64	1,68	8,09	1,73	8,39	1,76
	32,0	6,46	1,75	6,76	1,78	7,06	1,81	7,21	1,83	7,66	1,87	7,96	1,90
	35,0	6,28	1,82	6,58	1,85	6,88	1,88	**7,03**	**1,89**	7,48	1,94	7,78	1,97
	40,0	4,98	1,93	6,28	1,96	6,58	1,99	6,73	2,01	7,18	2,05	7,48	2,08
	43,0	4,80	2,01	6,10	2,04	6,40	2,07	6,54	2,08	6,99	2,13	7,29	2,16
	46,0	4,23	1,80	5,46	1,80	5,68	1,80	5,79	1,80	6,10	1,80	6,31	1,80

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C DB]

3D103881

5 Capacity tables

5 - 1 Cooling Capacity Tables

3MXM68M

Cooling 50Hz 230V

①	②	14°C TC kW	14°C PI kW	16°C TC kW	16°C PI kW	18°C TC kW	18°C PI kW	19°C TC kW	19°C PI kW	22°C TC kW	22°C PI kW	24°C TC kW	24°C PI kW
		Indoor air temperature [°C WB]											
2.0+2.0+3.5	22,0	7,44	1,67	7,78	1,71	8,11	1,75	8,28	1,77	8,78	1,82	9,11	1,86
	25,0	7,24	1,74	7,57	1,78	7,91	1,82	8,08	1,83	8,58	1,89	8,91	1,93
	32,0	6,77	1,92	7,10	1,95	7,44	1,99	7,60	2,01	8,10	2,07	8,44	2,10
	35,0	6,56	2,00	6,90	2,04	7,23	2,07	**7,40**	**2,09**	7,90	2,15	8,24	2,19
	40,0	6,23	2,14	6,56	2,18	6,90	2,22	7,06	2,24	7,56	2,29	7,90	2,33
	43,0	5,84	2,05	6,12	2,05	6,39	2,05	6,52	2,05	6,90	2,05	7,16	2,05
	46,0	4,95	1,54	5,16	1,54	5,37	1,54	5,47	1,54	5,78	1,54	5,97	1,54
2.0+2.0+4.2	22,0	7,65	1,81	7,99	1,85	8,32	1,89	8,49	1,91	8,99	1,96	9,32	2,00
	25,0	7,45	1,88	7,78	1,92	8,12	1,96	8,29	1,97	8,79	2,03	9,12	2,07
	32,0	6,98	2,06	7,31	2,09	7,65	2,13	7,81	2,15	8,31	2,21	8,65	2,24
	35,0	6,77	2,14	7,11	2,18	7,44	2,21	**7,61**	**2,23**	8,11	2,29	8,45	2,33
	40,0	6,44	2,28	6,77	2,32	7,11	2,36	7,27	2,38	7,77	2,43	8,11	2,47
	43,0	6,05	2,19	6,33	2,19	6,60	2,19	6,73	2,19	7,11	2,19	7,37	2,19
	46,0	5,16	1,68	5,37	1,68	5,58	1,68	5,68	1,68	5,99	1,68	6,18	1,68
2.0+2.0+5.0	22,0	8,06	1,91	8,42	1,95	8,78	2,00	8,96	2,02	9,50	2,08	9,86	2,13
	25,0	7,84	1,99	8,20	2,03	8,56	2,08	8,74	2,10	9,28	2,16	9,65	2,21
	32,0	7,33	2,19	7,69	2,23	8,05	2,28	8,23	2,30	8,77	2,36	9,13	2,41
	35,0	7,11	2,29	7,47	2,33	7,83	2,37	**8,01**	**2,39**	8,55	2,46	8,91	2,50
	40,0	6,74	2,45	7,10	2,49	7,44	2,51	7,60	2,51	8,06	2,51	8,37	2,51
	43,0	6,06	2,01	6,33	2,01	6,59	2,01	6,72	2,01	7,11	2,01	7,35	2,01
	46,0	5,15	1,50	5,36	1,50	5,57	1,50	5,67	1,50	5,96	1,50	6,16	1,50
2.0+2.0+6.0	22,0	8,32	1,87	8,68	1,91	9,04	1,96	9,22	1,98	9,76	2,04	10,12	2,09
	25,0	8,10	1,95	8,46	1,99	8,82	2,04	9,00	2,06	9,54	2,12	9,91	2,17
	32,0	7,59	2,15	7,95	2,19	8,31	2,24	8,49	2,26	9,03	2,32	9,39	2,37
	35,0	7,37	2,25	7,73	2,29	8,09	2,33	**8,27**	**2,35**	8,81	2,42	9,17	2,46
	40,0	7,00	2,41	7,36	2,45	7,70	2,47	7,86	2,47	8,32	2,47	8,63	2,47
	43,0	6,32	1,97	6,59	1,97	6,85	1,97	6,98	1,97	7,37	1,97	7,61	1,97
	46,0	5,41	1,46	5,62	1,46	5,83	1,46	5,93	1,46	6,22	1,46	6,42	1,46
2.0+2.5+2.5	22,0	7,28	1,67	7,58	1,70	7,88	1,73	8,03	1,75	8,48	1,79	8,78	1,82
	25,0	7,10	1,73	7,40	1,76	7,70	1,79	7,85	1,80	8,30	1,85	8,60	1,88
	32,0	6,67	1,87	6,97	1,90	7,27	1,93	7,42	1,95	7,87	1,99	8,17	2,02
	35,0	6,49	1,94	6,79	1,97	7,09	2,00	**7,24**	**2,01**	7,69	2,06	7,99	2,09
	40,0	5,19	2,05	6,49	2,08	6,79	2,11	6,94	2,13	7,39	2,17	7,69	2,20
	43,0	5,01	2,13	6,31	2,16	6,61	2,19	6,75	2,20	7,20	2,25	7,50	2,28
	46,0	4,44	1,92	5,67	1,92	5,89	1,92	6,00	1,92	6,31	1,92	6,52	1,92
2.0+2.5+3.5	22,0	7,78	1,89	8,12	1,93	8,45	1,97	8,62	1,99	9,12	2,04	9,45	2,08
	25,0	7,58	1,96	7,91	2,00	8,25	2,04	8,42	2,05	8,92	2,11	9,25	2,15
	32,0	7,11	2,14	7,44	2,17	7,78	2,21	7,94	2,23	8,44	2,29	8,78	2,32
	35,0	6,90	2,22	7,24	2,26	7,57	2,29	**7,74**	**2,31**	8,24	2,37	8,58	2,41
	40,0	6,57	2,36	6,90	2,40	7,24	2,44	7,40	2,46	7,90	2,51	8,24	2,55
	43,0	6,18	2,27	6,46	2,27	6,73	2,27	6,86	2,27	7,24	2,27	7,50	2,27
	46,0	5,29	1,76	5,50	1,76	5,71	1,76	5,81	1,76	6,12	1,76	6,31	1,76

①	②	14°C TC kW	14°C PI kW	16°C TC kW	16°C PI kW	18°C TC kW	18°C PI kW	19°C TC kW	19°C PI kW	22°C TC kW	22°C PI kW	24°C TC kW	24°C PI kW
		Indoor air temperature [°C WB]											
2.0+2.5+4.2	22,0	7,98	2,03	8,32	2,07	8,65	2,11	8,82	2,13	9,32	2,18	9,65	2,22
	25,0	7,78	2,10	8,11	2,14	8,45	2,18	8,62	2,19	9,12	2,25	9,45	2,29
	32,0	7,31	2,28	7,64	2,31	7,98	2,35	8,14	2,37	8,64	2,43	8,98	2,46
	35,0	7,10	2,36	7,44	2,40	7,77	2,43	**7,94**	**2,45**	8,44	2,51	8,78	2,55
	40,0	6,77	2,50	7,10	2,54	7,44	2,58	7,60	2,60	8,10	2,65	8,44	2,69
	43,0	6,38	2,41	6,66	2,41	6,93	2,41	7,06	2,41	7,44	2,41	7,70	2,41
	46,0	5,49	1,90	5,70	1,90	5,91	1,90	6,01	1,90	6,32	1,90	6,51	1,90
2.0+2.5+5.0	22,0	8,13	1,96	8,49	2,00	8,85	2,05	9,03	2,07	9,57	2,13	9,93	2,18
	25,0	7,91	2,04	8,27	2,08	8,63	2,13	8,81	2,15	9,35	2,21	9,72	2,26
	32,0	7,40	2,24	7,76	2,28	8,12	2,33	8,30	2,35	8,84	2,41	9,20	2,46
	35,0	7,18	2,34	7,54	2,38	7,90	2,42	**8,08**	**2,44**	8,62	2,51	8,98	2,55
	40,0	6,81	2,50	7,17	2,54	7,51	2,56	7,67	2,56	8,13	2,56	8,44	2,56
	43,0	6,13	2,06	6,40	2,06	6,66	2,06	6,79	2,06	7,18	2,06	7,42	2,06
	46,0	5,22	1,55	5,43	1,55	5,64	1,55	5,74	1,55	6,03	1,55	6,23	1,55
2.0+2.5+6.0	22,0	8,60	2,05	8,96	2,09	9,32	2,14	9,50	2,16	10,04	2,22	10,40	2,27
	25,0	8,38	2,13	8,74	2,17	9,10	2,22	9,28	2,24	9,82	2,30	10,19	2,35
	32,0	7,87	2,33	8,23	2,37	8,59	2,42	8,77	2,44	9,31	2,50	9,67	2,55
	35,0	7,65	2,43	8,01	2,47	8,37	2,51	**8,55**	**2,53**	9,09	2,60	9,45	2,64
	40,0	7,28	2,59	7,64	2,63	7,98	2,65	8,14	2,65	8,60	2,65	8,91	2,65
	43,0	6,60	2,15	6,87	2,15	7,13	2,15	7,26	2,15	7,65	2,15	7,89	2,15
	46,0	5,69	1,64	5,90	1,64	6,11	1,64	6,21	1,64	6,50	1,64	6,70	1,64
2.0+3.5+3.5	22,0	8,12	2,03	8,48	2,08	8,85	2,12	9,03	2,15	9,57	2,21	9,94	2,26
	25,0	7,90	2,12	8,26	2,16	8,62	2,21	8,81	2,23	9,35	2,30	9,72	2,34
	32,0	7,38	2,33	7,74	2,38	8,11	2,42	8,29	2,44	8,84	2,51	9,20	2,56
	35,0	7,16	2,43	7,52	2,47	7,89	2,52	**8,07**	**2,54**	8,62	2,61	8,98	2,66
	40,0	6,73	2,50	7,05	2,50	7,37	2,50	7,52	2,50	7,98	2,50	8,27	2,50
	43,0	6,04	2,00	6,30	2,00	6,56	2,00	6,69	2,00	7,06	2,00	7,30	2,00
	46,0	5,16	1,49	5,36	1,49	5,56	1,49	5,66	1,49	5,95	1,49	6,14	1,49
2.0+3.5+4.2	22,0	8,30	2,17	8,66	2,22	9,03	2,26	9,21	2,29	9,75	2,35	10,12	2,40
	25,0	8,08	2,26	8,44	2,30	8,80	2,35	8,99	2,37	9,53	2,44	9,90	2,48
	32,0	7,56	2,47	7,92	2,52	8,29	2,56	8,47	2,58	9,02	2,65	9,38	2,70
	35,0	7,34	2,57	7,70	2,61	8,07	2,66	**8,25**	**2,68**	8,80	2,75	9,16	2,80
	40,0	6,91	2,64	7,23	2,64	7,55	2,64	7,70	2,64	8,16	2,64	8,45	2,64
	43,0	6,22	2,14	6,48	2,14	6,74	2,14	6,87	2,14	7,24	2,14	7,48	2,14
	46,0	5,34	1,63	5,54	1,63	5,74	1,63	5,84	1,63	6,13	1,63	6,32	1,63
2.0+3.5+5.0	22,0	8,63	2,26	9,02	2,31	9,40	2,36	9,60	2,38	10,18	2,46	10,57	2,51
	25,0	8,39	2,35	8,78	2,40	9,17	2,45	9,36	2,48	9,94	2,55	10,33	2,60
	32,0	7,85	2,59	8,23	2,64	8,62	2,69	8,81	2,71	9,40	2,79	9,78	2,84
	35,0	7,61	2,70	8,00	2,75	8,39	2,80	**8,58**	**2,82**	9,16	2,90	9,55	2,95
	40,0	7,01	2,46	7,33	2,46	7,64	2,46	7,80	2,46	8,25	2,46	8,54	2,46
	43,0	6,30	1,96	6,56	1,96	6,82	1,96	6,95	1,96	7,32	1,96	7,56	1,96
	46,0	5,39	1,45	5,60	1,45	5,80	1,45	5,89	1,45	6,18	1,45	6,37	1,45

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C DB]

3D103882

5 Capacity tables

5 - 1 Cooling Capacity Tables

3MXM68M

Cooling 50Hz 230V

①	②	Indoor air temperature [°C WB]											
		14°C		16°C		18°C		19°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.0+4.2+4.2	22,0	8,42	2,26	8,78	2,31	9,15	2,35	9,33	2,38	9,87	2,44	10,24	2,49
	25,0	8,20	2,35	8,56	2,39	8,92	2,44	9,11	2,46	9,65	2,53	10,02	2,57
	32,0	7,68	2,56	8,04	2,61	8,41	2,65	8,59	2,67	9,14	2,74	9,50	2,79
	35,0	7,46	2,66	7,82	2,70	8,19	2,75	**8,37**	**2,77**	8,92	2,84	9,28	2,89
	40,0	7,03	2,73	7,35	2,73	7,67	2,73	7,82	2,73	8,28	2,73	8,57	2,73
	43,0	6,34	2,23	6,60	2,23	6,86	2,23	6,99	2,23	7,36	2,23	7,60	2,23
	46,0	5,46	1,72	5,66	1,72	5,86	1,72	5,96	1,72	6,25	1,72	6,44	1,72
2.5+2.5+2.5	22,0	7,57	1,84	7,87	1,87	8,17	1,90	8,32	1,92	8,77	1,96	9,07	1,99
	25,0	7,39	1,90	7,69	1,93	7,99	1,96	8,14	1,97	8,59	2,02	8,89	2,05
	32,0	6,96	2,04	7,26	2,07	7,56	2,10	7,71	2,12	8,16	2,16	8,46	2,19
	35,0	6,78	2,11	7,08	2,14	7,38	2,17	**7,53**	**2,18**	7,98	2,23	8,28	2,26
	40,0	5,48	2,22	6,78	2,25	7,08	2,28	7,23	2,30	7,68	2,34	7,98	2,37
	43,0	5,30	2,30	6,60	2,33	6,90	2,36	7,04	2,37	7,49	2,42	7,79	2,45
	46,0	4,73	2,09	5,96	2,09	6,18	2,09	6,29	2,09	6,60	2,09	6,81	2,09
2.5+2.5+3.5	22,0	7,98	2,03	8,32	2,07	8,65	2,11	8,82	2,13	9,32	2,18	9,65	2,22
	25,0	7,78	2,10	8,11	2,14	8,45	2,18	8,62	2,19	9,12	2,25	9,45	2,29
	32,0	7,31	2,28	7,64	2,31	7,98	2,35	8,14	2,37	8,64	2,43	8,98	2,46
	35,0	7,10	2,36	7,44	2,40	7,77	2,43	**7,94**	**2,45**	8,44	2,51	8,78	2,55
	40,0	6,77	2,50	7,10	2,54	7,44	2,58	7,60	2,60	8,10	2,65	8,44	2,69
	43,0	6,38	2,41	6,66	2,41	6,93	2,41	7,06	2,41	7,44	2,41	7,70	2,41
	46,0	5,49	1,90	5,70	1,90	5,91	1,90	6,01	1,90	6,32	1,90	6,51	1,90
2.5+2.5+4.2	22,0	8,16	2,16	8,50	2,20	8,83	2,24	9,00	2,26	9,50	2,31	9,83	2,35
	25,0	7,96	2,23	8,29	2,27	8,63	2,31	8,80	2,32	9,30	2,38	9,63	2,42
	32,0	7,49	2,41	7,82	2,44	8,16	2,48	8,32	2,50	8,82	2,56	9,16	2,59
	35,0	7,28	2,49	7,62	2,53	7,95	2,56	**8,12**	**2,58**	8,62	2,64	8,96	2,68
	40,0	6,95	2,63	7,28	2,67	7,62	2,71	7,78	2,73	8,28	2,78	8,62	2,82
	43,0	6,56	2,54	6,84	2,54	7,11	2,54	7,24	2,54	7,62	2,54	7,88	2,54
	46,0	5,67	2,03	5,88	2,03	6,09	2,03	6,19	2,03	6,50	2,03	6,69	2,03
2.5+2.5+5.0	22,0	8,50	2,24	8,86	2,28	9,22	2,33	9,40	2,35	9,94	2,41	10,30	2,46
	25,0	8,28	2,32	8,64	2,36	9,00	2,41	9,18	2,43	9,72	2,49	10,09	2,54
	32,0	7,77	2,52	8,13	2,56	8,49	2,61	8,67	2,63	9,21	2,69	9,57	2,74
	35,0	7,55	2,62	7,91	2,66	8,27	2,70	**8,45**	**2,72**	8,99	2,79	9,35	2,83
	40,0	7,18	2,78	7,54	2,82	7,88	2,84	8,04	2,84	8,50	2,84	8,81	2,84
	43,0	6,50	2,34	6,77	2,34	7,03	2,34	7,16	2,34	7,55	2,34	7,79	2,34
	46,0	5,59	1,83	5,80	1,83	6,01	1,83	6,11	1,83	6,40	1,83	6,60	1,83
2.5+2.5+6.0	22,0	8,79	2,19	9,15	2,23	9,51	2,28	9,69	2,30	10,23	2,36	10,59	2,41
	25,0	8,57	2,27	8,93	2,31	9,29	2,36	9,47	2,38	10,01	2,44	10,38	2,49
	32,0	8,06	2,47	8,42	2,51	8,78	2,56	8,96	2,58	9,50	2,64	9,86	2,69
	35,0	7,84	2,57	8,20	2,61	8,56	2,65	**8,74**	**2,67**	9,28	2,74	9,64	2,78
	40,0	7,47	2,73	7,83	2,77	8,17	2,79	8,33	2,79	8,79	2,79	9,10	2,79
	43,0	6,79	2,29	7,06	2,29	7,32	2,29	7,45	2,29	7,84	2,29	8,08	2,29
	46,0	5,88	1,78	6,09	1,78	6,30	1,78	6,40	1,78	6,69	1,78	6,89	1,78
2.5+3.5+3.5	22,0	8,35	2,21	8,71	2,26	9,08	2,30	9,26	2,33	9,80	2,39	10,17	2,44
	25,0	8,13	2,30	8,49	2,34	8,85	2,39	9,04	2,41	9,58	2,48	9,95	2,52
	32,0	7,61	2,51	7,97	2,56	8,34	2,60	8,52	2,62	9,07	2,69	9,43	2,74
	35,0	7,39	2,61	7,75	2,65	8,12	2,70	**8,30**	**2,72**	8,85	2,79	9,21	2,84
	40,0	6,96	2,68	7,28	2,68	7,60	2,68	7,75	2,68	8,21	2,68	8,50	2,68
	43,0	6,27	2,18	6,53	2,18	6,79	2,18	6,92	2,18	7,29	2,18	7,53	2,18
	46,0	5,39	1,67	5,59	1,67	5,79	1,67	5,89	1,67	6,18	1,67	6,37	1,67
2.5+3.5+4.2	22,0	8,48	2,31	8,84	2,36	9,21	2,40	9,39	2,43	9,93	2,49	10,30	2,54
	25,0	8,26	2,40	8,62	2,44	8,98	2,49	9,17	2,51	9,71	2,58	10,08	2,62
	32,0	7,74	2,61	8,10	2,66	8,47	2,70	8,65	2,72	9,20	2,79	9,56	2,84
	35,0	7,52	2,71	7,88	2,75	8,25	2,80	**8,43**	**2,82**	8,98	2,89	9,34	2,94
	40,0	7,09	2,78	7,41	2,78	7,73	2,78	7,88	2,78	8,34	2,78	8,63	2,78
	43,0	6,40	2,28	6,66	2,28	6,92	2,28	7,05	2,28	7,42	2,28	7,66	2,28
	46,0	5,52	1,77	5,72	1,77	5,92	1,77	6,02	1,77	6,31	1,77	6,50	1,77
2.5+3.5+5.0	22,0	8,79	2,40	9,18	2,45	9,56	2,50	9,76	2,52	10,34	2,60	10,73	2,65
	25,0	8,55	2,49	8,94	2,54	9,33	2,59	9,52	2,62	10,10	2,69	10,49	2,74
	32,0	8,01	2,73	8,39	2,78	8,78	2,83	8,97	2,85	9,56	2,93	9,94	2,98
	35,0	7,77	2,84	8,16	2,89	8,55	2,94	**8,74**	**2,96**	9,32	3,04	9,71	3,09
	40,0	7,17	2,60	7,49	2,60	7,80	2,60	7,96	2,60	8,41	2,60	8,70	2,60
	43,0	6,46	2,10	6,72	2,10	6,98	2,10	7,11	2,10	7,48	2,10	7,72	2,10
	46,0	5,55	1,59	5,76	1,59	5,96	1,59	6,05	1,59	6,34	1,59	6,53	1,59
2.5+4.2+4.2	22,0	8,54	2,36	8,90	2,41	9,27	2,45	9,45	2,48	9,99	2,54	10,36	2,59
	25,0	8,32	2,45	8,68	2,49	9,04	2,54	9,23	2,56	9,77	2,63	10,14	2,67
	32,0	7,80	2,66	8,16	2,71	8,53	2,75	8,71	2,77	9,26	2,84	9,62	2,89
	35,0	7,58	2,76	7,94	2,80	8,31	2,85	**8,49**	**2,87**	9,04	2,94	9,40	2,99
	40,0	7,15	2,83	7,47	2,83	7,79	2,83	7,94	2,83	8,40	2,83	8,69	2,83
	43,0	6,46	2,33	6,72	2,33	6,98	2,33	7,11	2,33	7,48	2,33	7,72	2,33
	46,0	5,58	1,82	5,78	1,82	5,98	1,82	6,08	1,82	6,37	1,82	6,56	1,82
3.5+3.5+3.5	22,0	8,64	2,37	9,03	2,42	9,42	2,47	9,61	2,50	10,19	2,58	10,58	2,63
	25,0	8,40	2,46	8,79	2,52	9,18	2,57	9,37	2,60	9,96	2,68	10,34	2,73
	32,0	7,86	2,71	8,24	2,77	8,63	2,82	8,83	2,85	9,41	2,93	9,80	2,98
	35,0	7,62	2,83	8,01	2,88	8,40	2,94	**8,59**	**2,96**	9,17	3,04	9,56	3,10
	40,0	6,99	2,44	7,31	2,44	7,62	2,44	7,77	2,44	8,21	2,44	8,50	2,44
	43,0	6,32	1,94	6,57	1,94	6,83	1,94	6,95	1,94	7,31	1,94	7,55	1,94
	46,0	5,42	1,43	5,62	1,43	5,82	1,43	5,91	1,43	6,20	1,43	6,38	1,43

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C DB]

3D103883

5 Capacity tables

5 - 2 Heating Capacity Tables

3MXM40M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1,5	-15,0	2,16	0,64	2,10	0,65	2,05	0,66	2,03	0,67	2,00	0,67	1,95	0,68
	-10,0	2,58	0,69	2,53	0,70	2,47	0,71	2,45	0,72	2,42	0,72	2,37	0,73
	-5,0	3,00	0,74	2,95	0,75	2,90	0,76	2,87	0,77	2,85	0,77	2,79	0,78
	0,0	3,43	0,79	3,37	0,80	3,32	0,81	**3,30**	**0,82**	3,27	0,82	3,22	0,83
	6,0	3,93	0,85	3,88	0,86	3,83	0,87	3,80	0,88	3,78	0,88	3,73	0,89
	10,0	4,27	0,89	4,22	0,90	4,17	0,91	4,14	0,91	4,12	0,92	4,07	0,93
	15,0	4,70	0,94	4,64	0,95	4,59	0,96	4,57	0,96	4,54	0,97	4,49	0,98
2,0	-15,0	2,56	1,05	2,50	1,06	2,45	1,07	2,43	1,08	2,40	1,08	2,35	1,09
	-10,0	2,98	1,10	2,93	1,11	2,87	1,12	2,85	1,13	2,82	1,13	2,77	1,14
	-5,0	3,40	1,15	3,35	1,16	3,30	1,17	3,27	1,18	3,25	1,18	3,19	1,19
	0,0	3,83	1,20	3,77	1,21	3,72	1,22	**3,70**	**1,23**	3,67	1,23	3,62	1,24
	6,0	4,33	1,26	4,28	1,27	4,23	1,28	4,20	1,29	4,18	1,29	4,13	1,30
	10,0	4,67	1,30	4,62	1,31	4,57	1,32	4,54	1,32	4,52	1,33	4,47	1,34
	15,0	5,10	1,35	5,04	1,36	4,99	1,37	4,97	1,37	4,94	1,38	4,89	1,39
2,5	-15,0	2,96	1,10	2,90	1,11	2,85	1,12	2,83	1,13	2,80	1,13	2,75	1,14
	-10,0	3,38	1,15	3,33	1,16	3,27	1,17	3,25	1,18	3,22	1,18	3,17	1,19
	-5,0	3,80	1,20	3,75	1,21	3,70	1,22	3,67	1,23	3,65	1,23	3,59	1,24
	0,0	4,23	1,25	4,17	1,26	4,12	1,27	**4,10**	**1,28**	4,07	1,28	4,02	1,29
	6,0	4,73	1,31	4,68	1,32	4,63	1,33	4,60	1,34	4,58	1,34	4,53	1,35
	10,0	5,07	1,35	5,02	1,36	4,97	1,37	4,94	1,37	4,92	1,38	4,87	1,39
	15,0	5,50	1,40	5,44	1,41	5,39	1,42	5,37	1,42	5,34	1,43	5,29	1,44
3,5	-15,0	3,34	1,47	3,27	1,48	3,20	1,50	3,17	1,51	3,14	1,51	3,07	1,53
	-10,0	3,88	1,54	3,81	1,55	3,75	1,57	3,72	1,58	3,68	1,58	3,62	1,60
	-5,0	4,43	1,61	4,36	1,62	4,29	1,64	4,26	1,65	4,23	1,65	4,16	1,67
	0,0	4,97	1,68	4,90	1,69	4,84	1,71	**4,80**	**1,71**	4,77	1,72	4,70	1,74
	6,0	5,62	1,76	5,56	1,77	5,49	1,79	5,46	1,80	5,42	1,81	5,36	1,82
	10,0	6,06	1,82	5,99	1,83	5,93	1,85	5,89	1,85	5,86	1,86	5,79	1,88
	15,0	6,60	1,88	6,54	1,90	6,47	1,91	6,44	1,92	6,40	1,93	6,34	1,94
1.5+1.5	-15,0	2,87	0,96	2,78	0,99	2,68	1,01	2,63	1,02	2,58	1,03	2,49	1,05
	-10,0	3,66	1,06	3,57	1,08	3,47	1,10	3,42	1,11	3,37	1,12	3,28	1,14
	-5,0	4,45	1,15	4,36	1,17	4,26	1,19	4,21	1,20	4,16	1,21	4,07	1,23
	0,0	5,24	1,25	5,15	1,27	5,05	1,29	**5,00**	**1,30**	4,95	1,31	4,86	1,33
	6,0	6,19	1,36	6,10	1,38	6,00	1,40	5,95	1,41	5,90	1,42	5,81	1,44
	10,0	6,83	1,43	6,73	1,45	6,63	1,48	6,58	1,49	6,54	1,50	6,44	1,52
	15,0	7,62	1,53	7,52	1,55	7,42	1,57	7,37	1,58	7,33	1,59	7,23	1,61
1.5+2.0	-15,0	2,87	0,94	2,78	0,97	2,68	0,99	2,63	1,00	2,58	1,01	2,49	1,03
	-10,0	3,66	1,04	3,57	1,06	3,47	1,08	3,42	1,09	3,37	1,10	3,28	1,12
	-5,0	4,45	1,13	4,36	1,15	4,26	1,17	4,21	1,18	4,16	1,19	4,07	1,21
	0,0	5,24	1,23	5,15	1,25	5,05	1,27	**5,00**	**1,28**	4,95	1,29	4,86	1,31
	6,0	6,19	1,34	6,10	1,36	6,00	1,38	5,95	1,39	5,90	1,40	5,81	1,42
	10,0	6,83	1,41	6,73	1,43	6,63	1,46	6,58	1,47	6,54	1,48	6,44	1,50
	15,0	7,62	1,51	7,52	1,53	7,42	1,55	7,37	1,56	7,33	1,57	7,23	1,59

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+2.5	-15,0	2,87	0,92	2,78	0,95	2,68	0,97	2,63	0,98	2,58	0,99	2,49	1,01
	-10,0	3,66	1,02	3,57	1,04	3,47	1,06	3,42	1,07	3,37	1,08	3,28	1,10
	-5,0	4,45	1,11	4,36	1,13	4,26	1,15	4,21	1,16	4,16	1,17	4,07	1,19
	0,0	5,24	1,21	5,15	1,23	5,05	1,25	**5,00**	**1,26**	4,95	1,27	4,86	1,29
	6,0	6,19	1,32	6,10	1,34	6,00	1,36	5,95	1,37	5,90	1,38	5,81	1,40
	10,0	6,83	1,39	6,73	1,41	6,63	1,44	6,58	1,45	6,54	1,46	6,44	1,48
	15,0	7,62	1,49	7,52	1,51	7,42	1,53	7,37	1,54	7,33	1,55	7,23	1,57
1.5+3.5	-15,0	2,86	0,90	2,76	0,93	2,66	0,95	2,61	0,96	2,56	0,97	2,47	0,99
	-10,0	3,65	1,00	3,55	1,02	3,46	1,04	3,41	1,05	3,36	1,06	3,26	1,08
	-5,0	4,45	1,09	4,35	1,11	4,25	1,13	4,20	1,14	4,15	1,15	4,06	1,17
	0,0	5,24	1,19	5,14	1,21	5,05	1,23	**5,00**	**1,24**	4,95	1,25	4,85	1,27
	6,0	6,19	1,30	6,10	1,32	6,00	1,34	5,95	1,35	5,90	1,36	5,81	1,38
	10,0	6,83	1,37	6,73	1,39	6,64	1,42	6,59	1,43	6,54	1,44	6,44	1,46
	15,0	7,63	1,47	7,53	1,49	7,43	1,51	7,38	1,52	7,33	1,53	7,24	1,55
2.0+2.0	-15,0	2,87	0,91	2,78	0,94	2,68	0,96	2,63	0,97	2,58	0,98	2,49	1,00
	-10,0	3,66	1,01	3,57	1,03	3,47	1,05	3,42	1,06	3,37	1,07	3,28	1,09
	-5,0	4,45	1,10	4,36	1,12	4,26	1,14	4,21	1,15	4,16	1,16	4,07	1,18
	0,0	5,24	1,20	5,15	1,22	5,05	1,24	**5,00**	**1,25**	4,95	1,26	4,86	1,28
	6,0	6,19	1,31	6,10	1,33	6,00	1,35	5,95	1,36	5,90	1,37	5,81	1,39
	10,0	6,83	1,38	6,73	1,40	6,63	1,43	6,58	1,44	6,54	1,45	6,44	1,47
	15,0	7,62	1,48	7,52	1,50	7,42	1,52	7,37	1,53	7,33	1,54	7,23	1,56
2.0+2.5	-15,0	2,87	0,89	2,78	0,92	2,68	0,94	2,63	0,95	2,58	0,96	2,49	0,98
	-10,0	3,66	0,99	3,57	1,01	3,47	1,03	3,42	1,04	3,37	1,05	3,28	1,07
	-5,0	4,45	1,08	4,36	1,10	4,26	1,12	4,21	1,13	4,16	1,14	4,07	1,16
	0,0	5,24	1,18	5,15	1,20	5,05	1,22	**5,00**	**1,23**	4,95	1,24	4,86	1,26
	6,0	6,19	1,29	6,10	1,31	6,00	1,33	5,95	1,34	5,90	1,35	5,81	1,37
	10,0	6,83	1,36	6,73	1,38	6,63	1,41	6,58	1,42	6,54	1,43	6,44	1,45
	15,0	7,62	1,46	7,52	1,48	7,42	1,50	7,37	1,51	7,33	1,52	7,23	1,54
2.0+3.5	-15,0	2,86	0,85	2,76	0,88	2,66	0,90	2,61	0,91	2,56	0,92	2,47	0,94
	-10,0	3,65	0,95	3,55	0,97	3,46	0,99	3,41	1,00	3,36	1,01	3,26	1,03
	-5,0	4,45	1,04	4,35	1,06	4,25	1,08	4,20	1,09	4,15	1,10	4,06	1,12
	0,0	5,24	1,14	5,14	1,16	5,05	1,18	**5,00**	**1,19**	4,95	1,20	4,85	1,22
	6,0	6,19	1,25	6,10	1,27	6,00	1,29	5,95	1,30	5,90	1,31	5,81	1,33
	10,0	6,83	1,32	6,73	1,34	6,64	1,37	6,59	1,38	6,54	1,39	6,44	1,41
	15,0	7,63	1,42	7,53	1,44	7,43	1,46	7,38	1,47	7,33	1,48	7,24	1,50
2.5+2.5	-15,0	2,87	0,87	2,78	0,90	2,68	0,92	2,63	0,93	2,58	0,94	2,49	0,96
	-10,0	3,66	0,97	3,57	0,99	3,47	1,01	3,42	1,02	3,37	1,03	3,28	1,05
	-5,0	4,45	1,06	4,36	1,08	4,26	1,10	4,21	1,11	4,16	1,12	4,07	1,14
	0,0	5,24	1,16	5,15	1,18	5,05	1,20	**5,00**	**1,21**	4,95	1,22	4,86	1,24
	6,0	6,19	1,27	6,10	1,29	6,00	1,31	5,95	1,32	5,90	1,33	5,81	1,35
	10,0	6,83	1,34	6,73	1,36	6,63	1,39	6,58	1,40	6,54	1,41	6,44	1,43
	15,0	7,62	1,44	7,52	1,46	7,42	1,48	7,37	1,49	7,33	1,50	7,23	1,52

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols

TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C WB]

3D102494

3MXM40M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.5+3.5	-15,0	2,86	0,84	2,76	0,87	2,66	0,89	2,61	0,90	2,56	0,91	2,47	0,93
	-10,0	3,65	0,94	3,55	0,96	3,46	0,98	3,41	0,99	3,36	1,00	3,26	1,02
	-5,0	4,45	1,03	4,35	1,05	4,25	1,07	4,20	1,08	4,15	1,09	4,06	1,11
	0,0	5,24	1,13	5,14	1,15	5,05	1,17	**5,00**	**1,18**	4,95	1,19	4,85	1,21
	6,0	6,19	1,24	6,10	1,26	6,00	1,28	5,95	1,29	5,90	1,30	5,81	1,32
	10,0	6,83	1,31	6,73	1,33	6,64	1,36	6,59	1,37	6,54	1,38	6,44	1,40
	15,0	7,63	1,41	7,53	1,43	7,43	1,45	7,38	1,46	7,33	1,47	7,24	1,49
3.5+3.5	-15,0	2,81	0,82	2,71	0,84	2,61	0,86	2,56	0,87	2,51	0,88	2,41	0,91
	-10,0	3,62	0,92	3,52	0,94	3,42	0,96	3,37	0,97	3,32	0,98	3,22	1,00
	-5,0	4,44	1,01	4,34	1,04	4,24	1,06	4,19	1,07	4,14	1,08	4,04	1,10
	0,0	5,25	1,11	5,15	1,13	5,05	1,15	**5,00**	**1,16**	4,95	1,18	4,85	1,20
	6,0	6,23	1,23	6,13	1,25	6,03	1,27	5,98	1,28	5,93	1,29	5,83	1,31
	10,0	6,88	1,31	6,78	1,33	6,68	1,35	6,63	1,36	6,58	1,37	6,48	1,39
	15,0	7,70	1,40	7,60	1,42	7,50	1,44	7,45	1,45	7,40	1,47	7,30	1,49
1.5+1.5+1.5	-15,0	2,65	0,71	2,54	0,73	2,43	0,75	2,38	0,76	2,32	0,77	2,21	0,79
	-10,0	3,56	0,80	3,45	0,82	3,34	0,84	3,29	0,85	3,23	0,86	3,12	0,88
	-5,0	4,47	0,89	4,36	0,91	4,25	0,93	4,19	0,94	4,14	0,95	4,03	0,96
	0,0	5,38	0,98	5,27	0,99	5,16	1,01	**5,10**	**1,02**	5,05	1,03	4,94	1,05
	6,0	6,47	1,08	6,36	1,10	6,25	1,12	6,19	1,13	6,14	1,14	6,03	1,16
	10,0	7,20	1,15	7,09	1,17	6,98	1,19	6,92	1,20	6,87	1,21	6,75	1,23
	15,0	8,11	1,24	8,00	1,26	7,89	1,28	7,83	1,29	7,78	1,30	7,66	1,32
1.5+1.5+2.0	-15,0	2,65	0,70	2,54	0,72	2,43	0,74	2,38	0,75	2,32	0,76	2,21	0,78
	-10,0	3,56	0,79	3,45	0,81	3,34	0,83	3,29	0,84	3,23	0,85	3,12	0,87
	-5,0	4,47	0,88	4,36	0,90	4,25	0,92	4,19	0,93	4,14	0,94	4,03	0,95
	0,0	5,38	0,97	5,27	0,98	5,16	1,00	**5,10**	**1,01**	5,05	1,02	4,94	1,04
	6,0	6,47	1,07	6,36	1,09	6,25	1,11	6,19	1,12	6,14	1,13	6,03	1,15
	10,0	7,20	1,14	7,09	1,16	6,98	1,18	6,92	1,19	6,87	1,20	6,75	1,22
	15,0	8,11	1,23	8,00	1,25	7,89	1,27	7,83	1,28	7,78	1,29	7,66	1,31
1.5+1.5+2.5	-15,0	2,59	0,68	2,47	0,70	2,36	0,72	2,30	0,72	2,24	0,73	2,13	0,75
	-10,0	3,52	0,76	3,41	0,78	3,29	0,80	3,23	0,81	3,18	0,82	3,06	0,84
	-5,0	4,45	0,85	4,34	0,87	4,23	0,89	4,17	0,90	4,11	0,91	4,00	0,93
	0,0	5,39	0,94	5,27	0,96	5,16	0,98	**5,10**	**0,99**	5,05	0,99	4,93	1,01
	6,0	6,51	1,04	6,39	1,06	6,28	1,08	6,22	1,09	6,17	1,10	6,05	1,12
	10,0	7,26	1,11	7,14	1,13	7,03	1,15	6,97	1,16	6,91	1,17	6,80	1,19
	15,0	8,19	1,20	8,08	1,22	7,96	1,24	7,90	1,25	7,85	1,26	7,73	1,27
1.5+1.5+3.5	-15,0	2,64	0,66	2,53	0,68	2,42	0,70	2,36	0,71	2,31	0,72	2,19	0,74
	-10,0	3,55	0,75	3,44	0,77	3,33	0,79	3,27	0,80	3,22	0,81	3,11	0,83
	-5,0	4,47	0,84	4,35	0,86	4,24	0,88	4,19	0,89	4,13	0,90	4,02	0,91
	0,0	5,38	0,93	5,27	0,94	5,16	0,96	**5,10**	**0,97**	5,04	0,98	4,93	1,00
	6,0	6,47	1,03	6,36	1,05	6,25	1,07	6,19	1,08	6,14	1,09	6,03	1,11
	10,0	7,20	1,10	7,09	1,12	6,98	1,14	6,92	1,15	6,87	1,16	6,76	1,18
	15,0	8,12	1,19	8,00	1,21	7,89	1,23	7,84	1,24	7,78	1,25	7,67	1,27

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+2.0+2.0	-15,0	2,65	0,64	2,54	0,66	2,43	0,68	2,38	0,69	2,32	0,70	2,21	0,72
	-10,0	3,56	0,73	3,45	0,75	3,34	0,77	3,29	0,78	3,23	0,79	3,12	0,81
	-5,0	4,47	0,82	4,36	0,84	4,25	0,86	4,19	0,87	4,14	0,88	4,03	0,89
	0,0	5,38	0,91	5,27	0,92	5,16	0,94	**5,10**	**0,95**	5,05	0,96	4,94	0,98
	6,0	6,47	1,01	6,36	1,03	6,25	1,05	6,19	1,06	6,14	1,07	6,03	1,09
	10,0	7,20	1,08	7,09	1,10	6,98	1,12	6,92	1,13	6,87	1,14	6,75	1,16
	15,0	8,11	1,17	8,00	1,19	7,89	1,21	7,83	1,22	7,78	1,23	7,66	1,25
1.5+2.0+2.5	-15,0	2,65	0,62	2,54	0,64	2,43	0,66	2,38	0,67	2,32	0,68	2,21	0,70
	-10,0	3,56	0,71	3,45	0,73	3,34	0,75	3,29	0,76	3,23	0,77	3,12	0,79
	-5,0	4,47	0,80	4,36	0,82	4,25	0,84	4,19	0,85	4,14	0,86	4,03	0,87
	0,0	5,38	0,89	5,27	0,90	5,16	0,92	**5,10**	**0,93**	5,05	0,94	4,94	0,96
	6,0	6,47	0,99	6,36	1,01	6,25	1,03	6,19	1,04	6,14	1,05	6,03	1,07
	10,0	7,20	1,06	7,09	1,08	6,98	1,10	6,92	1,11	6,87	1,12	6,75	1,14
	15,0	8,11	1,15	8,00	1,17	7,89	1,19	7,83	1,20	7,78	1,21	7,66	1,23
1.5+2.0+3.5	-15,0	2,59	0,60	2,47	0,62	2,36	0,64	2,30	0,64	2,24	0,65	2,13	0,67
	-10,0	3,52	0,68	3,41	0,70	3,29	0,72	3,23	0,73	3,18	0,74	3,06	0,76
	-5,0	4,45	0,77	4,34	0,79	4,23	0,81	4,17	0,82	4,11	0,83	4,00	0,85
	0,0	5,39	0,86	5,27	0,88	5,16	0,90	**5,10**	**0,91**	5,05	0,91	4,93	0,93
	6,0	6,51	0,96	6,39	0,98	6,28	1,00	6,22	1,01	6,17	1,02	6,05	1,04
	10,0	7,26	1,03	7,14	1,05	7,03	1,07	6,97	1,08	6,91	1,09	6,80	1,11
	15,0	8,19	1,12	8,08	1,14	7,96	1,16	7,90	1,17	7,85	1,18	7,73	1,19
1.5+2.5+2.5	-15,0	2,66	0,56	2,55	0,58	2,44	0,60	2,38	0,61	2,33	0,62	2,21	0,64
	-10,0	3,56	0,65	3,45	0,67	3,34	0,69	3,29	0,70	3,23	0,71	3,12	0,73
	-5,0	4,47	0,74	4,36	0,76	4,25	0,78	4,19	0,79	4,14	0,80	4,03	0,81
	0,0	5,37	0,83	5,26	0,84	5,15	0,86	**5,10**	**0,87**	5,04	0,88	4,93	0,90
	6,0	6,46	0,93	6,35	0,95	6,24	0,97	6,18	0,98	6,13	0,99	6,02	1,01
	10,0	7,19	1,00	7,08	1,02	6,96	1,04	6,91	1,05	6,85	1,06	6,74	1,08
	15,0	8,09	1,09	7,98	1,11	7,87	1,13	7,81	1,14	7,76	1,15	7,65	1,17
1.5+2.5+3.5	-15,0	2,65	0,58	2,54	0,60	2,43	0,62	2,38	0,63	2,32	0,64	2,21	0,66
	-10,0	3,56	0,67	3,45	0,69	3,34	0,71	3,29	0,72	3,23	0,73	3,12	0,75
	-5,0	4,47	0,76	4,36	0,78	4,25	0,80	4,19	0,81	4,14	0,82	4,03	0,83
	0,0	5,38	0,85	5,27	0,86	5,16	0,88	**5,10**	**0,89**	5,05	0,90	4,94	0,92
	6,0	6,47	0,95	6,36	0,97	6,25	0,99	6,19	1,00	6,14	1,01	6,03	1,03
	10,0	7,20	1,02	7,09	1,04	6,98	1,06	6,92	1,07	6,87	1,08	6,75	1,10
	15,0	8,11	1,11	8,00	1,13	7,89	1,15	7,83	1,16	7,78	1,17	7,66	1,19
2.0+2.0+2.5	-15,0	2,66	0,55	2,55	0,57	2,44	0,59	2,38	0,60	2,33	0,61	2,21	0,63
	-10,0	3,56	0,64	3,45	0,66	3,34	0,68	3,29	0,69	3,23	0,70	3,12	0,72
	-5,0	4,47	0,73	4,36	0,75	4,25	0,77	4,19	0,78	4,14	0,79	4,03	0,80
	0,0	5,37	0,82	5,26	0,83	5,15	0,85	**5,10**	**0,86**	5,04	0,87	4,93	0,89
	6,0	6,46	0,92	6,35	0,94	6,24	0,96	6,18	0,97	6,13	0,98	6,02	1,00
	10,0	7,19	0,99	7,08	1,01	6,96	1,03	6,91	1,04	6,85	1,05	6,74	1,07
	15,0	8,09	1,08	7,98	1,10	7,87	1,12	7,81	1,13	7,76	1,14	7,65	1,16

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5, 2.0,2.5,3.5 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols

TC: Total capacity [kW]
PI: Power input [kW]
① Indoor unit combinations
② Outdoor air temperature [°C WB]

3D102796

5 Capacity tables

5 - 2 Heating Capacity Tables

3MXM40M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB] 16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.0+2.5+2.5	-15,0	2,66	0,53	2,55	0,55	2,44	0,57	2,38	0,58	2,33	0,59	2,21	0,61
	-10,0	3,56	0,62	3,45	0,64	3,34	0,66	3,29	0,67	3,23	0,68	3,12	0,70
	-5,0	4,47	0,71	4,36	0,73	4,25	0,75	4,19	0,76	4,14	0,77	4,03	0,78
	0,0	5,37	0,80	5,26	0,81	5,15	0,83	**5,10**	**0,84**	5,04	0,85	4,93	0,87
	6,0	6,46	0,90	6,35	0,92	6,24	0,94	6,18	0,95	6,13	0,96	6,02	0,98
	10,0	7,19	0,97	7,08	0,99	6,96	1,01	6,91	1,02	6,85	1,03	6,74	1,05
	15,0	8,09	1,06	7,98	1,08	7,87	1,10	7,81	1,11	7,76	1,12	7,65	1,14

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0,2.5 kW class
   Wall-mounted FTXM-M series

Symbols
- TC: Total capacity [kW]
- PI: Power input [kW]
- ① Indoor unit combinations
- ② Outdoor air temperature [°C WB]

3D102797

3MXM52M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB] 16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1,5	-15,0	2,26	0,91	2,20	0,92	2,15	0,93	2,13	0,94	2,10	0,94	2,05	0,95
	-10,0	2,68	0,96	2,63	0,97	2,57	0,98	2,55	0,99	2,52	0,99	2,47	1,00
	-5,0	3,10	1,01	3,05	1,02	3,00	1,03	2,97	1,04	2,95	1,04	2,89	1,05
	0,0	3,53	1,06	3,47	1,07	3,42	1,08	**3,40**	**1,09**	3,37	1,09	3,32	1,10
	6,0	4,03	1,12	3,98	1,13	3,93	1,14	3,90	1,15	3,88	1,15	3,83	1,16
	10,0	4,37	1,16	4,32	1,17	4,27	1,18	4,24	1,18	4,22	1,19	4,17	1,20
	15,0	4,80	1,21	4,74	1,22	4,69	1,23	4,67	1,23	4,64	1,24	4,59	1,25
2,0	-15,0	2,66	1,01	2,60	1,02	2,55	1,03	2,53	1,04	2,50	1,04	2,45	1,05
	-10,0	3,08	1,06	3,03	1,07	2,97	1,08	2,95	1,09	2,92	1,09	2,87	1,10
	-5,0	3,50	1,11	3,45	1,12	3,40	1,13	3,37	1,14	3,35	1,14	3,29	1,15
	0,0	3,93	1,16	3,87	1,17	3,82	1,18	**3,80**	**1,19**	3,77	1,19	3,72	1,20
	6,0	4,43	1,22	4,38	1,23	4,33	1,24	4,30	1,25	4,28	1,25	4,23	1,26
	10,0	4,77	1,26	4,72	1,27	4,67	1,28	4,64	1,28	4,62	1,29	4,57	1,30
	15,0	5,20	1,31	5,14	1,32	5,09	1,33	5,07	1,33	5,04	1,34	4,99	1,35
2,5	-15,0	2,86	1,06	2,80	1,07	2,75	1,08	2,73	1,09	2,70	1,09	2,65	1,10
	-10,0	3,28	1,11	3,23	1,12	3,17	1,13	3,15	1,14	3,12	1,14	3,07	1,15
	-5,0	3,70	1,16	3,65	1,17	3,60	1,18	3,57	1,19	3,55	1,19	3,49	1,20
	0,0	4,13	1,21	4,07	1,22	4,02	1,23	**4,00**	**1,24**	3,97	1,24	3,92	1,25
	6,0	4,63	1,27	4,58	1,28	4,53	1,29	4,50	1,30	4,48	1,30	4,43	1,31
	10,0	4,97	1,31	4,92	1,32	4,87	1,33	4,84	1,33	4,82	1,34	4,77	1,35
	15,0	5,40	1,36	5,34	1,37	5,29	1,38	5,27	1,38	5,24	1,39	5,19	1,40
3,5	-15,0	3,34	1,42	3,27	1,43	3,20	1,45	3,17	1,46	3,14	1,46	3,07	1,48
	-10,0	3,88	1,49	3,81	1,50	3,75	1,52	3,72	1,53	3,68	1,53	3,62	1,55
	-5,0	4,43	1,56	4,36	1,57	4,29	1,59	4,26	1,60	4,23	1,60	4,16	1,62
	0,0	4,97	1,63	4,90	1,64	4,84	1,66	**4,80**	**1,66**	4,77	1,67	4,70	1,69
	6,0	5,62	1,71	5,56	1,72	5,49	1,74	5,46	1,75	5,42	1,76	5,36	1,77
	10,0	6,06	1,77	5,99	1,78	5,93	1,80	5,89	1,80	5,86	1,81	5,79	1,83
	15,0	6,60	1,83	6,54	1,85	6,47	1,86	6,44	1,87	6,40	1,88	6,34	1,89
4,2	-15,0	4,14	1,79	4,07	1,80	4,00	1,82	3,97	1,83	3,94	1,83	3,87	1,85
	-10,0	4,68	1,86	4,61	1,87	4,55	1,89	4,52	1,90	4,48	1,90	4,42	1,92
	-5,0	5,23	1,93	5,16	1,94	5,09	1,96	5,06	1,97	5,03	1,97	4,96	1,99
	0,0	5,77	2,00	5,70	2,01	5,64	2,03	**5,60**	**2,03**	5,57	2,04	5,50	2,06
	6,0	6,42	2,08	6,36	2,09	6,29	2,11	6,26	2,12	6,22	2,13	6,16	2,14
	10,0	6,86	2,14	6,79	2,15	6,73	2,17	6,69	2,17	6,66	2,18	6,59	2,20
	15,0	7,40	2,20	7,34	2,22	7,27	2,23	7,24	2,24	7,20	2,25	7,14	2,26
5,0	-15,0	4,74	2,21	4,64	2,23	4,55	2,25	4,50	2,26	4,46	2,28	4,36	2,30
	-10,0	5,50	2,31	5,41	2,34	5,32	2,36	5,27	2,37	5,22	2,38	5,13	2,41
	-5,0	6,27	2,42	6,18	2,44	6,08	2,47	6,04	2,48	5,99	2,49	5,90	2,51
	0,0	7,04	2,53	6,94	2,55	6,85	2,57	**6,80**	**2,58**	6,76	2,60	6,66	2,62
	6,0	7,96	2,65	7,86	2,68	7,77	2,70	7,72	2,71	7,68	2,72	7,58	2,75
	10,0	8,57	2,74	8,48	2,76	8,38	2,79	8,31	2,77	8,13	2,69	7,77	2,52
	15,0	9,20	2,75	8,84	2,61	8,48	2,46	8,31	2,39	8,13	2,32	7,77	2,18

①	②	Indoor air temperature [°C DB] 16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+1.5	-15,0	3,67	1,28	3,58	1,31	3,48	1,33	3,43	1,34	3,38	1,35	3,29	1,37
	-10,0	4,46	1,38	4,37	1,40	4,27	1,42	4,22	1,43	4,17	1,44	4,08	1,46
	-5,0	5,25	1,47	5,16	1,49	5,06	1,51	5,01	1,52	4,96	1,53	4,87	1,55
	0,0	6,04	1,57	5,95	1,59	5,85	1,61	**5,80**	**1,62**	5,75	1,63	5,66	1,65
	6,0	6,99	1,68	6,90	1,70	6,80	1,72	6,75	1,73	6,70	1,74	6,61	1,76
	10,0	7,63	1,75	7,53	1,77	7,43	1,80	7,38	1,81	7,34	1,82	7,24	1,84
	15,0	8,42	1,85	8,32	1,87	8,22	1,89	8,17	1,90	8,13	1,91	8,03	1,93
1.5+2.0	-15,0	3,67	1,26	3,58	1,29	3,48	1,31	3,43	1,32	3,38	1,33	3,29	1,35
	-10,0	4,46	1,36	4,37	1,38	4,27	1,40	4,22	1,41	4,17	1,42	4,08	1,44
	-5,0	5,25	1,45	5,16	1,47	5,06	1,49	5,01	1,50	4,96	1,51	4,87	1,53
	0,0	6,04	1,55	5,95	1,57	5,85	1,59	**5,80**	**1,60**	5,75	1,61	5,66	1,63
	6,0	6,99	1,66	6,90	1,68	6,80	1,70	6,75	1,71	6,70	1,72	6,61	1,74
	10,0	7,63	1,73	7,53	1,75	7,43	1,78	7,38	1,79	7,34	1,80	7,24	1,82
	15,0	8,42	1,83	8,32	1,85	8,22	1,87	8,17	1,88	8,13	1,89	8,03	1,91
1.5+2.5	-15,0	4,77	1,92	4,68	1,95	4,58	1,97	4,53	1,98	4,48	1,99	4,39	2,01
	-10,0	5,56	2,02	5,47	2,04	5,37	2,06	5,32	2,07	5,27	2,08	5,18	2,10
	-5,0	6,35	2,11	6,26	2,13	6,16	2,15	6,11	2,16	6,06	2,17	5,97	2,19
	0,0	7,14	2,21	7,05	2,23	6,95	2,25	**6,90**	**2,26**	6,85	2,27	6,76	2,29
	6,0	8,09	2,32	8,00	2,34	7,90	2,36	7,85	2,37	7,80	2,38	7,71	2,40
	10,0	8,73	2,39	8,63	2,41	8,53	2,44	8,48	2,45	8,44	2,46	8,34	2,48
	15,0	9,52	2,49	9,42	2,51	9,32	2,53	9,27	2,54	9,23	2,55	9,13	2,57
1.5+3.5	-15,0	4,86	1,91	4,76	1,94	4,66	1,96	4,61	1,97	4,56	1,98	4,47	2,00
	-10,0	5,65	2,01	5,55	2,03	5,46	2,05	5,41	2,06	5,36	2,07	5,26	2,09
	-5,0	6,45	2,10	6,35	2,12	6,25	2,14	6,20	2,15	6,15	2,16	6,06	2,18
	0,0	7,24	2,20	7,14	2,22	7,05	2,24	**7,00**	**2,25**	6,95	2,26	6,85	2,28
	6,0	8,19	2,31	8,10	2,33	8,00	2,35	7,95	2,36	7,90	2,37	7,81	2,39
	10,0	8,83	2,38	8,73	2,40	8,64	2,43	8,59	2,44	8,54	2,45	8,44	2,47
	15,0	9,63	2,48	9,53	2,50	9,43	2,52	9,38	2,53	9,33	2,54	9,24	2,56
1.5+4.2	-15,0	4,86	1,89	4,76	1,92	4,66	1,94	4,61	1,95	4,56	1,96	4,47	1,98
	-10,0	5,65	1,99	5,55	2,01	5,46	2,03	5,41	2,04	5,36	2,05	5,26	2,07
	-5,0	6,45	2,08	6,35	2,10	6,25	2,12	6,20	2,13	6,15	2,14	6,06	2,16
	0,0	7,24	2,18	7,14	2,20	7,05	2,22	**7,00**	**2,23**	6,95	2,24	6,85	2,26
	6,0	8,19	2,29	8,10	2,31	8,00	2,33	7,95	2,34	7,90	2,35	7,81	2,37
	10,0	8,83	2,36	8,73	2,38	8,64	2,41	8,59	2,42	8,54	2,43	8,44	2,45
	15,0	9,63	2,46	9,53	2,48	9,43	2,50	9,38	2,51	9,33	2,52	9,24	2,54
1.5+5.0	-15,0	5,01	1,96	4,91	1,98	4,82	2,00	4,77	2,01	4,72	2,02	4,62	2,04
	-10,0	5,83	2,05	5,73	2,07	5,63	2,09	5,58	2,10	5,53	2,12	5,43	2,14
	-5,0	6,64	2,15	6,54	2,17	6,44	2,19	6,39	2,20	6,34	2,21	6,24	2,23
	0,0	7,45	2,24	7,35	2,26	7,25	2,29	**7,20**	**2,30**	7,15	2,31	7,06	2,33
	6,0	8,43	2,36	8,33	2,38	8,23	2,40	8,18	2,41	8,13	2,42	8,03	2,44
	10,0	9,08	2,43	8,98	2,46	8,88	2,48	8,83	2,49	8,78	2,50	8,68	2,52
	15,0	9,89	2,53	9,79	2,55	9,69	2,57	9,64	2,58	9,59	2,59	9,49	2,61

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols
- TC: Total capacity [kW]
- PI: Power input [kW]
- ① Indoor unit combinations
- ② Outdoor air temperature [°C WB]

3D102788A

5 Capacity tables

5 - 2 Heating Capacity Tables

3MXM52M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.0+2.0	-15,0	4,87	1,92	4,78	1,95	4,68	1,97	4,63	1,98	4,58	1,99	4,49	2,01
	-10,0	5,66	2,02	5,57	2,04	5,47	2,06	5,42	2,07	5,37	2,08	5,28	2,10
	-5,0	6,45	2,11	6,36	2,13	6,26	2,15	6,21	2,16	6,16	2,17	6,07	2,19
	0,0	7,24	2,21	7,15	2,23	7,05	2,25	**7,00**	**2,26**	6,95	2,27	6,86	2,29
	6,0	8,19	2,32	8,10	2,34	8,00	2,36	7,95	2,37	7,90	2,38	7,81	2,40
	10,0	8,83	2,39	8,73	2,41	8,63	2,44	8,58	2,45	8,54	2,46	8,44	2,48
	15,0	9,62	2,49	9,52	2,51	9,42	2,53	9,37	2,54	9,33	2,55	9,23	2,57
2.0+2.5	-15,0	4,87	1,91	4,78	1,94	4,68	1,96	4,63	1,97	4,58	1,98	4,49	2,00
	-10,0	5,66	2,01	5,57	2,03	5,47	2,05	5,42	2,06	5,37	2,07	5,28	2,09
	-5,0	6,45	2,10	6,36	2,12	6,26	2,14	6,21	2,15	6,16	2,16	6,07	2,18
	0,0	7,24	2,20	7,15	2,22	7,05	2,24	**7,00**	**2,25**	6,95	2,26	6,86	2,28
	6,0	8,19	2,31	8,10	2,33	8,00	2,35	7,95	2,36	7,90	2,37	7,81	2,39
	10,0	8,83	2,38	8,73	2,40	8,63	2,43	8,58	2,44	8,54	2,45	8,44	2,47
	15,0	9,62	2,48	9,52	2,50	9,42	2,52	9,37	2,53	9,33	2,54	9,23	2,56
2.0+3.5	-15,0	4,96	1,92	4,86	1,95	4,76	1,97	4,71	1,98	4,66	1,99	4,57	2,01
	-10,0	5,75	2,02	5,65	2,04	5,56	2,06	5,51	2,07	5,46	2,08	5,36	2,10
	-5,0	6,55	2,11	6,45	2,13	6,35	2,15	6,30	2,16	6,25	2,17	6,16	2,19
	0,0	7,34	2,21	7,24	2,23	7,15	2,25	**7,10**	**2,26**	7,05	2,27	6,95	2,29
	6,0	8,29	2,32	8,20	2,34	8,10	2,36	8,05	2,37	8,00	2,38	7,91	2,40
	10,0	8,93	2,39	8,83	2,41	8,74	2,44	8,69	2,45	8,64	2,46	8,54	2,48
	15,0	9,73	2,49	9,63	2,51	9,53	2,53	9,48	2,54	9,43	2,55	9,34	2,57
2.0+4.2	-15,0	4,96	1,90	4,86	1,93	4,76	1,95	4,71	1,96	4,66	1,97	4,57	1,99
	-10,0	5,75	2,00	5,65	2,02	5,56	2,04	5,51	2,05	5,46	2,06	5,36	2,08
	-5,0	6,55	2,09	6,45	2,11	6,35	2,13	6,30	2,14	6,25	2,15	6,16	2,17
	0,0	7,34	2,19	7,24	2,21	7,15	2,23	**7,10**	**2,24**	7,05	2,25	6,95	2,27
	6,0	8,29	2,30	8,20	2,32	8,10	2,34	8,05	2,35	8,00	2,36	7,91	2,38
	10,0	8,93	2,37	8,83	2,39	8,74	2,42	8,69	2,43	8,64	2,44	8,54	2,46
	15,0	9,73	2,47	9,63	2,49	9,53	2,51	9,48	2,52	9,43	2,53	9,34	2,55
2.0+5.0	-15,0	5,01	1,94	4,91	1,96	4,82	1,98	4,77	1,99	4,72	2,00	4,62	2,02
	-10,0	5,83	2,03	5,73	2,05	5,63	2,07	5,58	2,08	5,53	2,10	5,43	2,12
	-5,0	6,64	2,13	6,54	2,15	6,44	2,17	6,39	2,18	6,34	2,19	6,24	2,21
	0,0	7,45	2,22	7,35	2,24	7,25	2,27	**7,20**	**2,28**	7,15	2,29	7,06	2,31
	6,0	8,43	2,34	8,33	2,36	8,23	2,38	8,18	2,39	8,13	2,40	8,03	2,42
	10,0	9,08	2,41	8,98	2,44	8,88	2,46	8,83	2,47	8,78	2,48	8,68	2,50
	15,0	9,89	2,51	9,79	2,53	9,69	2,55	9,64	2,56	9,59	2,57	9,49	2,59
2.5+2.5	-15,0	4,87	1,89	4,78	1,92	4,68	1,94	4,63	1,95	4,58	1,96	4,49	1,98
	-10,0	5,66	1,99	5,57	2,01	5,47	2,03	5,42	2,04	5,37	2,05	5,28	2,07
	-5,0	6,45	2,08	6,36	2,10	6,26	2,12	6,21	2,13	6,16	2,14	6,07	2,16
	0,0	7,24	2,18	7,15	2,20	7,05	2,22	**7,00**	**2,23**	6,95	2,24	6,86	2,26
	6,0	8,19	2,29	8,10	2,31	8,00	2,33	7,95	2,34	7,90	2,35	7,81	2,37
	10,0	8,83	2,36	8,73	2,38	8,63	2,41	8,58	2,42	8,54	2,43	8,44	2,45
	15,0	9,62	2,46	9,52	2,48	9,42	2,50	9,37	2,51	9,33	2,52	9,23	2,54

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.5+3.5	-15,0	5,06	2,01	4,96	2,04	4,86	2,06	4,81	2,07	4,76	2,08	4,67	2,10
	-10,0	5,85	2,11	5,75	2,13	5,66	2,15	5,61	2,16	5,56	2,17	5,46	2,19
	-5,0	6,65	2,20	6,55	2,22	6,45	2,24	6,40	2,25	6,35	2,26	6,26	2,28
	0,0	7,44	2,30	7,34	2,32	7,25	2,34	**7,20**	**2,35**	7,15	2,36	7,05	2,38
	6,0	8,39	2,41	8,30	2,43	8,20	2,45	8,15	2,46	8,10	2,47	8,01	2,49
	10,0	9,03	2,48	8,93	2,50	8,84	2,53	8,79	2,54	8,74	2,55	8,64	2,57
	15,0	9,83	2,58	9,73	2,60	9,63	2,62	9,58	2,63	9,53	2,64	9,44	2,66
2.5+4.2	-15,0	5,06	1,99	4,96	2,02	4,86	2,04	4,81	2,05	4,76	2,06	4,67	2,08
	-10,0	5,85	2,09	5,75	2,11	5,66	2,13	5,61	2,14	5,56	2,15	5,46	2,17
	-5,0	6,65	2,18	6,55	2,20	6,45	2,22	6,40	2,23	6,35	2,24	6,26	2,26
	0,0	7,44	2,28	7,34	2,30	7,25	2,32	**7,20**	**2,33**	7,15	2,34	7,05	2,36
	6,0	8,39	2,39	8,30	2,41	8,20	2,43	8,15	2,44	8,10	2,45	8,01	2,47
	10,0	9,03	2,46	8,93	2,48	8,84	2,51	8,79	2,52	8,74	2,53	8,64	2,55
	15,0	9,83	2,56	9,73	2,58	9,63	2,60	9,58	2,61	9,53	2,62	9,44	2,64
2.5+5.0	-15,0	5,21	1,99	5,11	2,01	5,02	2,03	4,97	2,04	4,92	2,05	4,82	2,07
	-10,0	6,03	2,08	5,93	2,10	5,83	2,12	5,78	2,13	5,73	2,15	5,63	2,17
	-5,0	6,84	2,18	6,74	2,20	6,64	2,22	6,59	2,23	6,54	2,24	6,44	2,26
	0,0	7,65	2,27	7,55	2,29	7,45	2,32	**7,40**	**2,33**	7,35	2,34	7,26	2,36
	6,0	8,63	2,39	8,53	2,41	8,43	2,43	8,38	2,44	8,33	2,45	8,23	2,47
	10,0	9,28	2,46	9,18	2,49	9,08	2,51	9,03	2,52	8,98	2,53	8,88	2,55
	15,0	10,09	2,56	9,99	2,58	9,89	2,60	9,84	2,61	9,79	2,62	9,69	2,64
3.5+3.5	-15,0	5,11	2,04	5,01	2,06	4,91	2,08	4,86	2,09	4,81	2,10	4,71	2,13
	-10,0	5,92	2,14	5,82	2,16	5,72	2,18	5,67	2,19	5,62	2,20	5,52	2,22
	-5,0	6,74	2,23	6,64	2,26	6,54	2,28	6,49	2,29	6,44	2,30	6,34	2,32
	0,0	7,55	2,33	7,45	2,35	7,35	2,37	**7,30**	**2,38**	7,25	2,40	7,15	2,42
	6,0	8,53	2,45	8,43	2,47	8,33	2,49	8,28	2,50	8,23	2,51	8,13	2,53
	10,0	9,18	2,53	9,08	2,55	8,98	2,57	8,93	2,58	8,88	2,59	8,78	2,61
	15,0	10,00	2,62	9,90	2,64	9,80	2,66	9,75	2,67	9,70	2,69	9,60	2,71
3.5+4.2	-15,0	5,11	2,02	5,01	2,04	4,91	2,06	4,86	2,07	4,81	2,08	4,71	2,11
	-10,0	5,92	2,12	5,82	2,14	5,72	2,16	5,67	2,17	5,62	2,18	5,52	2,20
	-5,0	6,74	2,21	6,64	2,24	6,54	2,26	6,49	2,27	6,44	2,28	6,34	2,30
	0,0	7,55	2,31	7,45	2,33	7,35	2,35	**7,30**	**2,36**	7,25	2,38	7,15	2,40
	6,0	8,53	2,43	8,43	2,45	8,33	2,47	8,28	2,48	8,23	2,49	8,13	2,51
	10,0	9,18	2,51	9,08	2,53	8,98	2,55	8,93	2,56	8,88	2,57	8,78	2,59
	15,0	10,00	2,60	9,90	2,62	9,80	2,64	9,75	2,65	9,70	2,67	9,60	2,69
3.5+5.0	-15,0	5,31	1,96	5,21	1,98	5,12	2,00	5,07	2,01	5,02	2,02	4,92	2,04
	-10,0	6,13	2,05	6,03	2,07	5,93	2,09	5,88	2,10	5,83	2,12	5,73	2,14
	-5,0	6,94	2,15	6,84	2,17	6,74	2,19	6,69	2,20	6,64	2,21	6,54	2,23
	0,0	7,75	2,24	7,65	2,26	7,55	2,29	**7,50**	**2,30**	7,45	2,31	7,36	2,33
	6,0	8,73	2,36	8,63	2,38	8,53	2,40	8,48	2,41	8,43	2,42	8,33	2,44
	10,0	9,38	2,43	9,28	2,46	9,18	2,48	9,13	2,49	9,08	2,50	8,98	2,52
	15,0	10,19	2,53	10,09	2,55	9,99	2,57	9,94	2,58	9,89	2,59	9,79	2,61

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0,2.5,3.5 kW class
   Wall-mounted FTXM-M series

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C WB]

3D102789A

3MXM52M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
4.2+4.2	-15,0	4,86	2,04	4,75	2,06	4,64	2,08	4,58	2,09	4,53	2,10	4,41	2,12
	-10,0	5,76	2,13	5,65	2,15	5,54	2,17	5,49	2,18	5,43	2,19	5,32	2,21
	-5,0	6,67	2,22	6,56	2,24	6,45	2,26	6,39	2,27	6,34	2,28	6,23	2,29
	0,0	7,57	2,31	7,46	2,32	7,35	2,34	**7,30**	**2,35**	7,24	2,36	7,13	2,38
	6,0	8,66	2,41	8,55	2,43	8,44	2,45	8,38	2,46	8,33	2,47	8,22	2,49
	10,0	9,39	2,48	9,28	2,50	9,16	2,52	9,11	2,53	9,05	2,54	8,94	2,56
	15,0	10,29	2,57	10,18	2,59	10,07	2,61	10,01	2,62	9,96	2,63	9,85	2,65
1.5+1.5+1.5	-15,0	5,55	1,81	5,44	1,83	5,33	1,85	5,28	1,86	5,22	1,87	5,11	1,89
	-10,0	6,46	1,90	6,35	1,92	6,24	1,94	6,19	1,95	6,13	1,96	6,02	1,98
	-5,0	7,37	1,99	7,26	2,01	7,15	2,03	7,09	2,04	7,04	2,05	6,93	2,06
	0,0	8,28	2,08	8,17	2,09	8,06	2,11	**8,00**	**2,12**	7,95	2,13	7,84	2,15
	6,0	9,37	2,18	9,26	2,20	9,15	2,22	9,09	2,23	9,04	2,24	8,93	2,26
	10,0	10,10	2,25	9,99	2,27	9,88	2,29	9,82	2,30	9,77	2,31	9,65	2,33
	15,0	11,01	2,34	10,90	2,36	10,79	2,38	10,73	2,39	10,68	2,40	10,56	2,42
1.5+1.5+2.0	-15,0	5,55	1,79	5,44	1,81	5,33	1,83	5,28	1,84	5,22	1,85	5,11	1,87
	-10,0	6,46	1,88	6,35	1,90	6,24	1,92	6,19	1,93	6,13	1,94	6,02	1,96
	-5,0	7,37	1,97	7,26	1,99	7,15	2,01	7,09	2,02	7,04	2,03	6,93	2,04
	0,0	8,28	2,06	8,17	2,07	8,06	2,09	**8,00**	**2,10**	7,95	2,11	7,84	2,13
	6,0	9,37	2,16	9,26	2,18	9,15	2,20	9,09	2,21	9,04	2,22	8,93	2,24
	10,0	10,10	2,23	9,99	2,25	9,88	2,27	9,82	2,28	9,77	2,29	9,65	2,31
	15,0	11,01	2,32	10,90	2,34	10,79	2,36	10,73	2,37	10,68	2,38	10,56	2,40
1.5+1.5+2.5	-15,0	5,49	1,77	5,37	1,79	5,26	1,81	5,20	1,81	5,14	1,82	5,03	1,84
	-10,0	6,42	1,85	6,31	1,87	6,19	1,89	6,13	1,90	6,08	1,91	5,96	1,93
	-5,0	7,35	1,94	7,24	1,96	7,13	1,98	7,07	1,99	7,01	2,00	6,90	2,02
	0,0	8,29	2,03	8,17	2,05	8,06	2,07	**8,00**	**2,08**	7,95	2,08	7,83	2,10
	6,0	9,41	2,13	9,29	2,15	9,18	2,17	9,12	2,18	9,07	2,19	8,95	2,21
	10,0	10,16	2,20	10,04	2,22	9,93	2,24	9,87	2,25	9,81	2,26	9,70	2,28
	15,0	11,09	2,29	10,98	2,31	10,86	2,33	10,80	2,34	10,75	2,35	10,63	2,36
1.5+1.5+3.5	-15,0	5,64	1,82	5,53	1,84	5,42	1,86	5,36	1,87	5,31	1,88	5,19	1,90
	-10,0	6,55	1,91	6,44	1,93	6,33	1,95	6,27	1,96	6,22	1,97	6,11	1,99
	-5,0	7,47	2,00	7,35	2,02	7,24	2,04	7,19	2,05	7,13	2,06	7,02	2,07
	0,0	8,38	2,09	8,27	2,10	8,16	2,12	**8,10**	**2,13**	8,04	2,14	7,93	2,16
	6,0	9,47	2,19	9,36	2,21	9,25	2,23	9,19	2,24	9,14	2,25	9,03	2,27
	10,0	10,20	2,26	10,09	2,28	9,98	2,30	9,92	2,31	9,87	2,32	9,76	2,34
	15,0	11,12	2,35	11,00	2,37	10,89	2,39	10,84	2,40	10,78	2,41	10,67	2,43
1.5+1.5+4.2	-15,0	5,66	1,80	5,55	1,82	5,44	1,84	5,38	1,85	5,33	1,86	5,21	1,88
	-10,0	6,56	1,89	6,45	1,91	6,34	1,93	6,29	1,94	6,23	1,95	6,12	1,97
	-5,0	7,47	1,98	7,36	2,00	7,25	2,02	7,19	2,03	7,14	2,04	7,03	2,05
	0,0	8,37	2,07	8,26	2,08	8,15	2,10	**8,10**	**2,11**	8,04	2,12	7,93	2,14
	6,0	9,46	2,17	9,35	2,19	9,24	2,21	9,18	2,22	9,13	2,23	9,02	2,25
	10,0	10,19	2,24	10,08	2,26	9,96	2,28	9,91	2,29	9,85	2,30	9,74	2,32
	15,0	11,09	2,33	10,98	2,35	10,87	2,37	10,81	2,38	10,76	2,39	10,65	2,41

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+1.5+5.0	-15,0	5,86	1,78	5,75	1,80	5,64	1,82	5,58	1,83	5,53	1,84	5,41	1,86
	-10,0	6,76	1,87	6,65	1,89	6,54	1,91	6,49	1,92	6,43	1,93	6,32	1,95
	-5,0	7,67	1,96	7,56	1,98	7,45	2,00	7,39	2,01	7,34	2,02	7,23	2,03
	0,0	8,57	2,05	8,46	2,06	8,35	2,08	**8,30**	**2,09**	8,24	2,10	8,13	2,12
	6,0	9,66	2,15	9,55	2,17	9,44	2,19	9,38	2,20	9,33	2,21	9,22	2,23
	10,0	10,39	2,22	10,28	2,24	10,16	2,26	10,11	2,27	10,05	2,28	9,94	2,30
	15,0	11,29	2,31	11,18	2,33	11,07	2,35	11,01	2,36	10,96	2,37	10,85	2,39
1.5+2.0+2.0	-15,0	5,55	1,83	5,44	1,85	5,33	1,87	5,28	1,88	5,22	1,89	5,11	1,91
	-10,0	6,46	1,92	6,35	1,94	6,24	1,96	6,19	1,97	6,13	1,98	6,02	2,00
	-5,0	7,37	2,01	7,26	2,03	7,15	2,05	7,09	2,06	7,04	2,07	6,93	2,08
	0,0	8,28	2,10	8,17	2,11	8,06	2,13	**8,00**	**2,14**	7,95	2,15	7,84	2,17
	6,0	9,37	2,20	9,26	2,22	9,15	2,24	9,09	2,25	9,04	2,26	8,93	2,28
	10,0	10,10	2,27	9,99	2,29	9,88	2,31	9,82	2,32	9,77	2,33	9,65	2,35
	15,0	11,01	2,36	10,90	2,38	10,79	2,40	10,73	2,41	10,68	2,42	10,56	2,44
1.5+2.0+2.5	-15,0	5,55	1,81	5,44	1,83	5,33	1,85	5,28	1,86	5,22	1,87	5,11	1,89
	-10,0	6,46	1,90	6,35	1,92	6,24	1,94	6,19	1,95	6,13	1,96	6,02	1,98
	-5,0	7,37	1,99	7,26	2,01	7,15	2,03	7,09	2,04	7,04	2,05	6,93	2,06
	0,0	8,28	2,08	8,17	2,09	8,06	2,11	**8,00**	**2,12**	7,95	2,13	7,84	2,15
	6,0	9,37	2,18	9,26	2,20	9,15	2,22	9,09	2,23	9,04	2,24	8,93	2,26
	10,0	10,10	2,25	9,99	2,27	9,88	2,29	9,82	2,30	9,77	2,31	9,65	2,33
	15,0	11,01	2,34	10,90	2,36	10,79	2,38	10,73	2,39	10,68	2,40	10,56	2,42
1.5+2.0+3.5	-15,0	5,59	1,85	5,47	1,87	5,36	1,89	5,30	1,89	5,24	1,90	5,13	1,92
	-10,0	6,52	1,93	6,41	1,95	6,29	1,97	6,23	1,98	6,18	1,99	6,06	2,01
	-5,0	7,45	2,02	7,34	2,04	7,23	2,06	7,17	2,07	7,11	2,08	7,00	2,10
	0,0	8,39	2,11	8,27	2,13	8,16	2,15	**8,10**	**2,16**	8,05	2,16	7,93	2,18
	6,0	9,51	2,21	9,39	2,23	9,28	2,25	9,22	2,26	9,17	2,27	9,05	2,29
	10,0	10,26	2,28	10,14	2,30	10,03	2,32	9,97	2,33	9,91	2,34	9,80	2,36
	15,0	11,19	2,37	11,08	2,39	10,96	2,41	10,90	2,42	10,85	2,43	10,73	2,44
1.5+2.0+4.2	-15,0	5,66	1,83	5,55	1,85	5,44	1,87	5,38	1,88	5,33	1,89	5,21	1,91
	-10,0	6,56	1,92	6,45	1,94	6,34	1,96	6,29	1,97	6,23	1,98	6,12	2,00
	-5,0	7,47	2,01	7,36	2,03	7,25	2,05	7,19	2,06	7,14	2,07	7,03	2,08
	0,0	8,37	2,10	8,26	2,11	8,15	2,13	**8,10**	**2,14**	8,04	2,15	7,93	2,17
	6,0	9,46	2,20	9,35	2,22	9,24	2,24	9,18	2,25	9,13	2,26	9,02	2,28
	10,0	10,19	2,27	10,08	2,29	9,96	2,31	9,91	2,32	9,85	2,33	9,74	2,35
	15,0	11,09	2,36	10,98	2,38	10,87	2,40	10,81	2,41	10,76	2,42	10,65	2,44
1.5+2.0+5.0	-15,0	5,85	1,76	5,74	1,78	5,63	1,80	5,58	1,81	5,52	1,82	5,41	1,84
	-10,0	6,76	1,85	6,65	1,87	6,54	1,89	6,49	1,90	6,43	1,91	6,32	1,93
	-5,0	7,67	1,94	7,56	1,96	7,45	1,98	7,39	1,99	7,34	2,00	7,23	2,01
	0,0	8,58	2,03	8,47	2,04	8,36	2,06	**8,30**	**2,07**	8,25	2,08	8,14	2,10
	6,0	9,67	2,13	9,56	2,15	9,45	2,17	9,39	2,18	9,34	2,19	9,23	2,21
	10,0	10,40	2,20	10,29	2,22	10,18	2,24	10,12	2,25	10,07	2,26	9,95	2,28
	15,0	11,31	2,29	11,20	2,31	11,09	2,33	11,03	2,34	10,98	2,35	10,86	2,37

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C WB]

3D102790A

5 Capacity tables

5 - 2 Heating Capacity Tables

5

3MXM52M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1.5+2.5+2.5	-15,0	5,56	1,81	5,45	1,83	5,34	1,85	5,28	1,86	5,23	1,87	5,11	1,89
	-10,0	6,46	1,90	6,35	1,92	6,24	1,94	6,19	1,95	6,13	1,96	6,02	1,98
	-5,0	7,37	1,99	7,26	2,01	7,15	2,03	7,09	2,04	7,04	2,05	6,93	2,06
	0,0	8,27	2,08	8,16	2,09	8,05	2,11	**8,00**	**2,12**	7,94	2,13	7,83	2,15
	6,0	9,36	2,18	9,25	2,20	9,14	2,22	9,08	2,23	9,03	2,24	8,92	2,26
	10,0	10,09	2,25	9,98	2,27	9,86	2,29	9,81	2,30	9,75	2,31	9,64	2,33
	15,0	10,99	2,34	10,88	2,36	10,77	2,38	10,71	2,39	10,66	2,40	10,55	2,42
1.5+2.5+3.5	-15,0	5,65	1,82	5,54	1,84	5,43	1,86	5,38	1,87	5,32	1,88	5,21	1,90
	-10,0	6,56	1,91	6,45	1,93	6,34	1,95	6,29	1,96	6,23	1,97	6,12	1,99
	-5,0	7,47	2,00	7,36	2,02	7,25	2,04	7,19	2,05	7,14	2,06	7,03	2,07
	0,0	8,38	2,09	8,27	2,10	8,16	2,12	**8,10**	**2,13**	8,05	2,14	7,94	2,16
	6,0	9,47	2,19	9,36	2,21	9,25	2,23	9,19	2,24	9,14	2,25	9,03	2,27
	10,0	10,20	2,26	10,09	2,28	9,98	2,30	9,92	2,31	9,87	2,32	9,75	2,34
	15,0	11,11	2,35	11,00	2,37	10,89	2,39	10,83	2,40	10,78	2,41	10,66	2,43
1.5+2.5+4.2	-15,0	5,65	1,80	5,54	1,82	5,43	1,84	5,38	1,85	5,32	1,86	5,21	1,88
	-10,0	6,56	1,89	6,45	1,91	6,34	1,93	6,29	1,94	6,23	1,95	6,12	1,97
	-5,0	7,47	1,98	7,36	2,00	7,25	2,02	7,19	2,03	7,14	2,04	7,03	2,05
	0,0	8,38	2,07	8,27	2,08	8,16	2,10	**8,10**	**2,11**	8,05	2,12	7,94	2,14
	6,0	9,47	2,17	9,36	2,19	9,25	2,21	9,19	2,22	9,14	2,23	9,03	2,25
	10,0	10,20	2,24	10,09	2,26	9,98	2,28	9,92	2,29	9,87	2,30	9,75	2,32
	15,0	11,11	2,33	11,00	2,35	10,89	2,37	10,83	2,38	10,78	2,39	10,66	2,41
1.5+2.5+5.0	-15,0	5,79	1,78	5,67	1,80	5,56	1,82	5,50	1,82	5,44	1,83	5,33	1,85
	-10,0	6,72	1,86	6,61	1,88	6,49	1,90	6,43	1,91	6,38	1,92	6,26	1,94
	-5,0	7,65	1,95	7,54	1,97	7,43	1,99	7,37	2,00	7,31	2,01	7,20	2,03
	0,0	8,59	2,04	8,47	2,06	8,36	2,08	**8,30**	**2,09**	8,25	2,09	8,13	2,11
	6,0	9,71	2,14	9,59	2,16	9,48	2,18	9,42	2,19	9,37	2,20	9,25	2,22
	10,0	10,46	2,21	10,34	2,23	10,23	2,25	10,17	2,26	10,11	2,27	10,00	2,29
	15,0	11,39	2,30	11,28	2,32	11,16	2,34	11,10	2,35	11,05	2,36	10,93	2,37
1.5+3.5+3.5	-15,0	5,74	1,83	5,63	1,85	5,52	1,87	5,46	1,88	5,41	1,89	5,29	1,91
	-10,0	6,65	1,92	6,54	1,94	6,43	1,96	6,37	1,97	6,32	1,98	6,21	2,00
	-5,0	7,57	2,01	7,45	2,03	7,34	2,05	7,29	2,06	7,23	2,07	7,12	2,08
	0,0	8,48	2,10	8,37	2,11	8,26	2,13	**8,20**	**2,14**	8,14	2,15	8,03	2,17
	6,0	9,57	2,20	9,46	2,22	9,35	2,24	9,29	2,25	9,24	2,26	9,13	2,28
	10,0	10,30	2,27	10,19	2,29	10,08	2,31	10,02	2,32	9,97	2,33	9,86	2,35
	15,0	11,22	2,36	11,10	2,38	10,99	2,40	10,94	2,41	10,88	2,42	10,77	2,44
2.0+2.0+2.0	-15,0	5,56	1,82	5,45	1,84	5,34	1,86	5,28	1,87	5,23	1,88	5,11	1,90
	-10,0	6,46	1,91	6,35	1,93	6,24	1,95	6,19	1,96	6,13	1,97	6,02	1,99
	-5,0	7,37	2,00	7,26	2,02	7,15	2,04	7,09	2,05	7,04	2,06	6,93	2,07
	0,0	8,27	2,09	8,16	2,10	8,05	2,12	**8,00**	**2,13**	7,94	2,14	7,83	2,16
	6,0	9,36	2,19	9,25	2,21	9,14	2,23	9,08	2,24	9,03	2,25	8,92	2,27
	10,0	10,09	2,26	9,98	2,28	9,86	2,30	9,81	2,31	9,75	2,32	9,64	2,34
	15,0	10,99	2,35	10,88	2,37	10,77	2,39	10,71	2,40	10,66	2,41	10,55	2,43

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.0+2.0+2.5	-15,0	5,56	1,80	5,45	1,82	5,34	1,84	5,28	1,85	5,23	1,86	5,11	1,88
	-10,0	6,46	1,89	6,35	1,91	6,24	1,93	6,19	1,94	6,13	1,95	6,02	1,97
	-5,0	7,37	1,98	7,26	2,00	7,15	2,02	7,09	2,03	7,04	2,04	6,93	2,05
	0,0	8,27	2,07	8,16	2,08	8,05	2,10	**8,00**	**2,11**	7,94	2,12	7,83	2,14
	6,0	9,36	2,17	9,25	2,19	9,14	2,21	9,08	2,22	9,03	2,23	8,92	2,25
	10,0	10,09	2,24	9,98	2,26	9,86	2,28	9,81	2,29	9,75	2,30	9,64	2,32
	15,0	10,99	2,33	10,88	2,35	10,77	2,37	10,71	2,38	10,66	2,39	10,55	2,41
2.0+2.0+3.5	-15,0	5,65	1,81	5,54	1,83	5,43	1,85	5,38	1,86	5,32	1,87	5,21	1,89
	-10,0	6,56	1,90	6,45	1,92	6,34	1,94	6,29	1,95	6,23	1,96	6,12	1,98
	-5,0	7,47	1,99	7,36	2,01	7,25	2,03	7,19	2,04	7,14	2,05	7,03	2,06
	0,0	8,38	2,08	8,27	2,09	8,16	2,11	**8,10**	**2,12**	8,05	2,13	7,94	2,15
	6,0	9,47	2,18	9,36	2,20	9,25	2,22	9,19	2,23	9,14	2,24	9,03	2,26
	10,0	10,20	2,25	10,09	2,27	9,98	2,29	9,92	2,30	9,87	2,31	9,75	2,33
	15,0	11,11	2,34	11,00	2,36	10,89	2,38	10,83	2,39	10,78	2,40	10,66	2,42
2.0+2.0+4.2	-15,0	5,65	1,79	5,54	1,81	5,43	1,83	5,38	1,84	5,32	1,85	5,21	1,87
	-10,0	6,56	1,88	6,45	1,90	6,34	1,92	6,29	1,93	6,23	1,94	6,12	1,96
	-5,0	7,47	1,97	7,36	1,99	7,25	2,01	7,19	2,02	7,14	2,03	7,03	2,04
	0,0	8,38	2,06	8,27	2,07	8,16	2,09	**8,10**	**2,10**	8,05	2,11	7,94	2,13
	6,0	9,47	2,16	9,36	2,18	9,25	2,20	9,19	2,21	9,14	2,22	9,03	2,24
	10,0	10,20	2,23	10,09	2,25	9,98	2,27	9,92	2,28	9,87	2,29	9,75	2,31
	15,0	11,11	2,32	11,00	2,34	10,89	2,36	10,83	2,37	10,78	2,38	10,66	2,40
2.0+2.0+5.0	-15,0	5,79	1,77	5,67	1,79	5,56	1,81	5,50	1,81	5,44	1,82	5,33	1,84
	-10,0	6,72	1,85	6,61	1,87	6,49	1,89	6,43	1,90	6,38	1,91	6,26	1,93
	-5,0	7,65	1,94	7,54	1,96	7,43	1,98	7,37	1,99	7,31	2,00	7,20	2,02
	0,0	8,59	2,03	8,47	2,05	8,36	2,07	**8,30**	**2,08**	8,25	2,08	8,13	2,10
	6,0	9,71	2,13	9,59	2,15	9,48	2,17	9,42	2,18	9,37	2,19	9,25	2,21
	10,0	10,46	2,20	10,34	2,22	10,23	2,24	10,17	2,25	10,11	2,26	10,00	2,28
	15,0	11,39	2,29	11,28	2,31	11,16	2,33	11,10	2,34	11,05	2,35	10,93	2,36
2.0+2.5+2.5	-15,0	5,56	1,78	5,45	1,80	5,34	1,82	5,28	1,83	5,23	1,84	5,11	1,86
	-10,0	6,46	1,87	6,35	1,89	6,24	1,91	6,19	1,92	6,13	1,93	6,02	1,95
	-5,0	7,37	1,96	7,26	1,98	7,15	2,00	7,09	2,01	7,04	2,02	6,93	2,03
	0,0	8,27	2,05	8,16	2,06	8,05	2,08	**8,00**	**2,09**	7,94	2,10	7,83	2,12
	6,0	9,36	2,15	9,25	2,17	9,14	2,19	9,08	2,20	9,03	2,21	8,92	2,23
	10,0	10,09	2,22	9,98	2,24	9,86	2,26	9,81	2,27	9,75	2,28	9,64	2,30
	15,0	10,99	2,31	10,88	2,33	10,77	2,35	10,71	2,36	10,66	2,37	10,55	2,39
2.0+2.5+3.5	-15,0	5,65	1,80	5,54	1,82	5,43	1,84	5,38	1,85	5,32	1,86	5,21	1,88
	-10,0	6,56	1,89	6,45	1,91	6,34	1,93	6,29	1,94	6,23	1,95	6,12	1,97
	-5,0	7,47	1,98	7,36	2,00	7,25	2,02	7,19	2,03	7,14	2,04	7,03	2,05
	0,0	8,38	2,07	8,27	2,08	8,16	2,10	**8,10**	**2,11**	8,05	2,12	7,94	2,14
	6,0	9,47	2,17	9,36	2,19	9,25	2,21	9,19	2,22	9,14	2,23	9,03	2,25
	10,0	10,20	2,24	10,09	2,26	9,98	2,28	9,92	2,29	9,87	2,30	9,75	2,32
	15,0	11,11	2,33	11,00	2,35	10,89	2,37	10,83	2,38	10,78	2,39	10,66	2,41

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5 kW class
   Wall-mounted CTXM-M,FTXM-M series

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C WB]

3D102791A

5 Capacity tables
5 - 2 Heating Capacity Tables

3MXM68M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
1,5	-15,0	3,07	1,07	3,02	1,08	2,98	1,09	2,95	1,09	2,93	1,10	2,88	1,11
	-10,0	3,45	1,11	3,40	1,12	3,35	1,13	3,33	1,13	3,31	1,14	3,26	1,15
	-5,0	3,82	1,15	3,78	1,16	3,73	1,17	3,71	1,17	3,68	1,18	3,64	1,19
	0,0	4,20	1,19	4,15	1,20	4,11	1,21	**4,08**	**1,22**	4,06	1,22	4,02	1,23
	6,0	4,65	1,24	4,61	1,25	4,56	1,26	4,54	1,26	4,51	1,27	4,47	1,28
	10,0	4,95	1,27	4,91	1,28	4,86	1,29	4,84	1,30	4,82	1,30	4,77	1,31
	15,0	5,33	1,32	5,28	1,32	5,24	1,33	5,22	1,34	5,19	1,34	5,15	1,35
2,0	-15,0	3,08	1,08	3,03	1,09	2,99	1,10	2,96	1,10	2,94	1,11	2,89	1,12
	-10,0	3,46	1,12	3,41	1,13	3,36	1,14	3,34	1,14	3,32	1,15	3,27	1,16
	-5,0	3,83	1,16	3,79	1,17	3,74	1,18	3,72	1,18	3,69	1,19	3,65	1,20
	0,0	4,21	1,20	4,16	1,21	4,12	1,22	**4,09**	**1,23**	4,07	1,23	4,03	1,24
	6,0	4,66	1,25	4,62	1,26	4,57	1,27	4,55	1,27	4,52	1,28	4,48	1,29
	10,0	4,96	1,28	4,92	1,29	4,87	1,30	4,85	1,31	4,83	1,31	4,78	1,32
	15,0	5,34	1,33	5,29	1,33	5,25	1,34	5,23	1,35	5,20	1,35	5,16	1,36
2,5	-15,0	3,29	1,18	3,24	1,19	3,20	1,20	3,17	1,20	3,15	1,21	3,10	1,22
	-10,0	3,67	1,22	3,62	1,23	3,57	1,24	3,55	1,24	3,53	1,25	3,48	1,26
	-5,0	4,04	1,26	4,00	1,27	3,95	1,28	3,93	1,28	3,90	1,29	3,86	1,30
	0,0	4,42	1,30	4,37	1,31	4,33	1,32	**4,30**	**1,33**	4,28	1,33	4,24	1,34
	6,0	4,87	1,35	4,83	1,36	4,78	1,37	4,76	1,37	4,73	1,38	4,69	1,39
	10,0	5,17	1,38	5,13	1,39	5,08	1,40	5,06	1,41	5,04	1,41	4,99	1,42
	15,0	5,55	1,43	5,50	1,43	5,46	1,44	5,44	1,45	5,41	1,45	5,37	1,46
3,5	-15,0	3,32	1,32	3,26	1,34	3,20	1,35	3,17	1,36	3,13	1,37	3,07	1,38
	-10,0	3,83	1,39	3,77	1,40	3,71	1,42	3,68	1,43	3,64	1,43	3,58	1,45
	-5,0	4,34	1,46	4,28	1,47	4,22	1,48	4,19	1,49	4,15	1,50	4,09	1,51
	0,0	4,85	1,52	4,79	1,54	4,73	1,55	**4,70**	**1,56**	4,67	1,56	4,60	1,58
	6,0	5,46	1,60	5,40	1,62	5,34	1,63	5,31	1,64	5,28	1,64	5,22	1,66
	10,0	5,87	1,65	5,81	1,67	5,75	1,68	5,72	1,69	5,69	1,70	5,62	1,71
	15,0	6,38	1,72	6,32	1,73	6,26	1,75	6,22	1,76	6,07	1,77	5,77	1,79
4,2	-15,0	3,31	1,32	3,25	1,34	3,19	1,35	3,16	1,36	3,12	1,37	3,06	1,38
	-10,0	3,82	1,39	3,76	1,40	3,70	1,42	3,67	1,43	3,63	1,43	3,57	1,45
	-5,0	4,33	1,46	4,27	1,47	4,21	1,48	4,18	1,49	4,14	1,50	4,08	1,51
	0,0	4,84	1,52	4,78	1,54	4,72	1,55	**4,69**	**1,56**	4,66	1,56	4,59	1,58
	6,0	5,45	1,60	5,39	1,62	5,33	1,63	5,30	1,64	5,27	1,64	5,21	1,66
	10,0	5,86	1,65	5,80	1,67	5,74	1,68	5,71	1,69	5,68	1,70	5,61	1,71
	15,0	6,37	1,72	6,31	1,73	6,25	1,75	6,21	1,76	6,06	1,77	5,76	1,79
5,0	-15,0	4,19	1,57	4,11	1,59	4,03	1,61	3,99	1,62	3,95	1,63	3,87	1,65
	-10,0	4,84	1,66	4,76	1,68	4,68	1,70	4,64	1,71	4,60	1,72	4,52	1,74
	-5,0	5,49	1,75	5,41	1,77	5,33	1,80	5,29	1,81	5,25	1,82	5,17	1,84
	0,0	6,14	1,85	6,06	1,87	5,98	1,89	**5,94**	**1,90**	5,90	1,91	5,82	1,93
	6,0	6,92	1,96	6,84	1,98	6,76	2,00	6,72	2,01	6,68	2,02	6,60	2,04
	10,0	7,44	2,03	7,36	2,05	7,28	2,07	7,24	2,08	7,17	2,07	6,82	1,90
	15,0	8,09	2,13	7,88	2,06	7,53	1,91	7,35	1,83	7,19	1,76	6,84	1,61

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
6,0	-15,0	7,16	2,31	7,08	2,33	7,00	2,35	6,96	2,36	6,92	2,37	6,84	2,39
	-10,0	7,81	2,40	7,73	2,42	7,65	2,44	7,61	2,45	7,57	2,46	7,49	2,48
	-5,0	8,46	2,49	8,38	2,51	8,30	2,54	8,26	2,55	8,22	2,56	8,14	2,58
	0,0	9,11	2,59	9,03	2,61	8,95	2,63	**8,91**	**2,64**	8,87	2,65	8,79	2,67
	6,0	9,89	2,70	9,81	2,72	9,73	2,74	9,69	2,75	9,65	2,76	9,57	2,78
	10,0	10,41	2,77	10,33	2,79	10,25	2,81	10,21	2,82	10,14	2,81	9,79	2,64
	15,0	11,06	2,87	10,85	2,80	10,50	2,65	10,32	2,57	10,16	2,50	9,81	2,35
1.5+1.5	-15,0	5,06	1,50	4,95	1,52	4,85	1,54	4,79	1,55	4,74	1,56	4,64	1,58
	-10,0	5,92	1,59	5,81	1,61	5,71	1,63	5,66	1,64	5,60	1,65	5,50	1,67
	-5,0	6,78	1,69	6,68	1,71	6,57	1,73	6,52	1,74	6,47	1,75	6,36	1,77
	0,0	7,65	1,78	7,54	1,80	7,43	1,82	**7,38**	**1,83**	7,33	1,84	7,22	1,86
	6,0	8,68	1,89	8,58	1,91	8,47	1,93	8,42	1,94	8,36	1,95	8,26	1,97
	10,0	9,37	1,96	9,27	1,98	9,16	2,00	9,11	2,01	9,05	2,02	8,95	2,04
	15,0	10,23	2,06	10,13	2,08	10,02	2,10	9,97	2,11	9,92	2,12	9,81	2,14
1.5+2.0	-15,0	5,44	1,66	5,33	1,68	5,23	1,70	5,17	1,71	5,12	1,72	5,02	1,74
	-10,0	6,30	1,75	6,19	1,77	6,09	1,79	6,04	1,80	5,98	1,81	5,88	1,83
	-5,0	7,16	1,85	7,06	1,87	6,95	1,89	6,90	1,90	6,85	1,91	6,74	1,93
	0,0	8,03	1,94	7,92	1,96	7,81	1,98	**7,76**	**1,99**	7,71	2,00	7,60	2,02
	6,0	9,06	2,05	8,96	2,07	8,85	2,09	8,80	2,10	8,74	2,11	8,64	2,13
	10,0	9,75	2,12	9,65	2,14	9,54	2,16	9,49	2,17	9,43	2,18	9,33	2,20
	15,0	10,61	2,22	10,51	2,24	10,40	2,26	10,35	2,27	10,30	2,28	10,19	2,30
1.5+2.5	-15,0	5,63	1,73	5,52	1,75	5,42	1,77	5,36	1,78	5,31	1,79	5,21	1,81
	-10,0	6,49	1,82	6,38	1,84	6,28	1,86	6,23	1,87	6,17	1,88	6,07	1,90
	-5,0	7,35	1,92	7,25	1,94	7,14	1,96	7,09	1,97	7,04	1,98	6,93	2,00
	0,0	8,22	2,01	8,11	2,03	8,00	2,05	**7,95**	**2,06**	7,90	2,07	7,79	2,09
	6,0	9,25	2,12	9,15	2,14	9,04	2,16	8,99	2,17	8,93	2,18	8,83	2,20
	10,0	9,94	2,19	9,84	2,21	9,73	2,23	9,68	2,24	9,62	2,25	9,52	2,27
	15,0	10,80	2,29	10,70	2,31	10,59	2,33	10,54	2,34	10,49	2,35	10,38	2,37
1.5+3.5	-15,0	5,97	1,97	5,85	1,99	5,73	2,01	5,68	2,03	5,62	2,04	5,50	2,06
	-10,0	6,91	2,07	6,79	2,10	6,68	2,12	6,62	2,13	6,56	2,15	6,45	2,17
	-5,0	7,85	2,18	7,73	2,21	7,62	2,23	7,56	2,24	7,50	2,25	7,39	2,28
	0,0	8,79	2,29	8,68	2,32	8,56	2,34	**8,50**	**2,35**	8,44	2,36	8,33	2,39
	6,0	9,92	2,42	9,81	2,45	9,69	2,47	9,63	2,48	9,57	2,49	9,46	2,52
	10,0	10,67	2,51	10,56	2,53	10,44	2,56	10,39	2,57	10,33	2,58	10,21	2,60
	15,0	11,62	2,62	11,50	2,64	11,39	2,67	11,33	2,68	11,27	2,69	11,10	2,70
1.5+4.2	-15,0	6,32	2,19	6,20	2,21	6,08	2,23	6,03	2,25	5,97	2,26	5,85	2,28
	-10,0	7,26	2,29	7,14	2,32	7,03	2,34	6,97	2,35	6,91	2,37	6,80	2,39
	-5,0	8,20	2,40	8,08	2,43	7,97	2,45	7,91	2,46	7,85	2,47	7,74	2,50
	0,0	9,14	2,51	9,03	2,54	8,91	2,56	**8,85**	**2,57**	8,79	2,58	8,68	2,61
	6,0	10,27	2,64	10,16	2,67	10,04	2,69	9,98	2,70	9,92	2,71	9,81	2,74
	10,0	11,02	2,73	10,91	2,75	10,79	2,78	10,74	2,79	10,68	2,80	10,56	2,82
	15,0	11,97	2,84	11,85	2,86	11,74	2,89	11,68	2,90	11,62	2,91	11,45	2,92

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C WB]

3D103884

5 Capacity tables
5 - 2 Heating Capacity Tables

3MXM68M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	-15,0	7,30	2,44	7,16	2,47	7,02	2,50	6,95	2,51	6,88	2,53	6,74	2,55
	-10,0	8,44	2,57	8,30	2,60	8,16	2,63	8,09	2,65	8,02	2,66	7,88	2,69
	-5,0	9,59	2,71	9,45	2,74	9,31	2,76	9,24	2,78	9,17	2,79	9,03	2,82
1.5+5.0	0,0	10,73	2,84	10,59	2,87	10,45	2,90	10,38	2,91	10,31	2,93	10,17	2,96
	6,0	12,11	3,00	11,97	3,03	11,83	3,06	11,76	3,07	11,69	3,09	11,55	3,12
	10,0	13,03	3,11	12,89	3,14	12,75	3,17	12,68	3,18	12,61	3,20	12,30	3,11
	15,0	14,17	3,24	14,03	3,27	13,59	3,10	13,27	2,96	12,94	2,82	12,32	2,55
	-15,0	7,50	2,20	7,36	2,23	7,22	2,26	7,15	2,27	7,08	2,29	6,94	2,31
	-10,0	8,64	2,33	8,50	2,36	8,36	2,39	8,29	2,41	8,22	2,42	8,08	2,45
	-5,0	9,79	2,47	9,65	2,50	9,51	2,52	9,44	2,54	9,37	2,55	9,23	2,58
1.5+6.0	0,0	10,93	2,60	10,79	2,63	10,65	2,66	10,58	2,67	10,51	2,69	10,37	2,72
	6,0	12,31	2,76	12,17	2,79	12,03	2,82	11,96	2,83	11,89	2,85	11,75	2,88
	10,0	13,23	2,87	13,09	2,90	12,95	2,93	12,88	2,94	12,81	2,96	12,50	2,87
	15,0	14,37	3,00	14,23	3,03	13,79	2,86	13,47	2,72	13,14	2,58	12,52	2,31
	-15,0	5,63	1,74	5,52	1,76	5,42	1,78	5,36	1,79	5,31	1,80	5,21	1,82
	-10,0	6,49	1,83	6,38	1,85	6,28	1,87	6,23	1,88	6,17	1,89	6,07	1,91
	-5,0	7,35	1,93	7,25	1,95	7,14	1,97	7,09	1,98	7,04	1,99	6,93	2,01
2.0+2.0	0,0	8,22	2,02	8,11	2,04	8,00	2,06	7,95	2,07	7,90	2,08	7,79	2,10
	6,0	9,25	2,13	9,15	2,15	9,04	2,17	8,99	2,18	8,93	2,19	8,83	2,21
	10,0	9,94	2,20	9,84	2,22	9,73	2,24	9,68	2,25	9,62	2,26	9,52	2,28
	15,0	10,80	2,30	10,70	2,32	10,59	2,34	10,54	2,35	10,49	2,36	10,38	2,38
	-15,0	5,80	1,81	5,69	1,83	5,59	1,85	5,53	1,86	5,48	1,87	5,38	1,89
	-10,0	6,66	1,90	6,55	1,92	6,45	1,94	6,40	1,95	6,34	1,96	6,24	1,98
	-5,0	7,52	2,00	7,42	2,02	7,31	2,04	7,26	2,05	7,21	2,06	7,10	2,08
2.0+2.5	0,0	8,39	2,09	8,28	2,11	8,17	2,13	8,12	2,14	8,07	2,15	7,96	2,17
	6,0	9,42	2,20	9,32	2,22	9,21	2,24	9,16	2,25	9,10	2,26	9,00	2,28
	10,0	10,11	2,27	10,01	2,29	9,90	2,31	9,85	2,32	9,79	2,33	9,69	2,35
	15,0	10,97	2,37	10,87	2,39	10,76	2,41	10,71	2,42	10,66	2,43	10,55	2,45
	-15,0	6,14	2,05	6,02	2,07	5,90	2,09	5,85	2,11	5,79	2,12	5,67	2,14
	-10,0	7,08	2,15	6,96	2,18	6,85	2,20	6,79	2,21	6,73	2,23	6,62	2,25
	-5,0	8,02	2,26	7,90	2,29	7,79	2,31	7,73	2,32	7,67	2,33	7,56	2,36
2.0+3.5	0,0	8,96	2,37	8,85	2,40	8,73	2,42	8,67	2,43	8,61	2,44	8,50	2,47
	6,0	10,09	2,50	9,98	2,53	9,86	2,55	9,80	2,56	9,74	2,57	9,63	2,60
	10,0	10,84	2,59	10,73	2,61	10,61	2,64	10,56	2,65	10,50	2,66	10,38	2,68
	15,0	11,79	2,70	11,67	2,72	11,56	2,75	11,50	2,76	11,44	2,77	11,27	2,78
	-15,0	6,50	2,28	6,38	2,30	6,26	2,32	6,21	2,34	6,15	2,35	6,03	2,37
	-10,0	7,44	2,38	7,32	2,41	7,21	2,43	7,15	2,44	7,09	2,46	6,98	2,48
	-5,0	8,38	2,49	8,26	2,52	8,15	2,54	8,09	2,55	8,03	2,56	7,92	2,59
2.0+4.2	0,0	9,32	2,60	9,21	2,63	9,09	2,65	9,03	2,66	8,97	2,67	8,86	2,70
	6,0	10,45	2,73	10,34	2,76	10,22	2,78	10,16	2,79	10,10	2,80	9,99	2,83
	10,0	11,20	2,82	11,09	2,84	10,97	2,87	10,92	2,88	10,86	2,89	10,74	2,91
	15,0	12,15	2,93	12,03	2,95	11,92	2,98	11,86	2,99	11,80	3,00	11,63	3,01

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	-15,0	7,48	2,53	7,34	2,56	7,20	2,59	7,13	2,60	7,06	2,62	6,92	2,64
	-10,0	8,62	2,66	8,48	2,69	8,34	2,72	8,27	2,74	8,20	2,75	8,06	2,78
	-5,0	9,77	2,80	9,63	2,83	9,49	2,85	9,42	2,87	9,35	2,88	9,21	2,91
2.0+5.0	0,0	10,91	2,93	10,77	2,96	10,63	2,99	10,56	3,00	10,49	3,02	10,35	3,05
	6,0	12,29	3,09	12,15	3,12	12,01	3,15	11,94	3,16	11,87	3,18	11,73	3,21
	10,0	13,21	3,20	13,07	3,23	12,93	3,26	12,86	3,27	12,79	3,29	12,48	3,20
	15,0	14,35	3,33	14,21	3,36	13,77	3,19	13,45	3,05	13,12	2,91	12,50	2,64
	-15,0	7,67	2,27	7,53	2,30	7,39	2,33	7,32	2,34	7,25	2,36	7,11	2,38
	-10,0	8,81	2,40	8,67	2,43	8,53	2,46	8,46	2,48	8,39	2,49	8,25	2,52
	-5,0	9,96	2,54	9,82	2,57	9,68	2,59	9,61	2,61	9,54	2,62	9,40	2,65
2.0+6.0	0,0	11,10	2,67	10,96	2,70	10,82	2,73	10,75	2,74	10,68	2,76	10,54	2,79
	6,0	12,48	2,83	12,34	2,86	12,20	2,89	12,13	2,90	12,06	2,92	11,92	2,95
	10,0	13,40	2,94	13,26	2,97	13,12	3,00	13,05	3,01	12,98	3,03	12,67	2,94
	15,0	14,54	3,07	14,40	3,10	13,96	2,93	13,64	2,79	13,31	2,65	12,69	2,38
	-15,0	6,17	2,03	6,06	2,05	5,96	2,07	5,90	2,08	5,85	2,09	5,75	2,11
	-10,0	7,03	2,12	6,92	2,14	6,82	2,16	6,77	2,17	6,71	2,18	6,61	2,20
	-5,0	7,89	2,22	7,79	2,24	7,68	2,26	7,63	2,27	7,58	2,28	7,47	2,30
2.5+2.5	0,0	8,76	2,31	8,65	2,33	8,54	2,35	8,49	2,36	8,44	2,37	8,33	2,39
	6,0	9,79	2,42	9,69	2,44	9,58	2,46	9,53	2,47	9,47	2,48	9,37	2,50
	10,0	10,48	2,49	10,38	2,51	10,27	2,53	10,22	2,54	10,16	2,55	10,06	2,57
	15,0	11,34	2,59	11,24	2,61	11,13	2,63	11,08	2,64	11,03	2,65	10,92	2,67
	-15,0	6,50	2,28	6,38	2,30	6,26	2,32	6,21	2,34	6,15	2,35	6,03	2,37
	-10,0	7,44	2,38	7,32	2,41	7,21	2,43	7,15	2,44	7,09	2,46	6,98	2,48
	-5,0	8,38	2,49	8,26	2,52	8,15	2,54	8,09	2,55	8,03	2,56	7,92	2,59
2.5+3.5	0,0	9,32	2,60	9,21	2,63	9,09	2,65	9,03	2,66	8,97	2,67	8,86	2,70
	6,0	10,45	2,73	10,34	2,76	10,22	2,78	10,16	2,79	10,10	2,80	9,99	2,83
	10,0	11,20	2,82	11,09	2,84	10,97	2,87	10,92	2,88	10,86	2,89	10,74	2,91
	15,0	12,15	2,93	12,03	2,95	11,92	2,98	11,86	2,99	11,80	3,00	11,63	3,01
	-15,0	6,76	2,44	6,64	2,46	6,52	2,48	6,47	2,50	6,41	2,51	6,29	2,53
	-10,0	7,70	2,54	7,58	2,57	7,47	2,59	7,41	2,60	7,35	2,62	7,24	2,64
	-5,0	8,64	2,65	8,52	2,68	8,41	2,70	8,35	2,71	8,29	2,72	8,18	2,75
2.5+4.2	0,0	9,58	2,76	9,47	2,79	9,35	2,81	9,29	2,82	9,23	2,83	9,12	2,86
	6,0	10,71	2,89	10,60	2,92	10,48	2,94	10,42	2,95	10,36	2,96	10,25	2,99
	10,0	11,46	2,98	11,35	3,00	11,23	3,03	11,18	3,04	11,12	3,05	11,00	3,07
	15,0	12,41	3,09	12,29	3,11	12,18	3,14	12,12	3,15	12,06	3,16	11,89	3,17
	-15,0	7,60	2,62	7,46	2,65	7,32	2,68	7,25	2,69	7,18	2,71	7,04	2,73
	-10,0	8,74	2,75	8,60	2,78	8,46	2,81	8,39	2,83	8,32	2,84	8,18	2,87
	-5,0	9,89	2,89	9,75	2,92	9,61	2,94	9,54	2,96	9,47	2,97	9,33	3,00
2.5+5.0	0,0	11,03	3,02	10,89	3,05	10,75	3,08	10,68	3,09	10,61	3,11	10,47	3,14
	6,0	12,41	3,18	12,27	3,21	12,13	3,24	12,06	3,25	11,99	3,27	11,85	3,30
	10,0	13,33	3,29	13,19	3,32	13,05	3,35	12,98	3,36	12,91	3,38	12,60	3,29
	15,0	14,47	3,42	14,33	3,45	13,89	3,28	13,57	3,14	13,24	3,00	12,62	2,73

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols
- TC: Total capacity [kW]
- PI: Power input [kW]
- ① Indoor unit combinations
- ② Outdoor air temperature [°C WB]

3D103885

5 Capacity tables

5 - 2 Heating Capacity Tables

3MXM68M

Heating 50Hz 230V

①	②	16°C TC kW	16°C PI kW	18°C TC kW	18°C PI kW	20°C TC kW	20°C PI kW	21°C TC kW	21°C PI kW	22°C TC kW	22°C PI kW	24°C TC kW	24°C PI kW
		Indoor air temperature [°C DB]											
	-15,0	7,80	2,30	7,66	2,33	7,52	2,36	7,45	2,37	7,38	2,39	7,24	2,41
	-10,0	8,94	2,43	8,80	2,46	8,66	2,49	8,59	2,51	8,52	2,52	8,38	2,55
	-5,0	10,09	2,57	9,95	2,60	9,81	2,62	9,74	2,64	9,67	2,65	9,53	2,68
2.5+6.0	0,0	11,23	2,70	11,09	2,73	10,95	2,76	**10,88**	**2,77**	10,81	2,79	10,67	2,82
	6,0	12,61	2,86	12,47	2,89	12,33	2,92	12,26	2,93	12,19	2,95	12,05	2,98
	10,0	13,53	2,97	13,39	3,00	13,25	3,03	13,18	3,04	13,11	3,06	12,80	2,97
	15,0	14,67	3,10	14,53	3,13	14,09	2,96	13,77	2,82	13,44	2,68	12,82	2,41
	-15,0	6,63	2,41	6,51	2,43	6,38	2,46	6,32	2,48	6,26	2,49	6,13	2,52
	-10,0	7,65	2,53	7,53	2,56	7,40	2,59	7,34	2,60	7,28	2,62	7,15	2,65
	-5,0	8,67	2,66	8,54	2,69	8,42	2,72	8,36	2,73	8,29	2,75	8,17	2,77
3.5+3.5	0,0	9,69	2,79	9,56	2,82	9,44	2,85	**9,38**	**2,86**	9,31	2,87	9,19	2,90
	6,0	10,91	2,94	10,78	2,97	10,66	3,00	10,60	3,01	10,54	3,03	10,41	3,06
	10,0	11,72	3,05	11,60	3,07	11,47	3,10	11,41	3,12	11,35	3,13	11,23	3,16
	15,0	12,74	3,17	12,62	3,20	12,49	3,23	12,43	3,24	12,15	3,10	11,54	2,81
	-15,0	6,72	2,46	6,60	2,48	6,47	2,51	6,41	2,53	6,35	2,54	6,22	2,57
	-10,0	7,74	2,58	7,62	2,61	7,49	2,64	7,43	2,65	7,37	2,67	7,24	2,70
	-5,0	8,76	2,71	8,63	2,74	8,51	2,77	8,45	2,78	8,38	2,80	8,26	2,82
3.5+4.2	0,0	9,78	2,84	9,65	2,87	9,53	2,90	**9,47**	**2,91**	9,40	2,92	9,28	2,95
	6,0	11,00	2,99	10,87	3,02	10,75	3,05	10,69	3,06	10,63	3,08	10,50	3,11
	10,0	11,81	3,10	11,69	3,12	11,56	3,15	11,50	3,17	11,44	3,18	11,32	3,21
	15,0	12,83	3,22	12,71	3,25	12,58	3,28	12,52	3,29	12,24	3,15	11,63	2,86
	-15,0	7,71	2,63	7,56	2,66	7,42	2,69	7,35	2,71	7,28	2,72	7,13	2,75
	-10,0	8,89	2,77	8,75	2,80	8,60	2,83	8,53	2,85	8,46	2,86	8,31	2,89
	-5,0	10,08	2,91	9,93	2,94	9,79	2,97	9,71	2,99	9,64	3,00	9,50	3,03
3.5+5.0	0,0	11,26	3,05	11,11	3,08	10,97	3,11	**10,90**	**3,13**	10,83	3,14	10,68	3,17
	6,0	12,68	3,22	12,53	3,25	12,39	3,28	12,32	3,30	12,25	3,31	12,10	3,34
	10,0	13,63	3,33	13,48	3,36	13,34	3,39	13,26	3,41	13,19	3,42	12,68	3,19
	15,0	14,81	3,47	14,64	3,49	13,99	3,18	13,66	3,04	13,34	2,90	12,71	2,63
	-15,0	7,82	2,26	7,67	2,29	7,53	2,32	7,46	2,34	7,39	2,35	7,24	2,38
	-10,0	9,00	2,40	8,86	2,43	8,71	2,46	8,64	2,48	8,57	2,49	8,42	2,52
	-5,0	10,19	2,54	10,04	2,57	9,90	2,60	9,82	2,62	9,75	2,63	9,61	2,66
3.5+6.0	0,0	11,37	2,68	11,22	2,71	11,08	2,74	**11,01**	**2,76**	10,94	2,77	10,79	2,80
	6,0	12,79	2,85	12,64	2,88	12,50	2,91	12,43	2,93	12,36	2,94	12,21	2,97
	10,0	13,74	2,96	13,59	2,99	13,45	3,02	13,37	3,04	13,30	3,05	12,79	2,82
	15,0	14,92	3,10	14,75	3,12	14,10	2,81	13,77	2,67	13,45	2,53	12,82	2,26
	-15,0	6,81	2,49	6,69	2,51	6,56	2,54	6,50	2,56	6,44	2,57	6,31	2,60
	-10,0	7,83	2,61	7,71	2,64	7,58	2,67	7,52	2,68	7,46	2,70	7,33	2,73
	-5,0	8,85	2,74	8,72	2,77	8,60	2,80	8,54	2,81	8,47	2,83	8,35	2,85
4.2+4.2	0,0	9,87	2,87	9,74	2,90	9,62	2,93	**9,56**	**2,94**	9,49	2,95	9,37	2,98
	6,0	11,09	3,02	10,96	3,05	10,84	3,08	10,78	3,09	10,72	3,11	10,59	3,14
	10,0	11,90	3,13	11,78	3,15	11,65	3,18	11,59	3,20	11,53	3,21	11,41	3,24
	15,0	12,92	3,25	12,80	3,28	12,67	3,31	12,61	3,32	12,33	3,18	11,72	2,89
	-15,0	7,72	2,69	7,57	2,72	7,43	2,75	7,36	2,77	7,29	2,78	7,14	2,81
	-10,0	8,90	2,83	8,76	2,86	8,61	2,89	8,54	2,91	8,47	2,92	8,32	2,95
	-5,0	10,09	2,97	9,94	3,00	9,80	3,03	9,72	3,05	9,65	3,06	9,51	3,09
4.2+5.0	0,0	11,27	3,11	11,12	3,14	10,98	3,17	**10,91**	**3,19**	10,84	3,20	10,69	3,23
	6,0	12,69	3,28	12,54	3,31	12,40	3,34	12,33	3,36	12,26	3,37	12,11	3,40
	10,0	13,64	3,39	13,49	3,42	13,35	3,45	13,27	3,47	13,20	3,48	12,69	3,25
	15,0	14,82	3,53	14,65	3,55	14,00	3,24	13,67	3,10	13,35	2,96	12,72	2,69
	-15,0	7,83	2,29	7,68	2,32	7,54	2,35	7,47	2,37	7,40	2,38	7,25	2,41
	-10,0	9,01	2,43	8,87	2,46	8,72	2,49	8,65	2,51	8,58	2,52	8,43	2,55
	-5,0	10,20	2,57	10,05	2,60	9,91	2,63	9,83	2,65	9,76	2,66	9,62	2,69
4.2+6.0	0,0	11,38	2,71	11,23	2,74	11,09	2,77	**11,02**	**2,79**	10,95	2,80	10,80	2,83
	6,0	12,80	2,88	12,65	2,91	12,51	2,94	12,44	2,96	12,37	2,97	12,22	3,00
	10,0	13,75	2,99	13,60	3,02	13,46	3,05	13,38	3,07	13,31	3,08	12,80	2,85
	15,0	14,93	3,13	14,76	3,15	14,11	2,84	13,78	2,70	13,46	2,56	12,83	2,29
	-15,0	7,85	2,61	7,71	2,64	7,56	2,68	7,49	2,69	7,41	2,71	7,27	2,74
	-10,0	9,06	2,75	8,91	2,78	8,76	2,81	8,69	2,83	8,62	2,85	8,47	2,88
	-5,0	10,26	2,89	10,12	2,92	9,97	2,95	9,90	2,97	9,82	2,98	9,67	3,01
5.0+5.0	0,0	11,47	3,03	11,32	3,06	11,17	3,09	**11,10**	**3,11**	11,03	3,12	10,88	3,15
	6,0	12,91	3,20	12,77	3,23	12,62	3,26	12,55	3,28	12,47	3,29	12,33	3,32
	10,0	13,88	3,31	13,73	3,34	13,58	3,37	13,51	3,39	13,44	3,40	13,29	3,43
	15,0	15,08	3,45	14,94	3,48	14,79	3,51	14,65	3,48	14,30	3,31	13,59	2,99
	-15,0	7,84	2,22	7,70	2,25	7,55	2,29	7,48	2,30	7,40	2,32	7,26	2,35
	-10,0	9,05	2,36	8,90	2,39	8,75	2,42	8,68	2,44	8,61	2,46	8,46	2,49
	-5,0	10,25	2,50	10,11	2,53	9,96	2,56	9,89	2,58	9,81	2,59	9,66	2,62
5.0+6.0	0,0	11,46	2,64	11,31	2,67	11,16	2,70	**11,09**	**2,72**	11,02	2,73	10,87	2,76
	6,0	12,90	2,81	12,76	2,84	12,61	2,87	12,54	2,89	12,46	2,90	12,32	2,93
	10,0	13,87	2,92	13,72	2,95	13,57	2,98	13,50	3,00	13,43	3,01	13,28	3,04
	15,0	15,07	3,06	14,93	3,09	14,78	3,12	14,64	3,09	14,29	2,92	13,58	2,60
	-15,0	6,87	1,86	6,73	1,89	6,59	1,91	6,52	1,93	6,45	1,94	6,31	1,96
	-10,0	8,00	1,98	7,86	2,00	7,72	2,02	7,65	2,04	7,58	2,05	7,44	2,07
	-5,0	9,13	2,09	8,99	2,11	8,86	2,14	8,79	2,15	8,72	2,16	8,58	2,18
1.5+1.5+1.5	0,0	10,27	2,20	10,13	2,22	9,99	2,25	**9,92**	**2,26**	9,85	2,27	9,71	2,30
	6,0	11,63	2,33	11,49	2,36	11,35	2,38	11,28	2,39	11,21	2,40	11,07	2,43
	10,0	12,53	2,42	12,40	2,44	12,26	2,47	12,19	2,48	12,12	2,49	11,98	2,52
	15,0	13,67	2,53	13,53	2,56	13,39	2,58	13,32	2,59	13,25	2,60	13,11	2,63
	-15,0	7,05	1,94	6,91	1,97	6,77	1,99	6,70	2,01	6,63	2,02	6,49	2,04
	-10,0	8,18	2,06	8,04	2,08	7,90	2,10	7,83	2,12	7,76	2,13	7,62	2,15
	-5,0	9,31	2,17	9,17	2,19	9,04	2,22	8,97	2,23	8,90	2,24	8,76	2,26
1.5+1.5+2.0	0,0	10,45	2,28	10,31	2,30	10,17	2,33	**10,10**	**2,34**	10,03	2,35	9,89	2,38
	6,0	11,81	2,41	11,67	2,44	11,53	2,46	11,46	2,47	11,39	2,48	11,25	2,51
	10,0	12,71	2,50	12,58	2,52	12,44	2,55	12,37	2,56	12,30	2,57	12,16	2,60
	15,0	13,85	2,61	13,71	2,64	13,57	2,66	13,50	2,67	13,43	2,68	13,29	2,71

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C WB]

3D103886

5 Capacity tables

5 - 2 Heating Capacity Tables

3MXM68M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	-15,0	7,13	1,97	6,99	2,00	6,85	2,02	6,78	2,04	6,71	2,05	6,57	2,07
	-10,0	8,26	2,09	8,12	2,11	7,98	2,13	7,91	2,15	7,84	2,16	7,70	2,18
	-5,0	9,39	2,20	9,25	2,22	9,12	2,25	9,05	2,26	8,98	2,27	8,84	2,29
1.5+1.5+2.5	0,0	10,53	2,31	10,39	2,33	10,25	2,36	**10,18**	**2,37**	10,11	2,38	9,97	2,41
	6,0	11,89	2,44	11,75	2,47	11,61	2,49	11,54	2,50	11,47	2,51	11,33	2,54
	10,0	12,79	2,53	12,66	2,55	12,52	2,58	12,45	2,59	12,38	2,60	12,24	2,63
	15,0	13,93	2,64	13,79	2,67	13,65	2,69	13,58	2,70	13,51	2,71	13,37	2,74
	-15,0	7,19	2,07	7,04	2,10	6,90	2,12	6,83	2,13	6,76	2,15	6,62	2,17
	-10,0	8,34	2,19	8,20	2,21	8,06	2,24	7,99	2,25	7,92	2,27	7,77	2,29
	-5,0	9,49	2,31	9,35	2,33	9,21	2,36	9,14	2,37	9,07	2,39	8,93	2,41
1.5+1.5+3.5	0,0	10,65	2,43	10,51	2,45	10,37	2,48	**10,29**	**2,49**	10,22	2,50	10,08	2,53
	6,0	12,03	2,57	11,89	2,59	11,75	2,62	11,68	2,63	11,61	2,65	11,47	2,67
	10,0	12,96	2,66	12,81	2,69	12,67	2,71	12,60	2,73	12,53	2,74	12,39	2,77
	15,0	14,11	2,78	13,97	2,81	13,83	2,83	13,76	2,85	13,69	2,86	13,55	2,89
	-15,0	7,19	2,07	7,04	2,10	6,90	2,12	6,83	2,13	6,76	2,15	6,62	2,17
	-10,0	8,34	2,19	8,20	2,21	8,06	2,24	7,99	2,25	7,92	2,27	7,77	2,29
	-5,0	9,49	2,31	9,35	2,33	9,21	2,36	9,14	2,37	9,07	2,39	8,93	2,41
1.5+1.5+4.2	0,0	10,65	2,43	10,51	2,45	10,37	2,48	**10,29**	**2,49**	10,22	2,50	10,08	2,53
	6,0	12,03	2,57	11,89	2,59	11,75	2,62	11,68	2,63	11,61	2,65	11,47	2,67
	10,0	12,96	2,66	12,81	2,69	12,67	2,71	12,60	2,73	12,53	2,74	12,39	2,77
	15,0	14,11	2,78	13,97	2,81	13,83	2,83	13,76	2,85	13,69	2,86	13,55	2,89
	-15,0	7,29	2,13	7,15	2,16	7,01	2,19	6,94	2,20	6,86	2,21	6,72	2,24
	-10,0	8,47	2,26	8,33	2,28	8,18	2,31	8,11	2,32	8,04	2,34	7,89	2,36
	-5,0	9,64	2,38	9,50	2,41	9,36	2,43	9,28	2,45	9,21	2,46	9,07	2,49
1.5+1.5+5.0	0,0	10,82	2,50	10,67	2,53	10,53	2,55	**10,46**	**2,57**	10,39	2,58	10,24	2,61
	6,0	12,23	2,65	12,08	2,67	11,94	2,70	11,87	2,71	11,80	2,73	11,65	2,75
	10,0	13,17	2,74	13,02	2,77	12,88	2,80	12,81	2,81	12,74	2,82	12,59	2,85
	15,0	14,34	2,87	14,20	2,89	14,05	2,92	13,98	2,93	13,91	2,95	13,77	2,97
	-15,0	7,42	1,87	7,28	1,90	7,14	1,93	7,07	1,94	6,99	1,95	6,85	1,98
	-10,0	8,60	2,00	8,46	2,02	8,31	2,05	8,24	2,06	8,17	2,08	8,02	2,10
	-5,0	9,77	2,12	9,63	2,15	9,49	2,17	9,41	2,19	9,34	2,20	9,20	2,23
1.5+1.5+6.0	0,0	10,95	2,24	10,80	2,27	10,66	2,29	**10,59**	**2,31**	10,52	2,32	10,37	2,35
	6,0	12,36	2,39	12,21	2,41	12,07	2,44	12,00	2,45	11,93	2,47	11,78	2,49
	10,0	13,30	2,48	13,15	2,51	13,01	2,54	12,94	2,55	12,87	2,56	12,72	2,59
	15,0	14,47	2,61	14,33	2,63	14,18	2,66	14,11	2,67	14,04	2,69	13,90	2,71
	-15,0	7,21	2,01	7,07	2,04	6,93	2,06	6,86	2,08	6,79	2,09	6,65	2,11
	-10,0	8,34	2,13	8,20	2,15	8,06	2,17	7,99	2,19	7,92	2,20	7,78	2,22
	-5,0	9,47	2,24	9,33	2,26	9,20	2,29	9,13	2,30	9,06	2,31	8,92	2,33
1.5+2.0+2.0	0,0	10,61	2,35	10,47	2,37	10,33	2,40	**10,26**	**2,41**	10,19	2,42	10,05	2,45
	6,0	11,97	2,48	11,83	2,51	11,69	2,53	11,62	2,54	11,55	2,55	11,41	2,58
	10,0	12,87	2,57	12,74	2,59	12,60	2,62	12,53	2,63	12,46	2,64	12,32	2,67
	15,0	14,01	2,68	13,87	2,71	13,73	2,73	13,66	2,74	13,59	2,75	13,45	2,78

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	-15,0	7,31	2,04	7,17	2,07	7,03	2,09	6,96	2,11	6,89	2,12	6,75	2,14
	-10,0	8,44	2,16	8,30	2,18	8,16	2,20	8,09	2,22	8,02	2,23	7,88	2,25
	-5,0	9,57	2,27	9,43	2,29	9,30	2,32	9,23	2,33	9,16	2,34	9,02	2,36
1.5+2.0+2.5	0,0	10,71	2,38	10,57	2,40	10,43	2,43	**10,36**	**2,44**	10,29	2,45	10,15	2,48
	6,0	12,07	2,51	11,93	2,54	11,79	2,56	11,72	2,57	11,65	2,58	11,51	2,61
	10,0	12,97	2,60	12,84	2,62	12,70	2,65	12,63	2,66	12,56	2,67	12,42	2,70
	15,0	14,11	2,71	13,97	2,74	13,83	2,76	13,76	2,77	13,69	2,78	13,55	2,81
	-15,0	7,35	2,16	7,20	2,19	7,06	2,21	6,99	2,22	6,92	2,24	6,78	2,26
	-10,0	8,50	2,28	8,36	2,30	8,22	2,33	8,15	2,34	8,08	2,36	7,93	2,38
	-5,0	9,65	2,40	9,51	2,42	9,37	2,45	9,30	2,46	9,23	2,48	9,09	2,50
1.5+2.0+3.5	0,0	10,81	2,52	10,67	2,54	10,53	2,57	**10,45**	**2,58**	10,38	2,59	10,24	2,62
	6,0	12,19	2,66	12,05	2,68	11,91	2,71	11,84	2,72	11,77	2,74	11,63	2,76
	10,0	13,12	2,75	12,97	2,78	12,83	2,80	12,76	2,82	12,69	2,83	12,55	2,86
	15,0	14,27	2,87	14,13	2,90	13,99	2,92	13,92	2,94	13,85	2,95	13,71	2,98
	-15,0	7,36	2,15	7,21	2,18	7,07	2,20	7,00	2,21	6,93	2,23	6,79	2,25
	-10,0	8,51	2,27	8,37	2,29	8,23	2,32	8,16	2,33	8,09	2,35	7,94	2,37
	-5,0	9,66	2,39	9,52	2,41	9,38	2,44	9,31	2,45	9,24	2,47	9,10	2,49
1.5+2.0+4.2	0,0	10,82	2,51	10,68	2,53	10,54	2,56	**10,46**	**2,57**	10,39	2,58	10,25	2,61
	6,0	12,20	2,65	12,06	2,67	11,92	2,70	11,85	2,71	11,78	2,73	11,64	2,75
	10,0	13,13	2,74	12,98	2,77	12,84	2,79	12,77	2,81	12,70	2,82	12,56	2,85
	15,0	14,28	2,86	14,14	2,89	14,00	2,91	13,93	2,93	13,86	2,94	13,72	2,97
	-15,0	7,71	2,20	7,57	2,23	7,43	2,26	7,36	2,27	7,28	2,28	7,14	2,31
	-10,0	8,89	2,33	8,75	2,35	8,60	2,38	8,53	2,39	8,46	2,41	8,31	2,43
	-5,0	10,06	2,45	9,92	2,48	9,78	2,50	9,70	2,52	9,63	2,53	9,49	2,56
1.5+2.0+5.0	0,0	11,24	2,57	11,09	2,60	10,95	2,62	**10,88**	**2,64**	10,81	2,65	10,66	2,68
	6,0	12,65	2,72	12,50	2,74	12,36	2,77	12,29	2,78	12,22	2,80	12,07	2,82
	10,0	13,59	2,81	13,44	2,84	13,30	2,87	13,23	2,88	13,16	2,89	13,01	2,92
	15,0	14,76	2,94	14,62	2,96	14,47	2,99	14,40	3,00	14,33	3,02	14,19	3,04
	-15,0	7,72	1,94	7,58	1,97	7,44	2,00	7,37	2,01	7,29	2,02	7,15	2,05
	-10,0	8,90	2,07	8,76	2,09	8,61	2,12	8,54	2,13	8,47	2,15	8,32	2,17
	-5,0	10,07	2,19	9,93	2,22	9,79	2,24	9,71	2,26	9,64	2,27	9,50	2,30
1.5+2.0+6.0	0,0	11,25	2,31	11,10	2,34	10,96	2,36	**10,89**	**2,38**	10,82	2,39	10,67	2,42
	6,0	12,66	2,46	12,51	2,48	12,37	2,51	12,30	2,52	12,23	2,54	12,08	2,56
	10,0	13,60	2,55	13,45	2,58	13,31	2,61	13,24	2,62	13,17	2,63	13,02	2,66
	15,0	14,77	2,68	14,63	2,70	14,48	2,73	14,41	2,74	14,34	2,76	14,20	2,78
	-15,0	7,42	2,04	7,28	2,07	7,14	2,09	7,07	2,11	7,00	2,12	6,86	2,14
	-10,0	8,55	2,16	8,41	2,18	8,27	2,20	8,20	2,22	8,13	2,23	7,99	2,25
	-5,0	9,68	2,27	9,54	2,29	9,41	2,32	9,34	2,33	9,27	2,34	9,13	2,36
1.5+2.5+2.5	0,0	10,82	2,38	10,68	2,40	10,54	2,43	**10,47**	**2,44**	10,40	2,45	10,26	2,48
	6,0	12,18	2,51	12,04	2,54	11,90	2,56	11,83	2,57	11,76	2,58	11,62	2,61
	10,0	13,08	2,60	12,95	2,62	12,81	2,65	12,74	2,66	12,67	2,67	12,53	2,70
	15,0	14,22	2,71	14,08	2,74	13,94	2,76	13,87	2,77	13,80	2,78	13,66	2,81

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C WB]

3D103887

5 Capacity tables

5 - 2 Heating Capacity Tables

3MXM68M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	-15,0	7,48	2,15	7,33	2,18	7,19	2,20	7,12	2,21	7,05	2,23	6,91	2,25
	-10,0	8,63	2,27	8,49	2,29	8,35	2,32	8,28	2,33	8,21	2,35	8,06	2,37
	-5,0	9,78	2,39	9,64	2,41	9,50	2,44	9,43	2,45	9,36	2,47	9,22	2,49
1.5+2.5+3.5	0,0	10,94	2,51	10,80	2,53	10,66	2,56	**10,58**	**2,57**	10,51	2,58	10,37	2,61
	6,0	12,32	2,65	12,18	2,67	12,04	2,70	11,97	2,71	11,90	2,73	11,76	2,75
	10,0	13,25	2,74	13,10	2,77	12,96	2,79	12,89	2,81	12,82	2,82	12,68	2,85
	15,0	14,40	2,86	14,26	2,89	14,12	2,91	14,05	2,93	13,98	2,94	13,84	2,97
	-15,0	7,48	2,15	7,33	2,18	7,19	2,20	7,12	2,21	7,05	2,23	6,91	2,25
	-10,0	8,63	2,27	8,49	2,29	8,35	2,32	8,28	2,33	8,21	2,35	8,06	2,37
	-5,0	9,78	2,39	9,64	2,41	9,50	2,44	9,43	2,45	9,36	2,47	9,22	2,49
1.5+2.5+4..2	0,0	10,94	2,51	10,80	2,53	10,66	2,56	**10,58**	**2,57**	10,51	2,58	10,37	2,61
	6,0	12,32	2,65	12,18	2,67	12,04	2,70	11,97	2,71	11,90	2,73	11,76	2,75
	10,0	13,25	2,74	13,10	2,77	12,96	2,79	12,89	2,81	12,82	2,82	12,68	2,85
	15,0	14,40	2,86	14,26	2,89	14,12	2,91	14,05	2,93	13,98	2,94	13,84	2,97
	-15,0	7,83	2,20	7,69	2,23	7,55	2,26	7,48	2,27	7,40	2,28	7,26	2,31
	-10,0	9,01	2,33	8,87	2,35	8,72	2,38	8,65	2,39	8,58	2,41	8,43	2,43
	-5,0	10,18	2,45	10,04	2,48	9,90	2,50	9,82	2,52	9,75	2,53	9,61	2,56
1.5+2.5+5.0	0,0	11,36	2,57	11,21	2,60	11,07	2,62	**11,00**	**2,64**	10,93	2,65	10,78	2,68
	6,0	12,77	2,72	12,62	2,74	12,48	2,77	12,41	2,78	12,34	2,80	12,19	2,82
	10,0	13,71	2,81	13,56	2,84	13,42	2,87	13,35	2,88	13,28	2,89	13,13	2,92
	15,0	14,88	2,94	14,74	2,96	14,59	2,99	14,52	3,00	14,45	3,02	14,31	3,04
	-15,0	7,60	1,94	7,46	1,97	7,32	2,00	7,25	2,01	7,17	2,02	7,03	2,05
	-10,0	8,78	2,07	8,64	2,09	8,49	2,12	8,42	2,13	8,35	2,15	8,20	2,17
	-5,0	9,95	2,19	9,81	2,22	9,67	2,24	9,59	2,26	9,52	2,27	9,38	2,30
1.5+2.5+6.0	0,0	11,13	2,31	10,98	2,34	10,84	2,36	**10,77**	**2,38**	10,70	2,39	10,55	2,42
	6,0	12,54	2,46	12,39	2,48	12,25	2,51	12,18	2,52	12,11	2,54	11,96	2,56
	10,0	13,48	2,55	13,33	2,58	13,19	2,61	13,12	2,62	13,05	2,63	12,90	2,66
	15,0	14,65	2,68	14,51	2,70	14,36	2,73	14,29	2,74	14,22	2,76	14,08	2,78
	-15,0	7,44	2,14	7,29	2,17	7,15	2,19	7,08	2,21	7,01	2,22	6,87	2,25
	-10,0	8,61	2,26	8,46	2,29	8,32	2,31	8,25	2,33	8,18	2,34	8,03	2,37
	-5,0	9,77	2,38	9,63	2,41	9,49	2,43	9,42	2,45	9,35	2,46	9,20	2,49
1.5+3.5+3.5	0,0	10,94	2,50	10,80	2,53	10,66	2,56	**10,59**	**2,57**	10,51	2,58	10,37	2,61
	6,0	12,35	2,65	12,20	2,67	12,06	2,70	11,99	2,71	11,92	2,73	11,77	2,75
	10,0	13,28	2,74	13,14	2,77	12,99	2,80	12,92	2,81	12,85	2,82	12,71	2,85
	15,0	14,45	2,86	14,31	2,89	14,16	2,92	14,09	2,93	14,02	2,94	13,85	2,97
	-15,0	7,44	2,13	7,29	2,16	7,15	2,18	7,08	2,20	7,01	2,21	6,87	2,24
	-10,0	8,61	2,25	8,46	2,28	8,32	2,30	8,25	2,32	8,18	2,33	8,03	2,36
	-5,0	9,77	2,37	9,63	2,40	9,49	2,42	9,42	2,44	9,35	2,45	9,20	2,48
1.5+3.5+4.2	0,0	10,94	2,49	10,80	2,52	10,66	2,55	**10,59**	**2,56**	10,51	2,57	10,37	2,60
	6,0	12,35	2,64	12,20	2,66	12,06	2,69	11,99	2,70	11,92	2,72	11,77	2,74
	10,0	13,28	2,73	13,14	2,76	12,99	2,79	12,92	2,80	12,85	2,81	12,71	2,84
	15,0	14,45	2,85	14,31	2,88	14,16	2,91	14,09	2,92	14,02	2,93	13,85	2,96

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	-15,0	7,68	2,15	7,53	2,17	7,38	2,20	7,31	2,21	7,24	2,23	7,09	2,26
	-10,0	8,89	2,27	8,74	2,30	8,59	2,33	8,52	2,34	8,44	2,35	8,00	2,38
	-5,0	10,09	2,40	9,94	2,43	9,80	2,45	9,72	2,47	9,65	2,48	9,50	2,51
1.5+3.5+5.0	0,0	11,30	2,52	11,15	2,55	11,00	2,58	**10,93**	**2,59**	10,86	2,61	10,71	2,63
	6,0	12,74	2,67	12,60	2,70	12,45	2,73	12,38	2,74	12,30	2,76	12,16	2,79
	10,0	13,71	2,78	13,56	2,80	13,41	2,83	13,34	2,84	13,27	2,86	13,12	2,89
	15,0	14,92	2,90	14,77	2,93	14,62	2,96	14,55	2,97	14,47	2,98	14,33	3,01
	-15,0	7,53	1,93	7,38	1,95	7,23	1,98	7,16	1,99	7,09	2,01	6,94	2,04
	-10,0	8,74	2,05	8,59	2,08	8,44	2,11	8,37	2,12	8,29	2,13	7,85	2,16
	-5,0	9,94	2,18	9,79	2,21	9,65	2,23	9,57	2,25	9,50	2,26	9,35	2,29
1.5+3.5+6.0	0,0	11,15	2,30	11,00	2,33	10,85	2,36	**10,78**	**2,37**	10,71	2,39	10,56	2,41
	6,0	12,59	2,45	12,45	2,48	12,30	2,51	12,23	2,52	12,15	2,54	12,01	2,57
	10,0	13,56	2,56	13,41	2,58	13,26	2,61	13,19	2,62	13,12	2,64	12,97	2,67
	15,0	14,77	2,68	14,62	2,71	14,47	2,74	14,40	2,75	14,32	2,76	14,18	2,79
	-15,0	7,53	2,16	7,38	2,19	7,24	2,21	7,17	2,23	7,10	2,24	6,96	2,27
	-10,0	8,70	2,28	8,55	2,31	8,41	2,33	8,34	2,35	8,27	2,36	8,12	2,39
	-5,0	9,86	2,40	9,72	2,43	9,58	2,45	9,51	2,47	9,44	2,48	9,29	2,51
1.5+4.2+4.2	0,0	11,03	2,52	10,89	2,55	10,75	2,58	**10,68**	**2,59**	10,60	2,60	10,46	2,63
	6,0	12,44	2,67	12,29	2,69	12,15	2,72	12,08	2,73	12,01	2,75	11,86	2,77
	10,0	13,37	2,76	13,23	2,79	13,08	2,82	13,01	2,83	12,94	2,84	12,80	2,87
	15,0	14,54	2,88	14,40	2,91	14,25	2,94	14,18	2,95	14,11	2,96	13,94	2,99
	-15,0	7,74	2,23	7,59	2,25	7,44	2,28	7,37	2,29	7,30	2,31	7,15	2,34
	-10,0	8,95	2,35	8,80	2,38	8,65	2,41	8,58	2,42	8,50	2,43	8,06	2,46
	-5,0	10,15	2,48	10,00	2,51	9,86	2,53	9,78	2,55	9,71	2,56	9,56	2,59
1.5+4.2+5.0	0,0	11,36	2,60	11,21	2,63	11,06	2,66	**10,99**	**2,67**	10,92	2,69	10,77	2,71
	6,0	12,80	2,75	12,66	2,78	12,51	2,81	12,44	2,82	12,36	2,84	12,22	2,87
	10,0	13,77	2,86	13,62	2,88	13,47	2,91	13,40	2,92	13,33	2,94	13,18	2,97
	15,0	14,98	2,98	14,83	3,01	14,68	3,04	14,61	3,05	14,53	3,06	14,39	3,09
	-15,0	7,39	2,08	7,25	2,11	7,11	2,13	7,04	2,15	6,97	2,16	6,83	2,18
	-10,0	8,52	2,20	8,38	2,22	8,24	2,24	8,17	2,26	8,10	2,27	7,96	2,29
	-5,0	9,65	2,31	9,51	2,33	9,38	2,36	9,31	2,37	9,24	2,38	9,10	2,40
2.0+2.0+2.0	0,0	10,79	2,42	10,65	2,44	10,51	2,47	**10,44**	**2,48**	10,37	2,49	10,23	2,52
	6,0	12,15	2,55	12,01	2,58	11,87	2,60	11,80	2,61	11,73	2,62	11,59	2,65
	10,0	13,05	2,64	12,92	2,66	12,78	2,69	12,71	2,70	12,64	2,71	12,50	2,74
	15,0	14,19	2,75	14,05	2,78	13,91	2,80	13,84	2,81	13,77	2,82	13,63	2,85
	-15,0	7,47	2,12	7,33	2,15	7,19	2,17	7,12	2,19	7,05	2,20	6,91	2,22
	-10,0	8,60	2,24	8,46	2,26	8,32	2,28	8,25	2,30	8,18	2,31	8,04	2,33
	-5,0	9,73	2,35	9,59	2,37	9,46	2,40	9,39	2,41	9,32	2,42	9,18	2,44
2.0+2.0+2.5	0,0	10,87	2,46	10,73	2,48	10,59	2,51	**10,52**	**2,52**	10,45	2,53	10,31	2,56
	6,0	12,23	2,59	12,09	2,62	11,95	2,64	11,88	2,65	11,81	2,66	11,67	2,69
	10,0	13,13	2,68	13,00	2,70	12,86	2,73	12,79	2,74	12,72	2,75	12,58	2,78
	15,0	14,27	2,79	14,13	2,82	13,99	2,84	13,92	2,85	13,85	2,86	13,71	2,89

Notes
1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   1.5,2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted CTXM-M,FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C WB]

3D103888

5 Capacity tables

5 - 2 Heating Capacity Tables

5

3MXM68M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	-15,0	7,53	2,23	7,38	2,26	7,24	2,28	7,17	2,29	7,10	2,31	6,96	2,33
	-10,0	8,68	2,35	8,54	2,37	8,40	2,40	8,33	2,41	8,26	2,43	8,11	2,45
	-5,0	9,83	2,47	9,69	2,49	9,55	2,52	9,48	2,53	9,41	2,55	9,27	2,57
2.0+2.0+3.5	0,0	10,99	2,59	10,85	2,61	10,71	2,64	**10,63**	**2,65**	10,56	2,66	10,42	2,69
	6,0	12,37	2,73	12,23	2,75	12,09	2,78	12,02	2,79	11,95	2,81	11,81	2,83
	10,0	13,30	2,82	13,15	2,85	13,01	2,87	12,94	2,89	12,87	2,90	12,73	2,93
	15,0	14,45	2,94	14,31	2,97	14,17	2,99	14,10	3,01	14,03	3,02	13,89	3,05
	-15,0	7,53	2,23	7,38	2,26	7,24	2,28	7,17	2,29	7,10	2,31	6,96	2,33
	-10,0	8,68	2,35	8,54	2,37	8,40	2,40	8,33	2,41	8,26	2,43	8,11	2,45
	-5,0	9,83	2,47	9,69	2,49	9,55	2,52	9,48	2,53	9,41	2,55	9,27	2,57
2.0+2.0+4.2	0,0	10,99	2,59	10,85	2,61	10,71	2,64	**10,63**	**2,65**	10,56	2,66	10,42	2,69
	6,0	12,37	2,73	12,23	2,75	12,09	2,78	12,02	2,79	11,95	2,81	11,81	2,83
	10,0	13,30	2,82	13,15	2,85	13,01	2,87	12,94	2,89	12,87	2,90	12,73	2,93
	15,0	14,45	2,94	14,31	2,97	14,17	2,99	14,10	3,01	14,03	3,02	13,89	3,05
	-15,0	7,65	2,28	7,51	2,31	7,37	2,34	7,30	2,35	7,22	2,36	7,08	2,39
	-10,0	8,83	2,41	8,69	2,43	8,54	2,46	8,47	2,47	8,40	2,49	8,25	2,51
	-5,0	10,00	2,53	9,86	2,56	9,72	2,58	9,64	2,60	9,57	2,61	9,43	2,64
2.0+2.0+5.0	0,0	11,18	2,65	11,03	2,68	10,89	2,70	**10,82**	**2,72**	10,75	2,73	10,60	2,76
	6,0	12,59	2,80	12,44	2,82	12,30	2,85	12,23	2,86	12,16	2,88	12,01	2,90
	10,0	13,53	2,89	13,38	2,92	13,24	2,95	13,17	2,96	13,10	2,97	12,95	3,00
	15,0	14,70	3,02	14,56	3,04	14,41	3,07	14,34	3,08	14,27	3,10	14,13	3,12
	-15,0	7,78	2,02	7,64	2,05	7,50	2,08	7,43	2,09	7,35	2,10	7,21	2,13
	-10,0	8,96	2,15	8,82	2,17	8,67	2,20	8,60	2,21	8,53	2,23	8,38	2,25
	-5,0	10,13	2,27	9,99	2,30	9,85	2,32	9,77	2,34	9,70	2,35	9,56	2,38
2.0+2.0+6.0	0,0	11,31	2,39	11,16	2,42	11,02	2,44	**10,95**	**2,46**	10,88	2,47	10,73	2,50
	6,0	12,72	2,54	12,57	2,56	12,43	2,59	12,36	2,60	12,29	2,62	12,14	2,64
	10,0	13,66	2,63	13,51	2,66	13,37	2,69	13,30	2,70	13,23	2,71	13,08	2,74
	15,0	14,83	2,76	14,69	2,78	14,54	2,81	14,47	2,82	14,40	2,84	14,26	2,86
	-15,0	7,49	2,21	7,35	2,24	7,21	2,26	7,14	2,28	7,07	2,29	6,93	2,31
	-10,0	8,62	2,33	8,48	2,35	8,34	2,37	8,27	2,39	8,20	2,40	8,06	2,42
	-5,0	9,75	2,44	9,61	2,46	9,48	2,49	9,41	2,50	9,34	2,51	9,20	2,53
2.0+2.5+2.5	0,0	10,89	2,55	10,75	2,57	10,61	2,60	**10,54**	**2,61**	10,47	2,62	10,33	2,65
	6,0	12,25	2,68	12,11	2,71	11,97	2,73	11,90	2,74	11,83	2,75	11,69	2,78
	10,0	13,15	2,77	13,02	2,79	12,88	2,82	12,81	2,83	12,74	2,84	12,60	2,87
	15,0	14,29	2,88	14,15	2,91	14,01	2,93	13,94	2,94	13,87	2,95	13,73	2,98
	-15,0	7,53	2,23	7,38	2,26	7,24	2,28	7,17	2,29	7,10	2,31	6,96	2,33
	-10,0	8,68	2,35	8,54	2,37	8,40	2,40	8,33	2,41	8,26	2,43	8,11	2,45
	-5,0	9,83	2,47	9,69	2,49	9,55	2,52	9,48	2,53	9,41	2,55	9,27	2,57
2.0+2.5+3.5	0,0	10,99	2,59	10,85	2,61	10,71	2,64	**10,63**	**2,65**	10,56	2,66	10,42	2,69
	6,0	12,37	2,73	12,23	2,75	12,09	2,78	12,02	2,79	11,95	2,81	11,81	2,83
	10,0	13,30	2,82	13,15	2,85	13,01	2,87	12,94	2,89	12,87	2,90	12,73	2,93
	15,0	14,45	2,94	14,31	2,97	14,17	2,99	14,10	3,01	14,03	3,02	13,89	3,05

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
	-15,0	7,54	2,22	7,39	2,25	7,25	2,27	7,18	2,28	7,11	2,30	6,97	2,32
	-10,0	8,69	2,34	8,55	2,36	8,41	2,39	8,34	2,40	8,27	2,42	8,12	2,44
	-5,0	9,84	2,46	9,70	2,48	9,56	2,51	9,49	2,52	9,42	2,54	9,28	2,56
2.0+2.5+4.2	0,0	11,00	2,58	10,86	2,60	10,72	2,63	**10,64**	**2,64**	10,57	2,65	10,43	2,68
	6,0	12,38	2,72	12,24	2,74	12,10	2,77	12,03	2,78	11,96	2,80	11,82	2,82
	10,0	13,31	2,81	13,16	2,84	13,02	2,86	12,95	2,88	12,88	2,89	12,74	2,92
	15,0	14,46	2,93	14,32	2,96	14,18	2,98	14,11	3,00	14,04	3,01	13,90	3,04
	-15,0	7,89	2,31	7,75	2,34	7,61	2,37	7,54	2,38	7,46	2,39	7,32	2,42
	-10,0	9,07	2,44	8,93	2,46	8,78	2,49	8,71	2,50	8,64	2,52	8,49	2,54
	-5,0	10,24	2,56	10,10	2,59	9,96	2,61	9,88	2,63	9,81	2,64	9,67	2,67
2.0+2.5+5.0	0,0	11,42	2,68	11,27	2,71	11,13	2,73	**11,06**	**2,75**	10,99	2,76	10,84	2,79
	6,0	12,83	2,83	12,68	2,85	12,54	2,88	12,47	2,89	12,40	2,91	12,25	2,93
	10,0	13,77	2,92	13,62	2,95	13,48	2,98	13,41	2,99	13,34	3,00	13,19	3,03
	15,0	14,94	3,05	14,80	3,07	14,65	3,10	14,58	3,11	14,51	3,13	14,37	3,15
	-15,0	7,90	1,99	7,76	2,02	7,62	2,05	7,55	2,06	7,47	2,07	7,33	2,10
	-10,0	9,08	2,12	8,94	2,14	8,79	2,17	8,72	2,18	8,65	2,20	8,50	2,22
	-5,0	10,25	2,24	10,11	2,27	9,97	2,29	9,89	2,31	9,82	2,32	9,68	2,35
2.0+2.5+6.0	0,0	11,43	2,36	11,28	2,39	11,14	2,41	**11,07**	**2,43**	11,00	2,44	10,85	2,47
	6,0	12,84	2,51	12,69	2,53	12,55	2,56	12,48	2,57	12,41	2,59	12,26	2,61
	10,0	13,78	2,60	13,63	2,63	13,49	2,66	13,42	2,67	13,35	2,68	13,20	2,71
	15,0	14,95	2,73	14,81	2,75	14,66	2,78	14,59	2,79	14,52	2,81	14,38	2,83
	-15,0	7,61	2,27	7,46	2,30	7,32	2,32	7,25	2,34	7,18	2,35	7,04	2,38
	-10,0	8,78	2,39	8,63	2,42	8,49	2,44	8,42	2,46	8,35	2,47	8,20	2,50
	-5,0	9,94	2,51	9,80	2,54	9,66	2,56	9,59	2,58	9,52	2,59	9,37	2,62
2.0+3.5+3.5	0,0	11,11	2,63	10,97	2,66	10,83	2,69	**10,76**	**2,70**	10,68	2,71	10,54	2,74
	6,0	12,52	2,78	12,37	2,80	12,23	2,83	12,16	2,84	12,09	2,86	11,94	2,88
	10,0	13,45	2,87	13,31	2,90	13,16	2,93	13,09	2,94	13,02	2,95	12,88	2,98
	15,0	14,62	2,99	14,48	3,02	14,33	3,05	14,26	3,06	14,19	3,07	14,02	3,10
	-15,0	7,61	2,26	7,46	2,29	7,32	2,31	7,25	2,33	7,18	2,34	7,04	2,37
	-10,0	8,78	2,38	8,63	2,41	8,49	2,43	8,42	2,45	8,35	2,46	8,20	2,49
	-5,0	9,94	2,50	9,80	2,53	9,66	2,55	9,59	2,57	9,52	2,58	9,37	2,61
2.0+3.5+4.2	0,0	11,11	2,62	10,97	2,65	10,83	2,68	**10,76**	**2,69**	10,68	2,70	10,54	2,73
	6,0	12,52	2,77	12,37	2,79	12,23	2,82	12,16	2,83	12,09	2,85	11,94	2,87
	10,0	13,45	2,86	13,31	2,89	13,16	2,92	13,09	2,93	13,02	2,94	12,88	2,97
	15,0	14,62	2,98	14,48	3,01	14,33	3,04	14,26	3,05	14,19	3,06	14,02	3,09
	-15,0	7,86	2,38	7,71	2,40	7,56	2,43	7,49	2,44	7,42	2,46	7,27	2,49
	-10,0	9,07	2,50	8,92	2,53	8,77	2,56	8,70	2,57	8,62	2,58	8,18	2,61
	-5,0	10,27	2,63	10,12	2,66	9,98	2,68	9,90	2,70	9,83	2,71	9,68	2,74
2.0+3.5+5.0	0,0	11,48	2,75	11,33	2,78	11,18	2,81	**11,11**	**2,82**	11,04	2,84	10,89	2,86
	6,0	12,92	2,90	12,78	2,93	12,63	2,96	12,56	2,97	12,48	2,99	12,34	3,02
	10,0	13,89	3,01	13,74	3,03	13,59	3,06	13,52	3,07	13,45	3,09	13,30	3,12
	15,0	15,10	3,13	14,95	3,16	14,80	3,19	14,73	3,20	14,65	3,21	14,51	3,24

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

② Outdoor air temperature [°C WB]

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5 Capacity tables

5 - 2 Heating Capacity Tables

3MXM68M

Heating 50Hz 230V

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.0+4.2+4.2	-15,0	7,62	2,26	7,47	2,29	7,33	2,31	7,26	2,33	7,19	2,34	7,05	2,37
	-10,0	8,79	2,38	8,64	2,41	8,50	2,43	8,43	2,45	8,36	2,46	8,21	2,49
	-5,0	9,95	2,50	9,81	2,53	9,67	2,55	9,60	2,57	9,53	2,58	9,38	2,61
	0,0	11,12	2,62	10,98	2,65	10,84	2,68	**10,77**	**2,69**	10,69	2,70	10,55	2,73
	6,0	12,53	2,77	12,38	2,79	12,24	2,82	12,17	2,83	12,10	2,85	11,95	2,87
	10,0	13,46	2,86	13,32	2,89	13,17	2,92	13,10	2,93	13,03	2,94	12,89	2,97
	15,0	14,63	2,98	14,49	3,01	14,34	3,04	14,27	3,05	14,20	3,06	14,03	3,09
2.5+2.5+2.5	-15,0	7,60	2,24	7,46	2,27	7,32	2,29	7,25	2,31	7,18	2,32	7,04	2,34
	-10,0	8,73	2,36	8,59	2,38	8,45	2,40	8,38	2,42	8,31	2,43	8,17	2,45
	-5,0	9,86	2,47	9,72	2,49	9,59	2,52	9,52	2,53	9,45	2,54	9,31	2,56
	0,0	11,00	2,58	10,86	2,60	10,72	2,63	**10,65**	**2,64**	10,58	2,65	10,44	2,68
	6,0	12,36	2,71	12,22	2,74	12,08	2,76	12,01	2,77	11,94	2,78	11,80	2,81
	10,0	13,26	2,80	13,13	2,82	12,99	2,85	12,92	2,86	12,85	2,87	12,71	2,90
	15,0	14,40	2,91	14,26	2,94	14,12	2,96	14,05	2,97	13,98	2,98	13,84	3,01
2.5+2.5+3.5	-15,0	7,77	2,30	7,62	2,33	7,48	2,35	7,41	2,36	7,34	2,38	7,20	2,40
	-10,0	8,92	2,42	8,78	2,44	8,64	2,47	8,57	2,48	8,50	2,50	8,35	2,52
	-5,0	10,07	2,54	9,93	2,56	9,79	2,59	9,72	2,60	9,65	2,62	9,51	2,64
	0,0	11,23	2,66	11,09	2,68	10,95	2,71	**10,87**	**2,72**	10,80	2,73	10,66	2,76
	6,0	12,61	2,80	12,47	2,82	12,33	2,85	12,26	2,86	12,19	2,88	12,05	2,90
	10,0	13,54	2,89	13,39	2,92	13,25	2,94	13,18	2,96	13,11	2,97	12,97	3,00
	15,0	14,69	3,01	14,55	3,04	14,41	3,06	14,34	3,08	14,27	3,09	14,13	3,12
2.5+2.5+4.2	-15,0	7,78	2,30	7,63	2,33	7,49	2,35	7,42	2,36	7,35	2,38	7,21	2,40
	-10,0	8,93	2,42	8,79	2,44	8,65	2,47	8,58	2,48	8,51	2,50	8,36	2,52
	-5,0	10,08	2,54	9,94	2,56	9,80	2,59	9,73	2,60	9,66	2,62	9,52	2,64
	0,0	11,24	2,66	11,10	2,68	10,96	2,71	**10,88**	**2,72**	10,81	2,73	10,67	2,76
	6,0	12,62	2,80	12,48	2,82	12,34	2,85	12,27	2,86	12,20	2,88	12,06	2,90
	10,0	13,55	2,89	13,40	2,92	13,26	2,94	13,19	2,96	13,12	2,97	12,98	3,00
	15,0	14,70	3,01	14,56	3,04	14,42	3,06	14,35	3,08	14,28	3,09	14,14	3,12
2.5+2.5+5.0	-15,0	7,90	2,34	7,76	2,37	7,62	2,40	7,55	2,41	7,47	2,42	7,33	2,45
	-10,0	9,08	2,47	8,94	2,49	8,79	2,52	8,72	2,53	8,65	2,55	8,50	2,57
	-5,0	10,25	2,59	10,11	2,62	9,97	2,64	9,89	2,66	9,82	2,67	9,68	2,70
	0,0	11,43	2,71	11,28	2,74	11,14	2,76	**11,07**	**2,78**	11,00	2,79	10,85	2,82
	6,0	12,84	2,86	12,69	2,88	12,55	2,91	12,48	2,92	12,41	2,94	12,26	2,96
	10,0	13,78	2,95	13,63	2,98	13,49	3,01	13,42	3,02	13,35	3,03	13,20	3,06
	15,0	14,95	3,08	14,81	3,10	14,66	3,13	14,59	3,14	14,52	3,16	14,38	3,18
2.5+2.5+6.0	-15,0	7,91	1,99	7,77	2,02	7,63	2,05	7,56	2,06	7,48	2,07	7,34	2,10
	-10,0	9,09	2,12	8,95	2,14	8,80	2,17	8,73	2,18	8,66	2,20	8,51	2,22
	-5,0	10,26	2,24	10,12	2,27	9,98	2,29	9,90	2,31	9,83	2,32	9,69	2,35
	0,0	11,44	2,36	11,29	2,39	11,15	2,41	**11,08**	**2,43**	11,01	2,44	10,86	2,47
	6,0	12,85	2,51	12,70	2,53	12,56	2,56	12,49	2,57	12,42	2,59	12,27	2,61
	10,0	13,79	2,60	13,64	2,63	13,50	2,66	13,43	2,67	13,36	2,68	13,21	2,71
	15,0	14,96	2,73	14,82	2,75	14,67	2,78	14,60	2,79	14,53	2,81	14,39	2,83

①	②	Indoor air temperature [°C DB]											
		16°C		18°C		20°C		21°C		22°C		24°C	
		TC	PI	TC	PI	TC	PI	TC	PI	TC	PI	TC	PI
		kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW	kW
2.5+3.5+3.5	-15,0	7,85	2,29	7,70	2,32	7,56	2,34	7,49	2,36	7,42	2,37	7,28	2,40
	-10,0	9,02	2,41	8,87	2,44	8,73	2,46	8,66	2,48	8,59	2,49	8,44	2,52
	-5,0	10,18	2,53	10,04	2,56	9,90	2,58	9,83	2,60	9,76	2,61	9,61	2,64
	0,0	11,35	2,65	11,21	2,68	11,07	2,71	**11,00**	**2,72**	10,92	2,73	10,78	2,76
	6,0	12,76	2,80	12,61	2,82	12,47	2,85	12,40	2,86	12,33	2,88	12,18	2,90
	10,0	13,69	2,89	13,55	2,92	13,40	2,95	13,33	2,96	13,26	2,97	13,12	3,00
	15,0	14,86	3,01	14,72	3,04	14,57	3,07	14,50	3,08	14,43	3,09	14,26	3,12
2.5+3.5+4.2	-15,0	7,86	2,28	7,71	2,31	7,57	2,33	7,50	2,35	7,43	2,36	7,29	2,39
	-10,0	9,03	2,40	8,88	2,43	8,74	2,45	8,67	2,47	8,60	2,48	8,45	2,51
	-5,0	10,19	2,52	10,05	2,55	9,91	2,57	9,84	2,59	9,77	2,60	9,62	2,63
	0,0	11,36	2,64	11,22	2,67	11,08	2,70	**11,01**	**2,71**	10,93	2,72	10,79	2,75
	6,0	12,77	2,79	12,62	2,81	12,48	2,84	12,41	2,85	12,34	2,87	12,19	2,89
	10,0	13,70	2,88	13,56	2,91	13,41	2,94	13,34	2,95	13,27	2,96	13,13	2,99
	15,0	14,87	3,00	14,73	3,03	14,58	3,06	14,51	3,07	14,44	3,08	14,27	3,11
2.5+3.5+5.0	-15,0	7,83	2,30	7,68	2,32	7,53	2,35	7,46	2,36	7,39	2,38	7,24	2,41
	-10,0	9,04	2,42	8,89	2,45	8,74	2,48	8,67	2,49	8,59	2,50	8,15	2,53
	-5,0	10,24	2,55	10,09	2,58	9,95	2,60	9,87	2,62	9,80	2,63	9,65	2,66
	0,0	11,45	2,67	11,30	2,70	11,15	2,73	**11,08**	**2,74**	11,01	2,76	10,86	2,78
	6,0	12,89	2,82	12,75	2,85	12,60	2,88	12,53	2,89	12,45	2,91	12,31	2,94
	10,0	13,86	2,93	13,71	2,95	13,56	2,98	13,49	2,99	13,42	3,01	13,27	3,04
	15,0	15,07	3,05	14,92	3,08	14,77	3,11	14,70	3,12	14,62	3,13	14,48	3,16
2.5+4.2+4.2	-15,0	7,86	2,28	7,71	2,31	7,57	2,33	7,50	2,35	7,43	2,36	7,29	2,39
	-10,0	9,03	2,40	8,88	2,43	8,74	2,45	8,67	2,47	8,60	2,48	8,45	2,51
	-5,0	10,19	2,52	10,05	2,55	9,91	2,57	9,84	2,59	9,77	2,60	9,62	2,63
	0,0	11,36	2,64	11,22	2,67	11,08	2,70	**11,01**	**2,71**	10,93	2,72	10,79	2,75
	6,0	12,77	2,79	12,62	2,81	12,48	2,84	12,41	2,85	12,34	2,87	12,19	2,89
	10,0	13,70	2,88	13,56	2,91	13,41	2,94	13,34	2,95	13,27	2,96	13,13	2,99
	15,0	14,87	3,00	14,73	3,03	14,58	3,06	14,51	3,07	14,44	3,08	14,27	3,11
3.5+3.5+3.5	-15,0	7,82	2,35	7,68	2,38	7,53	2,41	7,46	2,42	7,38	2,43	7,24	2,46
	-10,0	9,02	2,48	8,88	2,50	8,73	2,53	8,66	2,54	8,58	2,56	8,44	2,59
	-5,0	10,22	2,60	10,08	2,63	9,93	2,66	9,86	2,67	9,78	2,68	9,64	2,71
	0,0	11,42	2,73	11,28	2,75	11,13	2,78	**11,06**	**2,79**	10,98	2,81	10,84	2,83
	6,0	12,86	2,88	12,72	2,90	12,57	2,93	12,50	2,94	12,42	2,96	12,28	2,98
	10,0	13,82	2,98	13,68	3,00	13,53	3,03	13,46	3,04	13,38	3,06	13,24	3,08
	15,0	15,02	3,10	14,88	3,13	14,73	3,15	14,67	3,17	14,58	3,18	14,44	3,21

Notes

1. The capacities are based on the following conditions:
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
2. The bold cells indicate the standard conditions.
3. The values above are for connecting with the following indoor unit types:
   2.0,2.5,3.5,4.2,5.0,6.0 kW class
   Wall-mounted FTXM-M series
4. Editable data for this drawing are available in the GDE system.

Symbols

TC: Total capacity [kW]

PI: Power input [kW]

① Indoor unit combinations

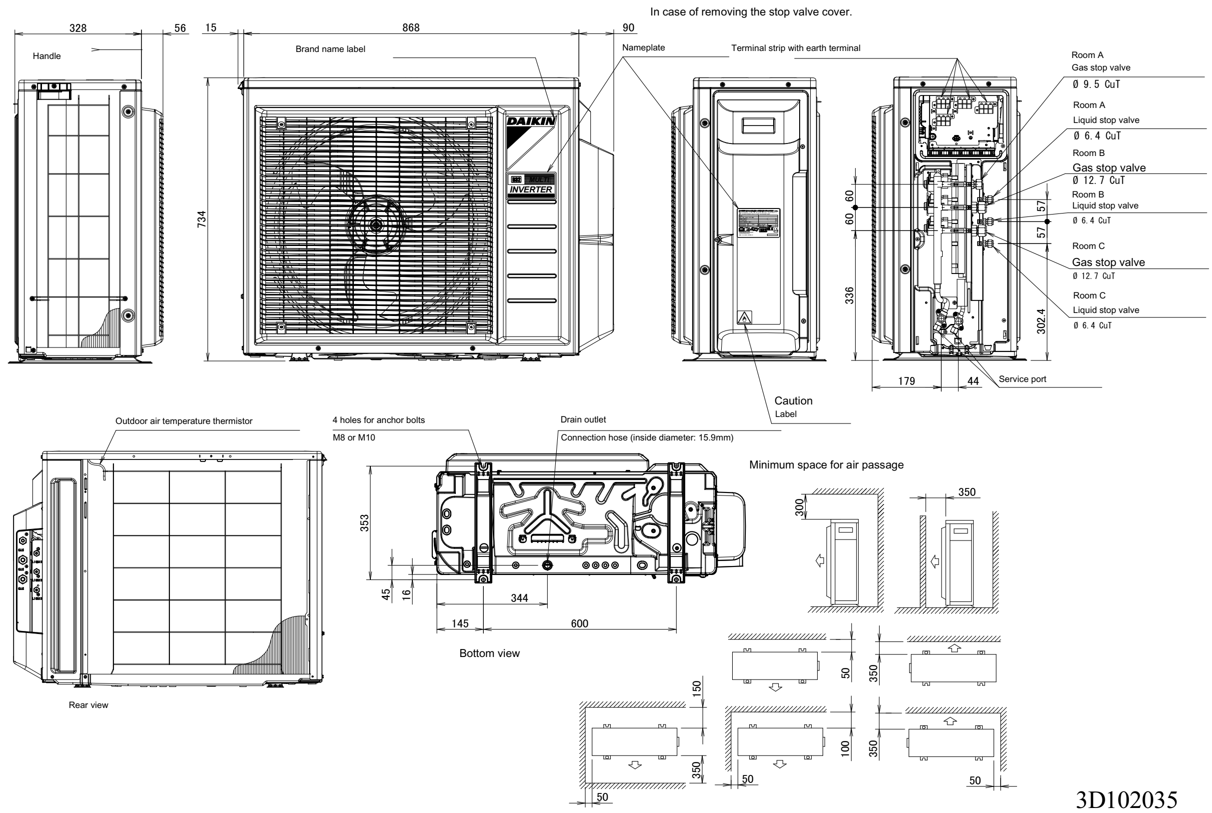
② Outdoor air temperature [°C WB]

3D103890

6 Dimensional drawings

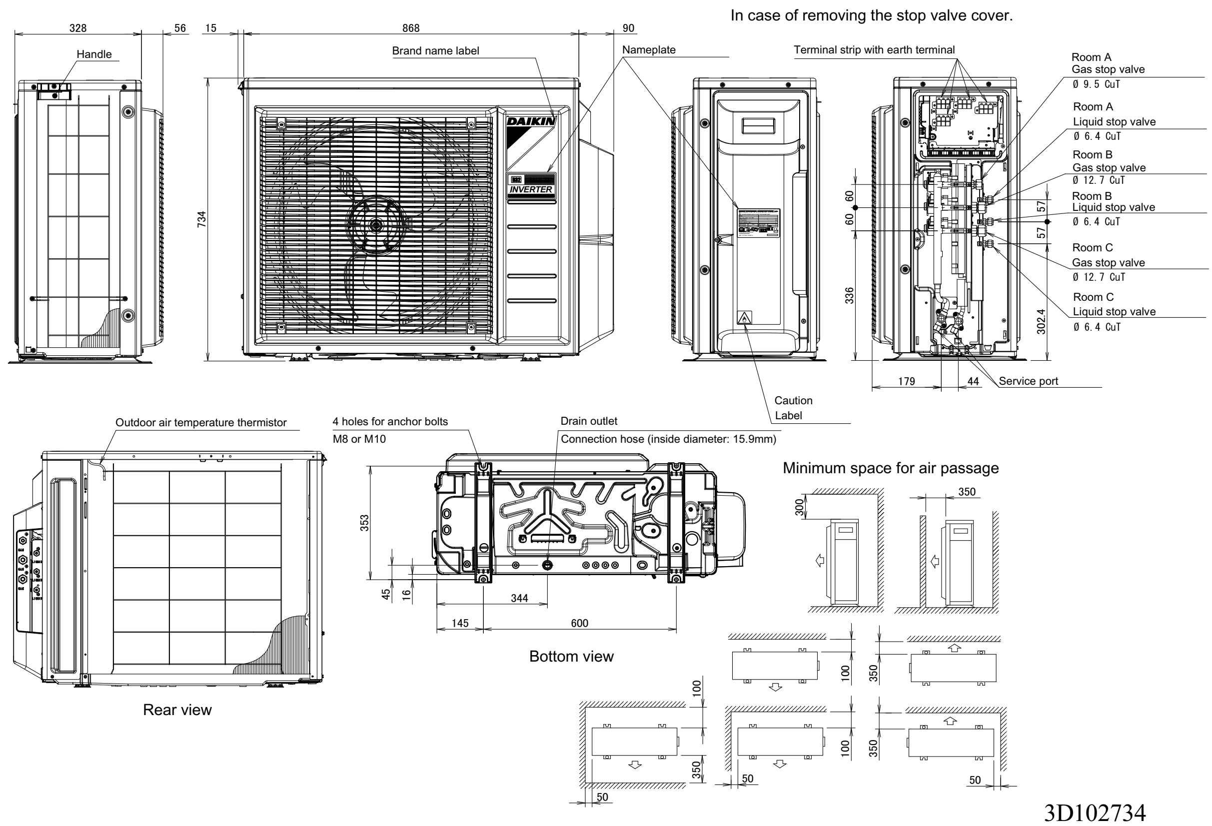
6 - 1 Dimensional Drawings

3MXM40-52M



3D102035

3MXM68M



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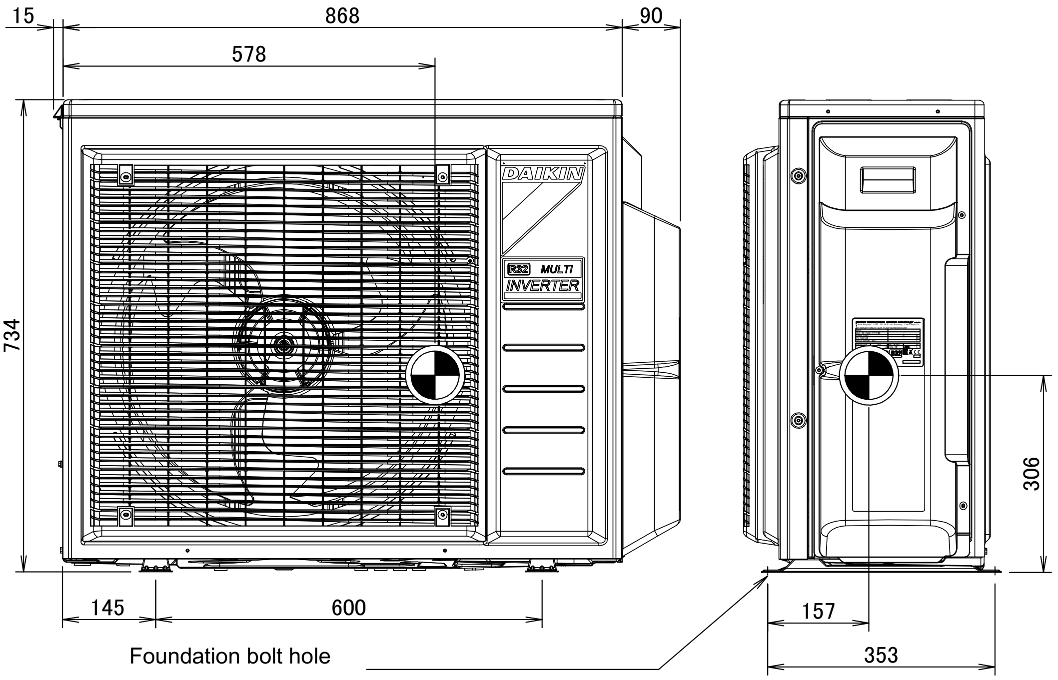
7 Centre of gravity

7 - 1 Centre of Gravity

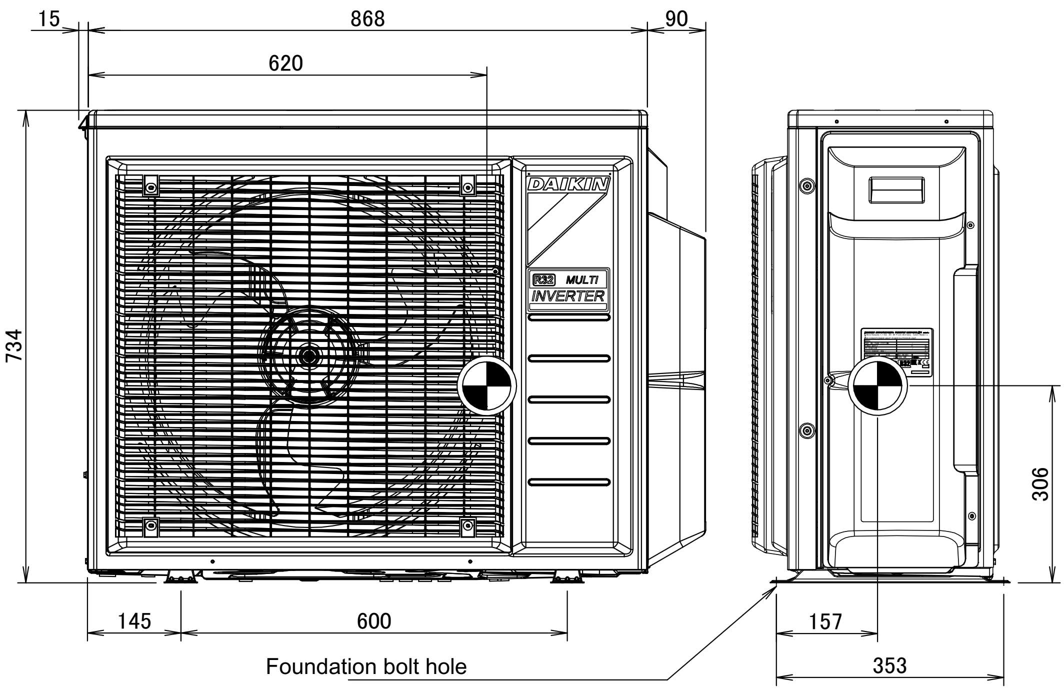
3MXM40-52M



4D102202

7 Centre of gravity
7 - 1 Centre of Gravity

3MXM68M

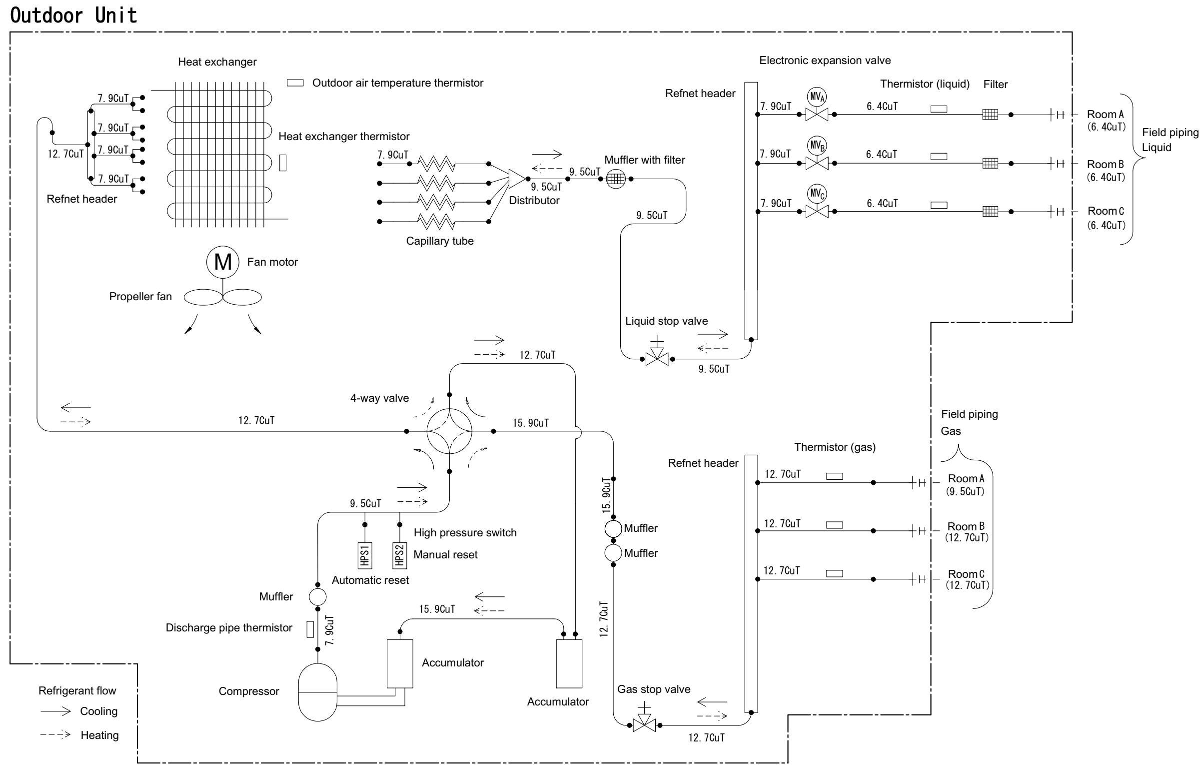


4D102822

8 Piping diagrams

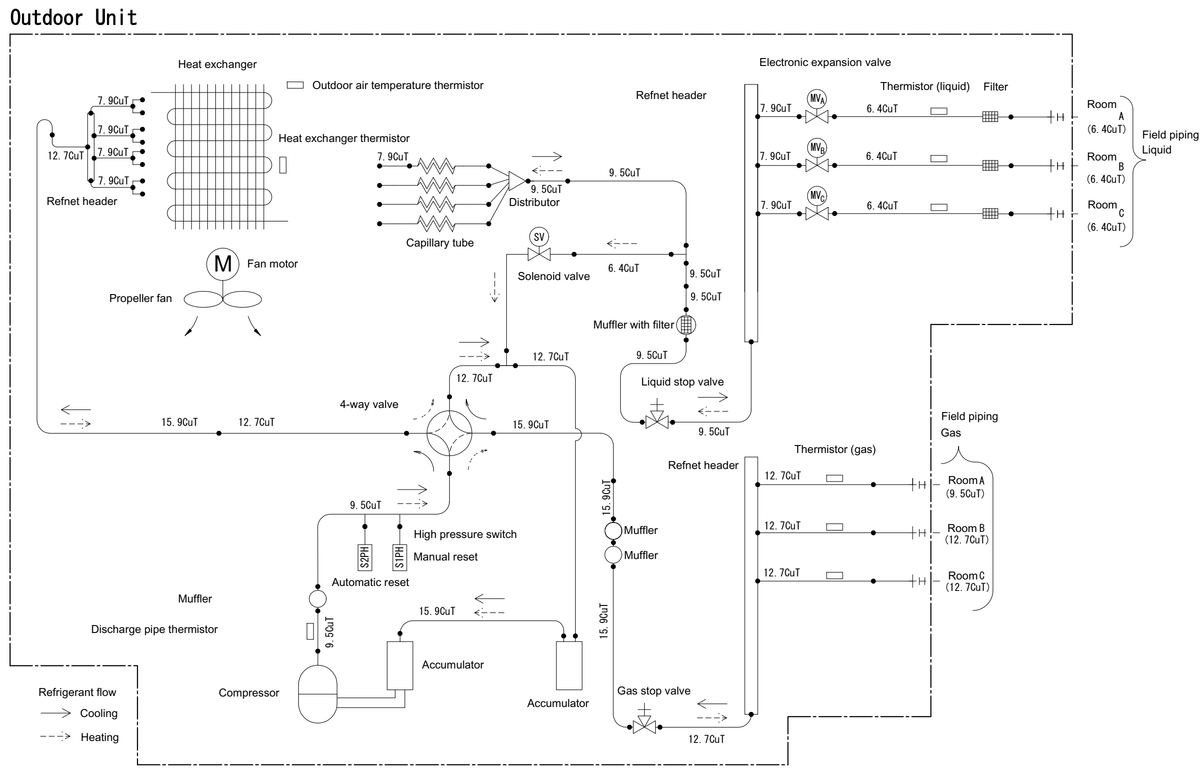
8 - 1 Piping Diagrams

3MXM40-52M



3D097989

3MXM68M

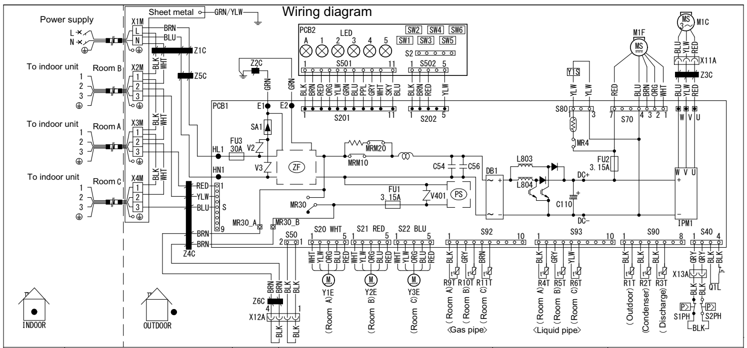


3D100777A

9 Wiring diagrams

9 - 1 Wiring Diagrams - Single Phase

3MXM40-52M



C110, C54, C56	Capacitor	PS	Switching power supply	ZF	Noise filter	
DB1	Diode bridge	Q1L	Overload protector	S, S2–S502	Connector	
FU1, FU2, FU3	Fuse	R1T–R11T	Thermistor	U, V, W	Connector	
IPM1	Intelligent power module	SA1	Surge arrestor	X11A, X12A, X13A, MR30_A, MR30_B	Connector	
L803, L804	Reactor	S1PH, S2PH	High pressure switch		Field wiring	
LED1–5, LEDA	Light-emitting diode	SW1–SW6	Switch		Screw terminal	
M1C	Compressor motor	V2, V3, V401	Varistor		Connector	
M1F	Fan motor	X1M–X4M	Terminal strip with earth terminal	BLK: black	GRY: grey	SKY BLU: sky blue
MRM10, MRM20	Magnetic relay	Y1E–Y3E	Electronic expansion valve coil	BLU: blue	ORG: orange	WHT: white
MR4, MR30	Magnetic relay	Y1S	Reversing solenoid valve coil	BRN: brown	PPL: purple	YLW: yellow
PCB1, PCB2	Printed circuit board	Z1C–Z6C	Ferrite core	GRN: green	RED: red	3P426029-1A

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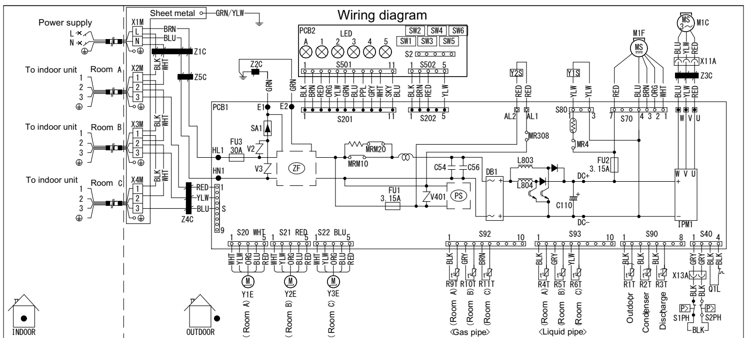
3MXM68M



C110, C54, C56	Capacitor					
DB1	Diode bridge	Q1L	Overload protector	ZF	Noise filter	
FU1, FU2, FU3	Fuse	R1T–R11T	Thermistor	S, S2–S502	Connector	
IPM1	Intelligent power module	SA1	Surge arrestor	U, V, W	Connector	
L803, L804	Reactor	S1PH, S2PH	High pressure switch	X11A, X13A, AL1, AL2	Connector	
LED1–5, LEDA	Light-emitting diode	SW1–SW6	Switch		Field wiring	
M1C	Compressor motor	V2, V3, V401	Varistor		Screw terminal	
M1F	Fan motor	X1M–X4M	Terminal strip with earth terminal		Connector	
MRM10, MRM20	Magnetic relay	Y1E–Y3E	Electronic expansion valve coil	BLK: black	GRY: grey	SKY BLU: sky blue
MR4, MR30, MR308	Magnetic relay	Y1S	Reversing solenoid valve coil	BLU: blue	ORG: orange	WHT: white
PCB1, PCB2	Printed circuit board	Y2S	Solenoid valve	BRN: brown	PPL: purple	YLW: yellow
PS	Switching power supply	Z1C–Z5C	Ferrite core	GRN: green	RED: red	

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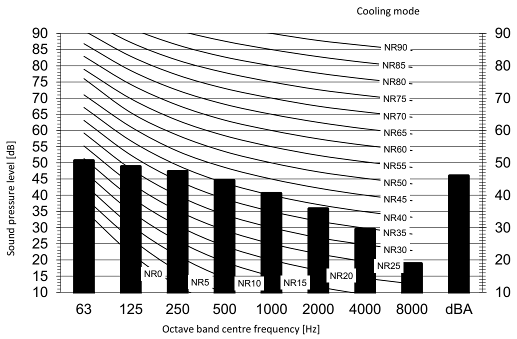
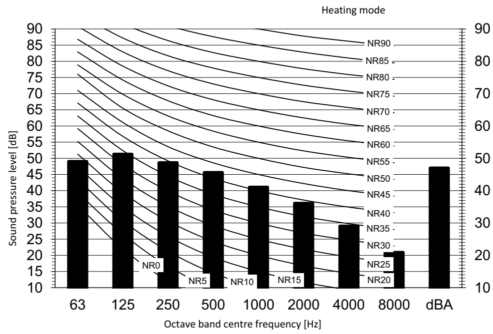
10 Sound data

10 - 1 Sound Pressure Spectrum

3MXM40-52M





Legend

dBA = A-weighted sound pressure level (A scale according to IEC).

A Scale

B High-tap

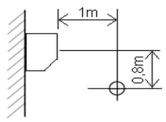
Cooling Total dB

A	B
dBA	46

Heating Total dB

A	B
dBA	47

Location of microphone



Notes

1 . Operating conditions: power source 220-240 V/220 V 50/60 Hz; JIS standard
2 . Background noise already taken into account.
3 . Operating noise varies depending on operation and ambient conditions.
4 . The operation noise measuring method is in accordance with JISC9612.
5 . Measuring location: anechoic chamber

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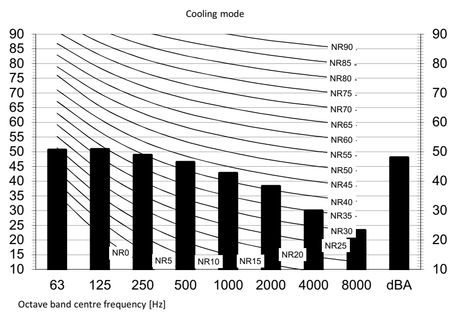
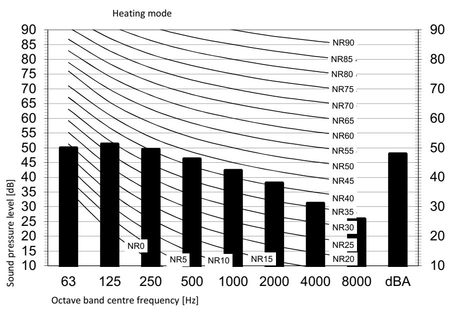
3MXM68M





Legend

dBA = A-weighted sound pressure level (A scale according to IEC).

A Scale

B High-tap

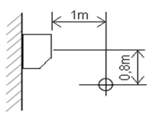
Cooling Total dB

A	B
dBA	48

Heating Total dB

A	B
dBA	49

Location of microphone



Notes

1 . Operating conditions: power source 220-240 V/220 V 50/60 Hz; JIS standard
2 . Background noise already taken into account.
3 . Operating noise varies depending on operation and ambient conditions.
4 . The operation noise measuring method is in accordance with JISC9612.
5 . Measuring location: anechoic chamber

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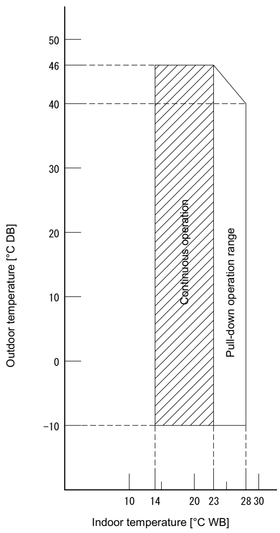
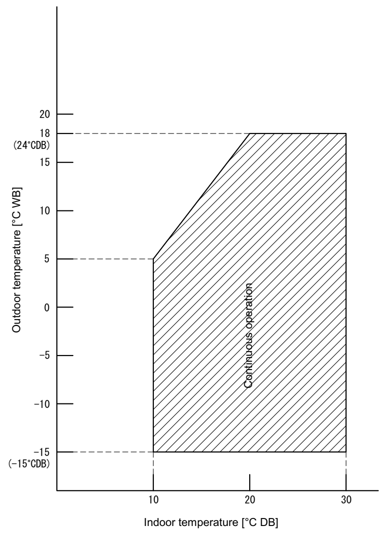
11 Operation range
11 - 1 Operation Range

3MXM-M

Cooling



Heating



Notes
1. The graph is based on the following conditions.
   Corresponding refrigerant piping length: 5 m
   Level difference: 0m
   Air flow rate High

3D101376

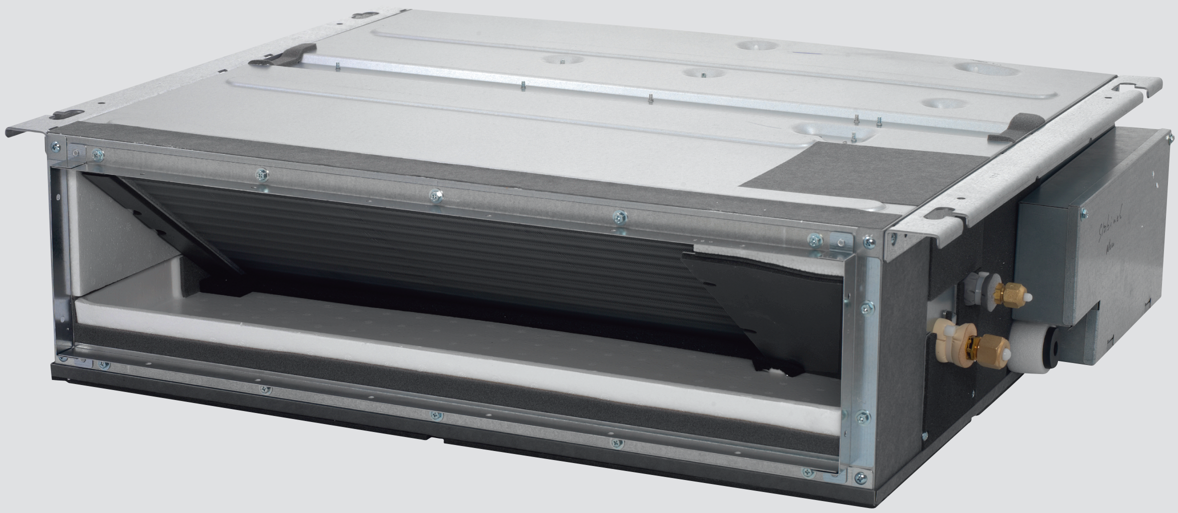
Daikin Europe N.V. Naamloze Vennootschap - Zandvoordestraat 300, B-8400 Oostende - Belgium - www.daikin.eu - BE 0412 120 336 - RPR Oostende

EEDEN XXX-03/16

Daikin Europe N.V. participates in the Eurovent Certification programme for Liquid Chilling Packages (LCP), Air handling units (AHU), Fan coil units (FCU) and variable refrigerant flow systems (VRF) Check ongoing validity of certificate online: www.eurovent-certification.com or using: www.certiflash.com

Air Conditioning
Technical Data

FDXM-F9



> FDXM25F3V1B9
> FDXM35F3V1B9
> FDXM50F3V1B9
> FDXM60F3V1B9

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FDXM-F9

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Electrical Specifications . . . 4

3 Safety device settings . . . 5

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5 Dimensional drawings . . . 7

6 Centre of gravity . . . 8

7 Piping diagrams . . . 10

8 Wiring diagrams . . . 11
Wiring Diagrams - Single Phase . . . 11

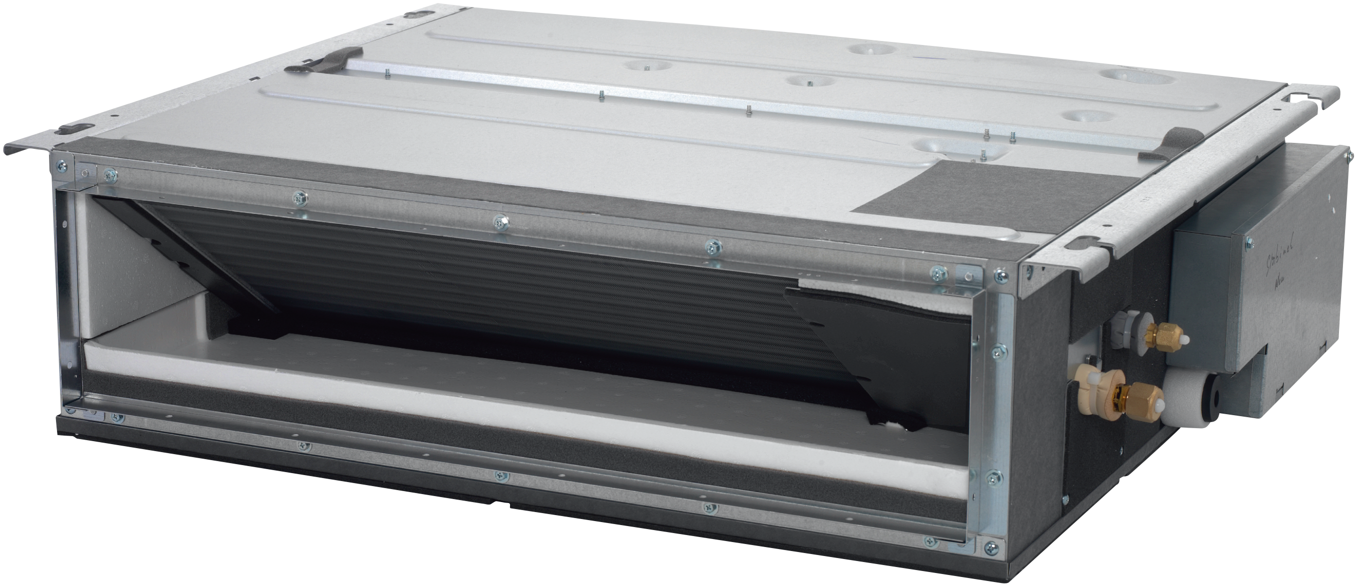
9 Sound data . . . 12
Sound Pressure Spectrum . . . 12

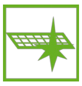
10 Fan characteristics . . . 14

1 Features

Compact concealed ceiling unit, with a height of only 200mm

- Invisible unit as the unit is concealed in the ceiling: only the suction and discharge grilles are visible
- Compact dimensions, can easily be mounted in a ceiling void of only 240mm
- Medium external static pressure up to 40Pa facilitates unit use with flexible ducts of varying lengths
- Unified indoor unit range for R-32 and R-410A
- Auto cleaning filter option ensures maximum efficiency, comfort and reliability by regular filter cleaning
- Multi zoning kit allows multiple individually-controlled climate zones to be served by one indoor unit
- Online controller (optional): control your indoor from any location with an app, via your local network or internet and keep an overview on your energy consumption
- Low energy consumption thanks to DC fan motor




Auto-cleaning filter


Multi zoning


Fan only

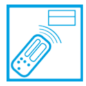

Fan speed steps

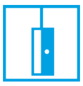
Dry programme


Air filter

Weekly timer

24 hour timer


Infrared remote control

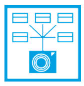

Wired remote control


Centralised control


Online controller via app

Auto-restart


Self diagnosis


Multi model application

2 Specifications

2-1 Technical Specifications					FDXM25F9	FDXM35F9	FDXM50F9	FDXM60F9
Power input	Cooling	Nom.		kW	0.036		0.060	
	Heating	Nom.		kW	0.036		0.060	
Dimensions	Unit	Height/Width/Depth		mm	200/750/620		200/1,150/620	
	Packed unit	Height/Width/Depth		mm	266/922/768		266/1,322/768	
Weight	Unit			kg	21		28	
	Packed unit			kg	24		31	
Heat exchanger	Length			mm	500		900	
	Rows	Quantity			3		2	
	Fin pitch			mm	1.50			
	Stages	Quantity			12			
	Passes	Quantity			2.0		5.0	
	Tube type				ø7 Hi-XD			
	Fin	Type			Multi slit fin			
Air filter	Type				Removable / washable			
Fan	Type				Sirocco fan			
	Air flow rate	Cooling	High	m^3/min	8.7		15.8	16.0
				cfm	307		558	565
			Medium	m^3/min	8.0 (1)		14.6 (1)	14.8 (1)
				cfm	282		516	523
			Low	m^3/min	7.3		13.3	13.5
				cfm	258		467	477
		Heating	High	m^3/min	8.7		15.8	16.0
				cfm	307		558	565
			Medium	m^3/min	8.0 (1)		14.6 (1)	14.8 (1)
				cfm	282		516	523
			Low	m^3/min	7.3		13.3	13.5
				cfm	258		467	477
	External static pressure	Nom.		Pa	30		40	
Fan motor	Model				KFD-280-44-8A		KFD-280-65-8A	
	Speed	Steps			3			
		Cooling	High/Medium/Low	rpm	1,270/1,180/1,090		1,270/1,150/1,030	1,280/1,160/1,040
		Heating	High/Medium/Low	rpm	1,270/1,180/1,090		1,270/1,150/1,030	1,280/1,160/1,040
Sound power level	Cooling			dBA	53.0		55.0	56.0
Sound pressure level	Cooling	High/Medium/Low		dBA	35.0/33.0 (1)/27.0		38.0/35.0 (1)/30.0	
	Heating	High/Medium/Low		dBA	35.0/33.0/27.0		38.0/35.0/30.0	
Refrigerant	Type				R-32 / R-410A			
Piping connections	Liquid	OD			6,35			
	Gas	OD			9.50		12.70	
	Drain				VP20 (I.D. 20/O.D. 26)			
	Heat insulation				Both liquid and gas pipes			
Temperature control					Microcomputer control			

Standard Accessories : Installation manual; Quantity : 1;
Standard Accessories : Operation manual; Quantity : 1;
Standard Accessories : Insulation for fitting; Quantity : 1;
Standard Accessories : Sealing pad; Quantity : 1;
Standard Accessories : Clamp metal; Quantity : 1;
Standard Accessories : Drain hose; Quantity : 1;
Standard Accessories : Washer for hanger bracket; Quantity : 8;
Standard Accessories : Sealing material; Quantity : 2;
Standard Accessories : Clamps; Quantity : 6;

2 Specifications

Standard Accessories : Washer fixing plate; Quantity : 4;
Standard Accessories : Screws for duct flanges; Quantity : 1;
Standard Accessories : Air filter; Quantity : 1;

2-2 Electrical Specifications			FDXM25F9	FDXM35F9	FDXM50F9	FDXM60F9
Power supply	Phase		1~			
	Frequency	Hz	50			
	Voltage	V	220-240			

Notes

(1) See separate drawing for electrical data

3 Safety device settings

3 - 1 Safety Device Settings

FDXM-F9

Safety devices		**FDXM25-60F3V1B(9)**
PCB fuse		250V, 3.15A
Fan motor overcurrent protection	Nominal	1.3A
Fan motor thermal protector	Maximum	125°C

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3

4 Options

4 - 1 Options

FDXM-F9

Option kit	Product name			
	FDXM25F3V1B	FDXM35F3V1B	FDXM50F3V1B	FDXM60F3V1B
Wired remote control	BRC1D52/BRC1D61 BRC1E53A7[(1)(4)]/BRC1E53B7[(2)(4)]/BRC1E53C7[(3)(4)]			
Simplified remote control	BRC2E52C7[(5)]			
Stylish remote control				
Remote control for hotel use	BRC3E52C7[(5)]			
Wireless remote control	BRC4C65			
Central remote control	DCS302CA51/DCS302CA61[(8)]			
Unified ON/OFF controller	DCS301BA51/DCS301BA61[(8)]			
Schedule timer	DST301BA51/DST301BA61[(8)]			
Residential central remote control	DCS303A51[(8)]			
Adaptor for wiring	KRP1B56[(6)]			
Wiring adaptor for electrical appendices 1	KRP2A53[(6)]			
Wiring adaptor for electrical appendices 2	KRP4A54[(6)]			
Remote sensor	KRCS01-4B			
Installation box for adaptor PCB	KRP1BA101			
Electrical box with earth terminal (2 blocks)	KJB212AA			
Electrical box with earth terminal (3 blocks)	KJB311AA			
Noise filter (for electromagnetic interface only)	KEK26-1A			
Insulation kit for high humidity	KDT25N32/KDT25N50/KDT25N63			
Digital input adaptor	BRP7A54[(6)(7)]			
Auto cleaning filter - Small	BAE20A62	BAE20A62	-	-
Auto cleaning filter - Large	-	-	BAE20A102	BAE20A102

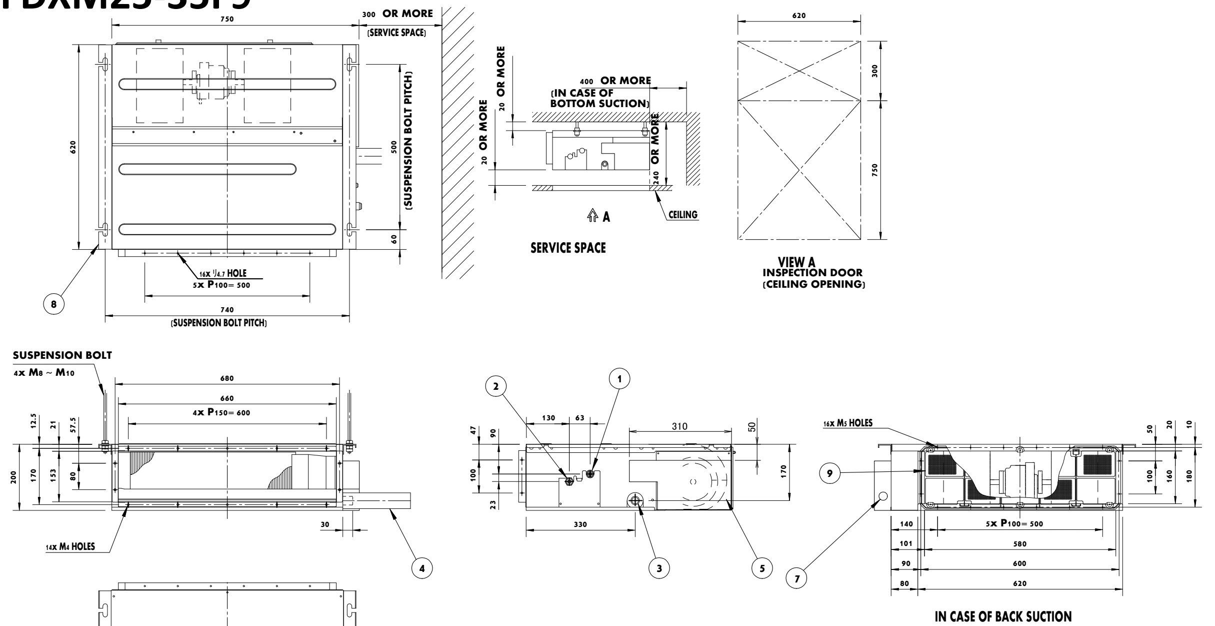
(1) Included languages are: English, German, French, Italian, Spanish, Portuguese, and Dutch.
(2) Included languages are: English, Czech, Croatian, Hungarian, Slovenian, Romanian, and Bulgarian.
(3) Included languages are: English, Russian, Greek, Turkish, Polish, Albanian, and Slovak.
(4) Includes duty rotation functionality
(5) Included languages are:
Language pack 1: English, German, French, Dutch, Spanish, Italian, and Portuguese.
With PC cable EKPCCAB3 in combination with the Updater PC software, you can additionally change the language to:
Language pack 2: English, Bulgarian, Croatian, Czech, Hungarian, Romanian, and Slovenian.
Language pack 3: English, Greek, Polish, Russian, Serbian, Slovak, and Turkish.
(6) Requires installation box 6.
(7) Only possible in combination with simplified remote control BRC2/3E52C7.
(8) For Daikin Middle East only.
(9) For residential use only. Cannot be used with other centralised control equipment.

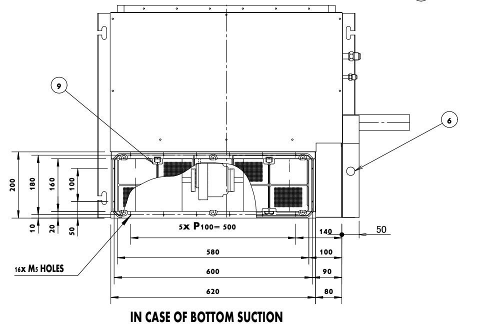
3D110004

5 Dimensional drawings

5 - 1 Dimensional Drawings

FDXM25-35F9





ITEM	NAME	DESCRIPTION
1	LIQUID PIPE CONNECTION	Ø6.4 FLARE CONNECTION
2	GAS PIPE CONNECTION	Ø9.5 FLARE CONNECTION
3	SOCKET FOR DRAIN	VP20 (OD Ø26, ID Ø20)
4	DRAIN HOSE (ACCESSORY)	ID Ø25 (OUTLET)
5	CONTROL BOX	.
6	TRANSMISSION WIRING	.
7	POWER SUPPLY CONNECTION	.
8	SUSPENSION BRACKET	.
9	AIR FILTER (ACCESSORY)	.

NOTES :

1. IN CASE OF BACK SUCTION,
   MOUNT CHAMBER COVER TO BOTTOM SIDE OF THE UNIT.
   IN CASE OF BOTTOM SUCTION,
   MOUNT CHAMBER COVER TO BACK SIDE OF THE UNIT.
2. LOCATION OF UNIT NAME PLATE: CONTROL BOX COVER.
3. MOUNT THE AIR FILTER AT THE SUCTION SIDE.
   (USE AN AIR FILTER WHOSE DUST COLLECTING EFFICIENCY IS AT LEAST 50% IN A GRAVIMETRIC TECHNIQUE).
   IT CAN NOT BE EQUIPPED WITH AIR FILTER (ACCESSORY) WHEN CONNECTING DUCT TO SUCTION SIDE.

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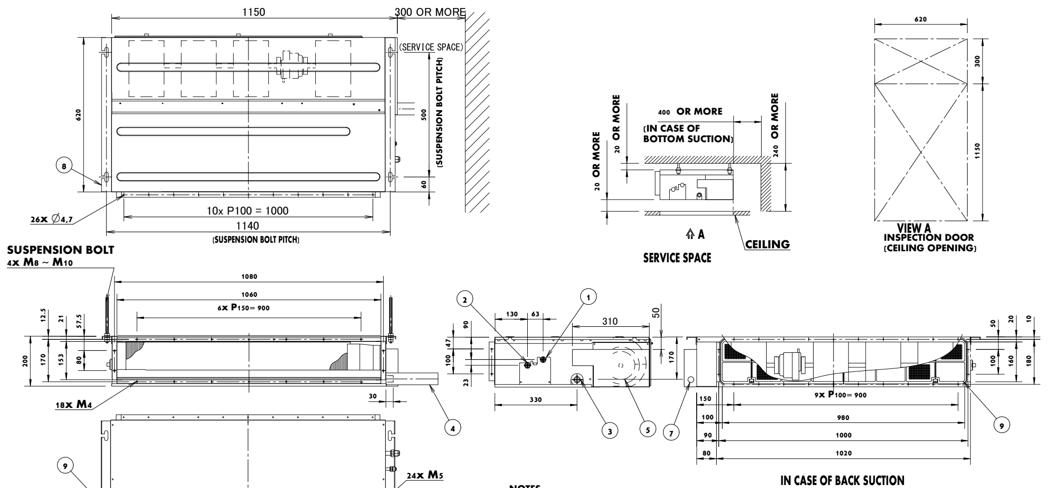
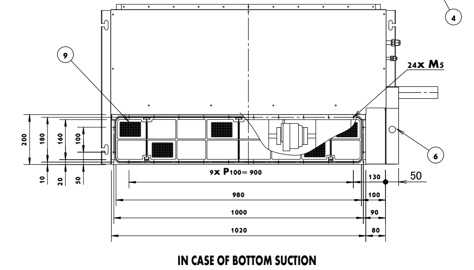
FDXM50-60F9





NOTES :

1. IN CASE OF BACK SUCTION,
   MOUNT CHAMBER COVER TO BOTTOM SIDE OF THE UNIT.
   IN CASE OF BOTTOM SUCTION,
   MOUNT CHAMBER COVER TO BACK SIDE OF THE UNIT.
2. LOCATION OF UNIT NAME PLATE: CONTROL BOX COVER.
3. MOUNT THE AIR FILTER AT THE SUCTION SIDE.
   (USE AN AIR FILTER WHOSE DUST COLLECTING EFFICIENCY IS AT LEAST 50% IN A GRAVIMETRIC TECHNIQUE).
   IT CAN NOT BE EQUIPPED WITH AIR FILTER (ACCESSORY) WHEN CONNECTING DUCT TO SUCTION SIDE.

ITEM	NAME	DESCRIPTION
1	LIQUID PIPE CONNECTION	Ø6.4 FLARE CONNECTION
2	GAS PIPE CONNECTION	Ø12.7 FLARE CONNECTION
3	SOCKET FOR DRAIN	VP20 (OD Ø26, ID Ø20)
4	DRAIN HOSE (ACCESSORY)	ID Ø25 (OUTLET)
5	CONTROL BOX	.
6	TRANSMISSION WIRING	.
7	POWER SUPPLY CONNECTION	.
8	SUSPENSION BRACKET	.
9	AIR FILTER (ACCESSORY)	.

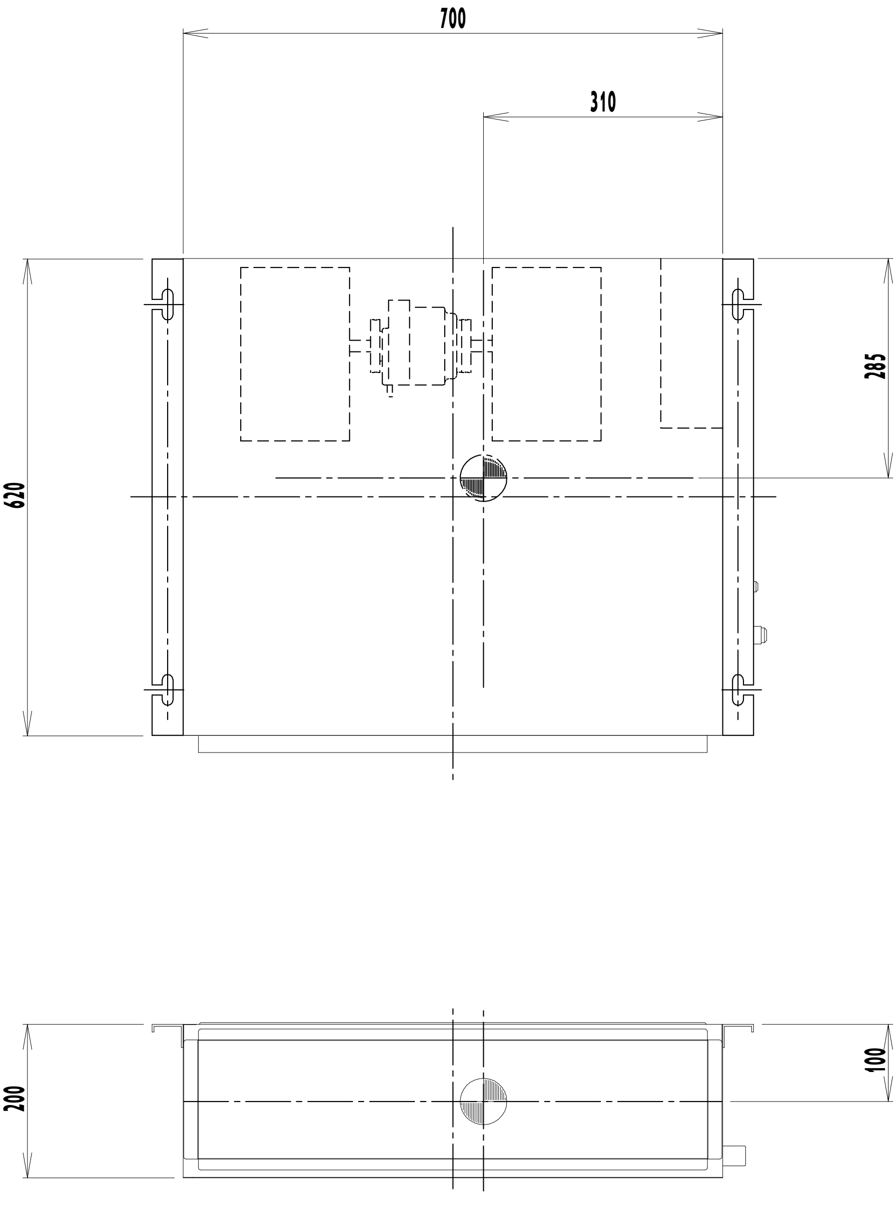
3D081360

6 Centre of gravity

6 - 1 Centre of Gravity

6

FDXM25-35F9



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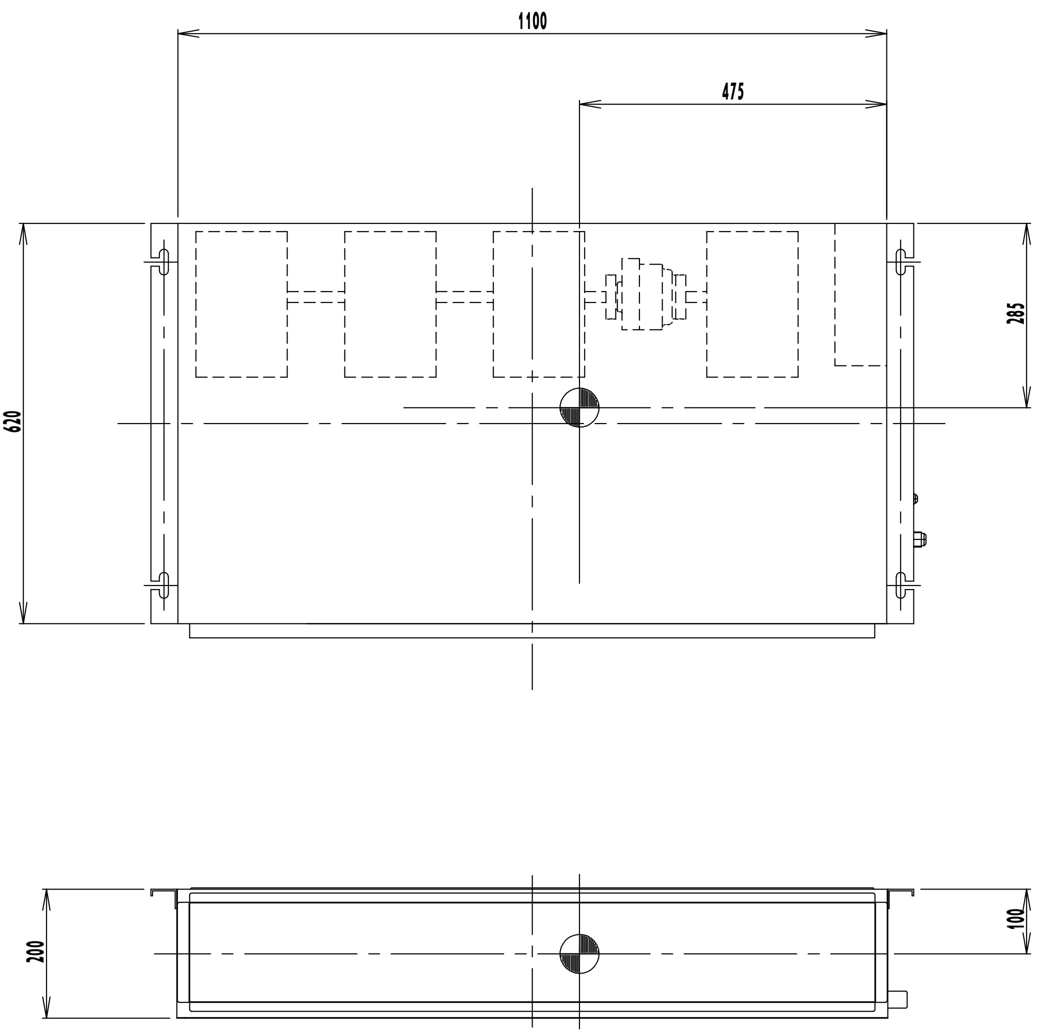
6 Centre of gravity
6 - 1 Centre of Gravity

FDXM50-60F9

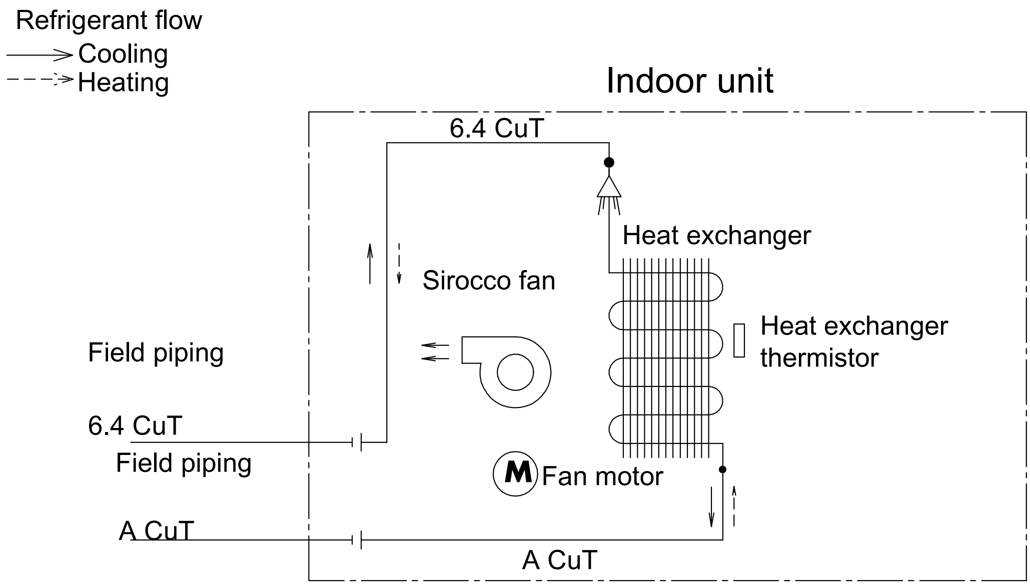


4D081339A

7 Piping diagrams

7 - 1 Piping Diagrams

FDXM-F9



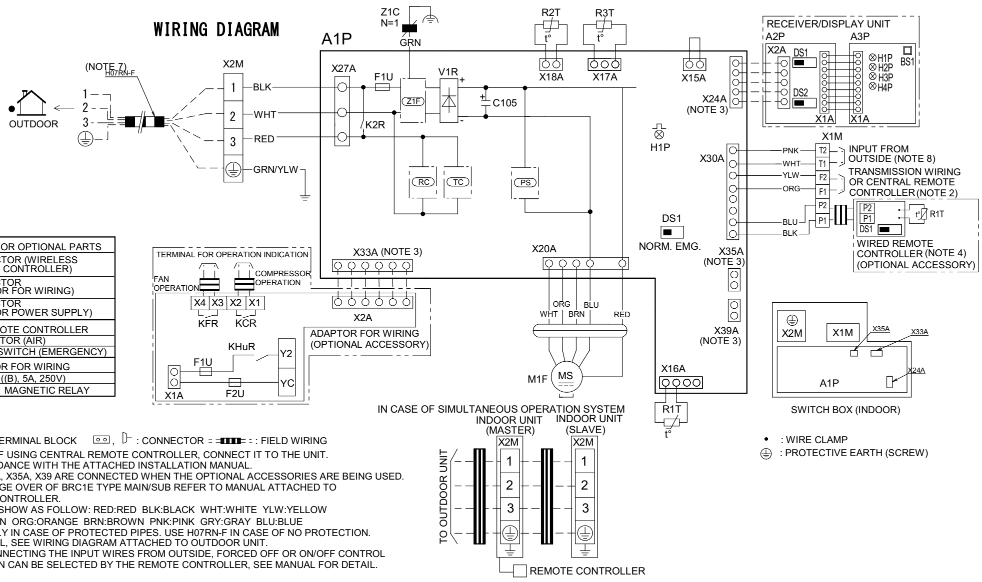
	A
FDXS25F2VEB	
FDXS35F2VEB	
FNQ25A2VEB	
FNQ35A2VEB	
FDXM25F2V1B	
FDXM25F3V1B9	9.5
FDXM35F2V1B	
FDXM25F3V1B	
FDXM35F3V1B	
FDXM35F3V1B9	
FDXS50F2VEB	
FDXS60F2VEB	
FDXS50F2VEB9	
FNQ50A2VEB	
FNQ60A2VEB	
FDXM50F2V1B	12.7
FDXM50F3V1B9	
FDXM60F2VEB	
FDXM50F3V1B	
FDXM60F3V1B	
FDXM60F3V1B9	

4D081335F

8 Wiring diagrams

8 - 1 Wiring Diagrams - Single Phase

FDXM-F9



INDOOR UNIT	
A1P	PRINTED CIRCUIT BOARD
C105	CAPACITOR
F1U	FUSE (F, 3,15A, 250V)
K2R	MAGNETIC RELAY
(PS)	POWER SUPPLY CIRCUIT
(RC)	RECEIVING CIRCUIT
(TC)	TRANSMISSION CIRCUIT
H1P	LIGHT EMITTING DIODE (SERVICE MONITOR-GREEN)
M1F	MOTOR (FAN)
R1T	THERMISTOR (AIR)
R2T,R3T	THERMISTOR (COIL)
DS1	SELECTOR SWITCH (EMERGENCY)
V1R	DIODE BRIDGE
X1M	TERMINAL STRIP (CONTROL)
X2M	TERMINAL STRIP (POWER SUPPLY)
Z1C	FERRITE CORE (NOISE FILTER)
Z1F	NOISE FILTER

RECEIVER/DISPLAY UNIT	
A2P	PRINTED CIRCUIT BOARD
A3P	PRINTED CIRCUIT BOARD
H1P	LIGHT EMITTING DIODE (ON-RED)
H2P	LIGHT EMITTING DIODE (FILTER SIGN-RED)
H3P	LIGHT EMITTING DIODE (TIMER-GREEN)
H4P	LIGHT EMITTING DIODE (DEFROST-ORANGE)
DS1	SELECTOR SWITCH (MAIN/SUB)
DS2	SELECTOR SWITCH(WIRELESS ADDRESS SET)
BS1	PUSH BUTTON (ON/OFF)

CONNECTOR FOR OPTIONAL PARTS	
X24A	CONNECTOR (WIRELESS REMOTE CONTROLLER)
X33A	CONNECTOR (ADAPTOR FOR WIRING)
X35A	CONNECTOR (ADAPTOR POWER SUPPLY)

WIRED REMOTE CONTROLLER	
R1T	THERMISTOR (AIR)
DS1	SELECT SWITCH (EMERGENCY)

ADAPTOR FOR WIRING	
F1U, F2U	FUSE ((B), 5A, 250V)
KFR,KCR, KHuR	MAGNETIC RELAY

NOTES:

1. : TERMINAL BLOCK , : CONNECTOR : FIELD WIRING
2. IN CASE OF USING CENTRAL REMOTE CONTROLLER, CONNECT IT TO THE UNIT. IN ACCORDANCE WITH THE ATTACHED INSTALLATION MANUAL.
3. X24A, X33A, X35A, X39 ARE CONNECTED WHEN THE OPTIONAL ACCESSORIES ARE BEING USED.
4. FOR CHANGE OVER OF BRC1E TYPE MAIN/SUB REFER TO MANUAL ATTACHED TO REMOTE CONTROLLER.
5. SYMBOLS SHOW AS FOLLOW: RED:RED BLK:BLACK WHT:WHITE YLW:YELLOW GRN:GREEN ORG:ORANGE BRN:BROWN PNK:PINK GRY:GRAY BLU:BLUE
6. SHOW ONLY IN CASE OF PROTECTED PIPES. USE H07RN-F IN CASE OF NO PROTECTION.
7. FOR DETAIL, SEE WIRING DIAGRAM ATTACHED TO OUTDOOR UNIT.
8. WHEN CONNECTING THE INPUT WIRES FROM OUTSIDE, FORCED OFF OR ON/OFF CONTROL OPERATION CAN BE SELECTED BY THE REMOTE CONTROLLER, SEE MANUAL FOR DETAIL.

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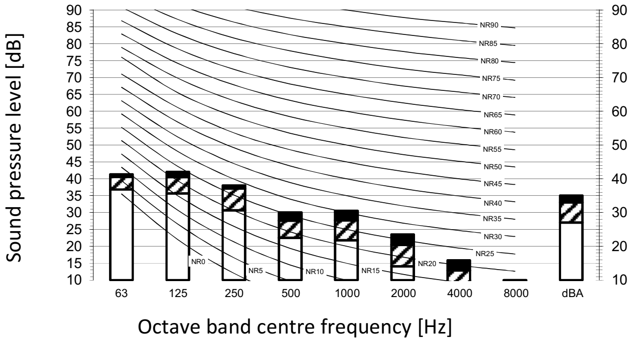
9 Sound data

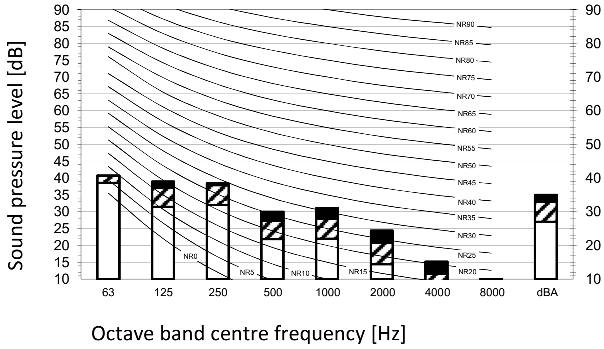
9 - 1 Sound Pressure Spectrum

FDXM25-35F9

Cooling mode



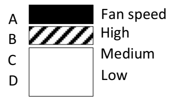
Heating mode



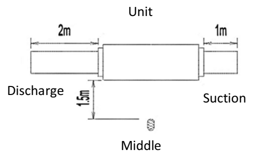
Legend

dBA = A-weighted sound pressure level (A scale according to IEC).

Scale



Location of microphone



Cooling — Total dB

A	B	C	D
dBA	35,0	33,0	27,0

Heating — Total dB

A	B	C	D
dBA	35,0	33,0	27,0

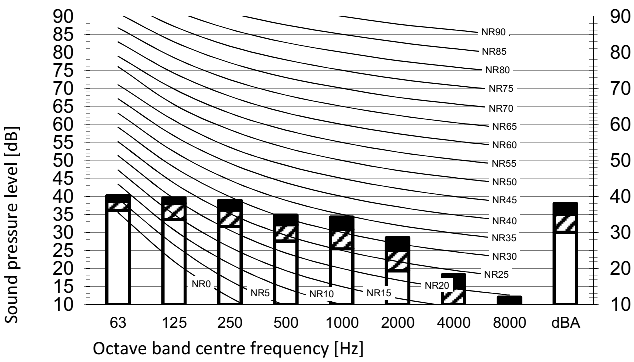
Notes

1 . Operating conditions: power source 220-240V 50Hz; JIS standard
2 . Background noise already taken into account.
3 . Operating noise varies depending on operation and ambient conditions.
4 . The operation noise measuring method is in accordance with JISC9612.
5 . Measuring location: anechoic chamber

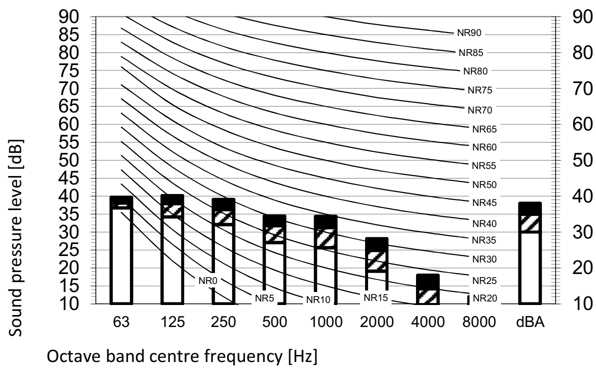
3D110007A

FTXM50F9

Cooling mode



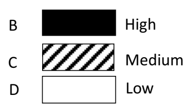
Heating mode



Legend

dBA = A-weighted sound pressure level (A scale according to IEC).

A Scale Fan speed



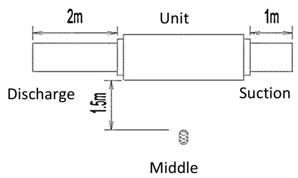
Cooling — Total dB

A	B	C	D
dBA	38,0	35,0	30,0

Heating — Total dB

A	B	C	D
dBA	38,0	35,0	30,0

Location of microphone



Notes

1 . Operating conditions: power source 220-240V 50Hz; JIS standard
2 . Background noise already taken into account.
3 . Operating noise varies depending on operation and ambient conditions.
4 . The operation noise measuring method is in accordance with JISC9612.
5 . Measuring location: anechoic chamber

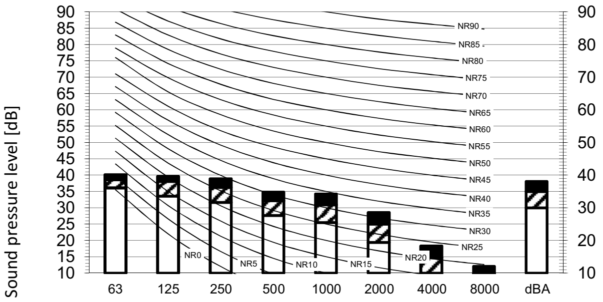
3D110009A

9 Sound data

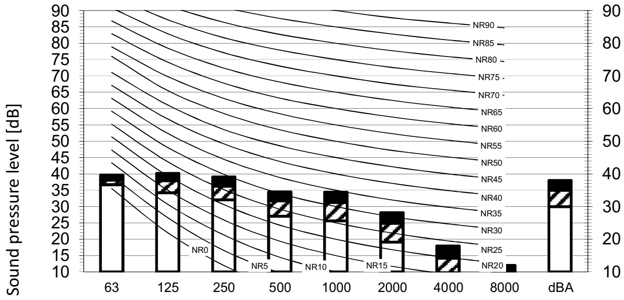
9 - 1 Sound Pressure Spectrum

FDXM60F9

Cooling mode



Heating mode

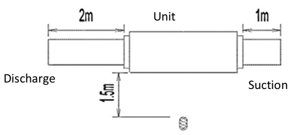


Legend

dBA = A-weighted sound pressure level
(A scale according to IEC).

Scale	Fan speed
A	High
B	Medium
C, D	Low

Location of microphone



Cooling — Total dB

A	B	C	D
dBA	38,0	35,0	30,0

Heating — Total dB

A	B	C	D
dBA	38,0	35,0	30,0

Notes

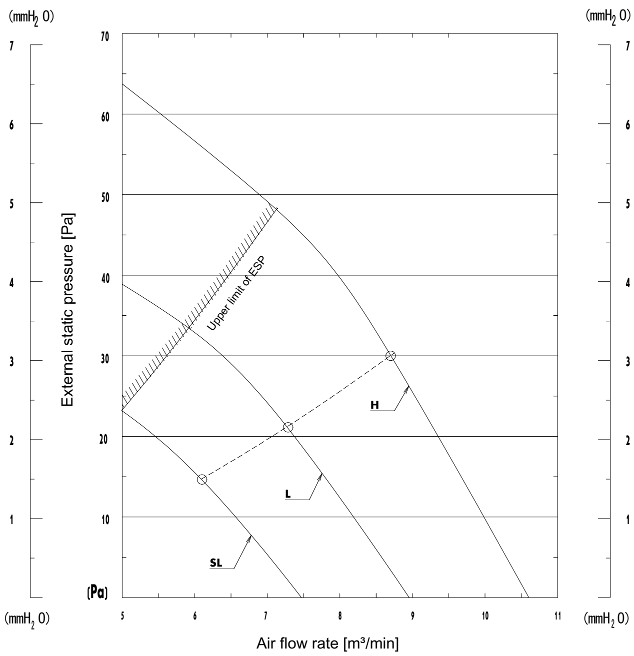
1. Operating conditions: power source 220-240V 50Hz; JIS standard
2. Background noise already taken into account.
3. Operating noise varies depending on operation and ambient conditions.
4. The operation noise measuring method is in accordance with JISC9612.
5. Measuring location: anechoic chamber

3D110010A

10 Fan characteristics

10 - 1 Fan Characteristics

FDXM25-35F9



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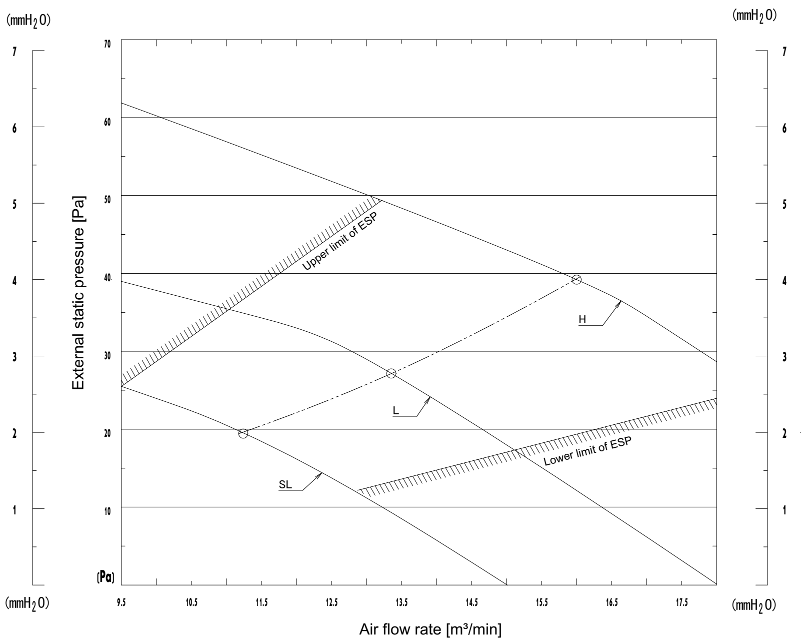
FDXM50F9



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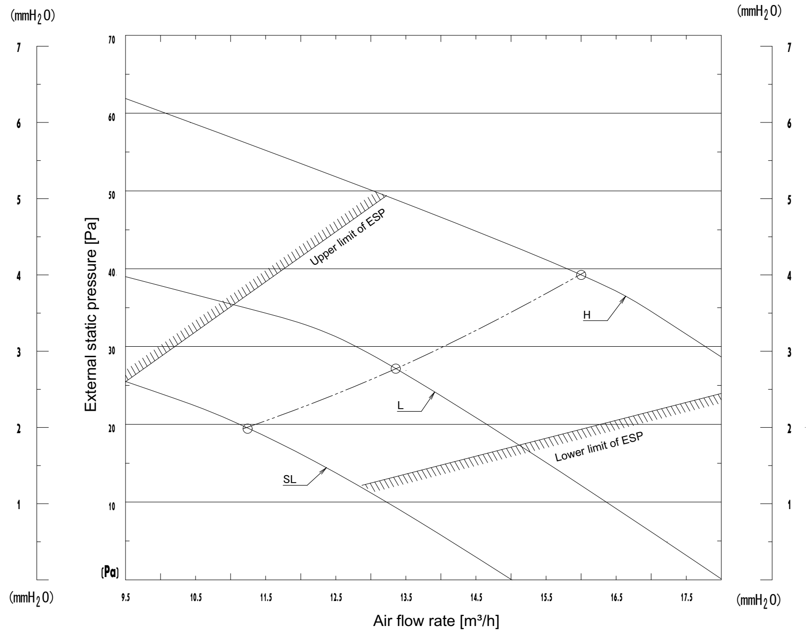
10 Fan characteristics

10 - 1 Fan Characteristics

FDXM60F9



3D081329C

10

Daikin Europe N.V. Naamloze Vennootschap - Zandvoordestraat 300, B-8400 Oostende - Belgium - www.daikin.eu - BE 0412 120 336 - RPR Oostende

MIX
Paper from responsible sources
FSC® C109049

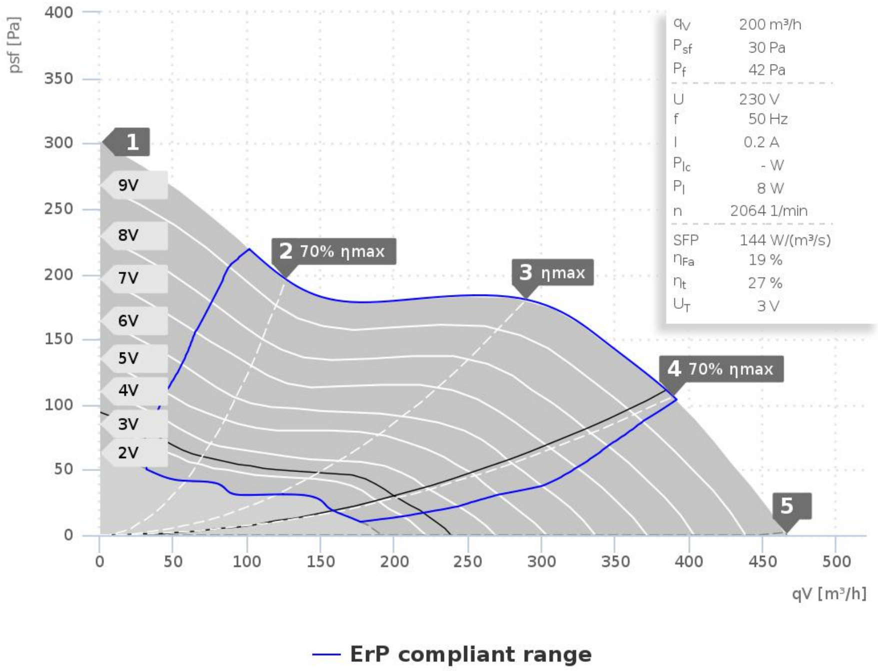
EEDEN19 10/18

Daikin Europe N.V. participates in the Eurovent Certified Performance programme for Liquid Chilling Packages and Hydronic Heat Pumps, Fan Coil Units and Variable Refrigerant Flow systems. Check ongoing validity of certificate: www.eurovent-certification.com

ISO 9001 · ISO 14001

DATA SHEET

EM 125L EC 02 | 145804

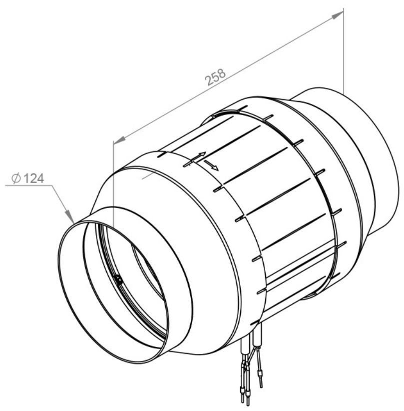


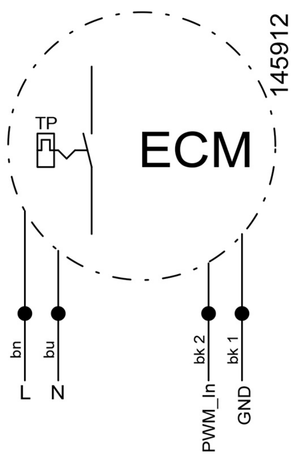
- Diagonal impeller with downstream three-dimensional guide vanes
- EC motor
- Integrated electronic
- Variable speed control
- Internal electronic temperature monitoring
- Plastic housing

Operating Point		1	2	3	4	5
Current I	A	0,3	0,3	0,4	0,4	0,4
Power consumption P_1	W	31	27	41	46	43
RPM n	1/min	3798	3788	3807	3811	3808
SPL inlet L_{WA5}	dB(A)	71	69	70	70	70
SPL outlet L_{WA6}	dB(A)	71	70	72	70	71
SPL casing break out L_{WA2}	dB(A)	55	55	55	54	57

Sound power (L_W) dB(A)		Medium Frequency Band								
		Σ	63	125	250	500	1k	2k	4k	8k
Inlet	L_{WA5}	55	27	30	38	51	51	47	38	27
Outlet	L_{WA6}	54	28	34	45	50	50	47	41	29
Casing	L_{WA2}	41	34	29	35	36	31	28	18	-

EM 125L EC 02 | 145804	
Voltage U_N	230 V 1~
Current I_{max}	0,4 A
Ambient temperature t_A	40 °C
Medium temperatures t_M	40 °C
Speed Control	PWM
Motor Protection	TEC
Isolation Class	F
Weight	1,2 kg





Print 16.05.2019

Data Sheet

SP15

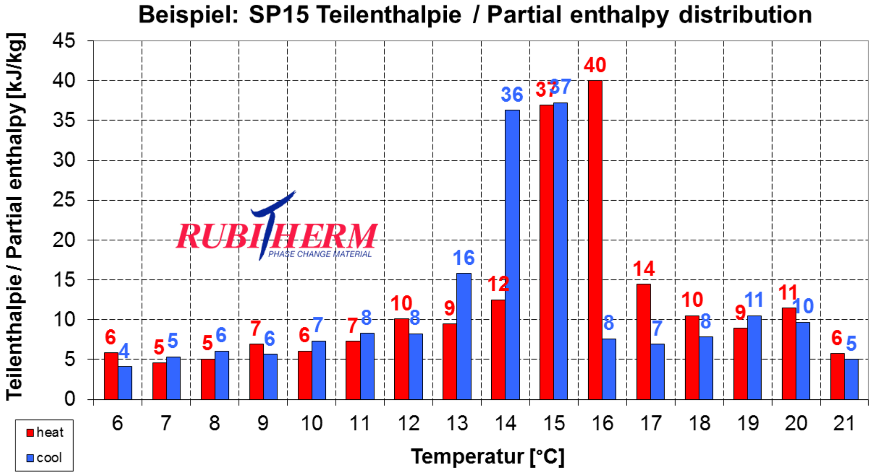
The creation of the latent heat blended material RUBITHERM® SP has led to a new and innovative class of low flammability PCM. RUBITHERM® SP consists of a unique composition of inorganic components.
RUBITHERM® SP is preferably used as macroencapsulated material. Densities of 1,0 kg/l and more can be achieved. This and all properties mentioned below make RUBITHERM® SP to the preferred PCM used in the construction industry. Both passive and active cooling can easily be realized e.g. in wall elements and air conditioners.
We look forward to discussing your particular questions, needs and interests with you.

Properties:
- stable performance throughout the phase change cycles
- high thermal storage capacity per volume
- limited supercooling (2-3K depenndig on volume and cooling rate),
- low flammability, non toxic
- different melting temperatures between -50°C und 70°C are available

The most important data:

	Typical Values	
Melting area	**15-17** main peak: 15	**[°C]**
Congealing area	**15-13** main peak: 15	**[°C]**
Heat storage capacity ± 7,5%	**180**	**[kJ/kg]**
Combination of sensible and latent heat in a temperatur range of 6 °C to 21°C.	**50**	**[Wh/kg]***
Specific heat capacity	**2**	**[kJ/kg·K]***
Density solid at 10 °C	**~1,4**	**[kg/l]**
Density liquid at 20 °C	**~1,35**	**[kg/l]**
Volume expansion	**3-4**	**[%]**
Heat conductivity	**0,6**	**[W/(m·K)]**
Max. operation temperature	**45**	**[°C]**
Corrosion	**corrosive effect on metals**	

Note: The product must be initialized (melt, homogenize and cool to 0 ° C) once before use to achieve the specified properties.
Many SP-product are hygroscopic and may absorb moisture if stored improperly. This can result in a change of the physical properties given.



*Measured with 3-layer-calorimeter.

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D-12307 Berlin
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Fax: +49 (30) 7109622-22
E-Mail: info@rubitherm.com
Internet: www.rubitherm.com

Data sheet

RT18HC

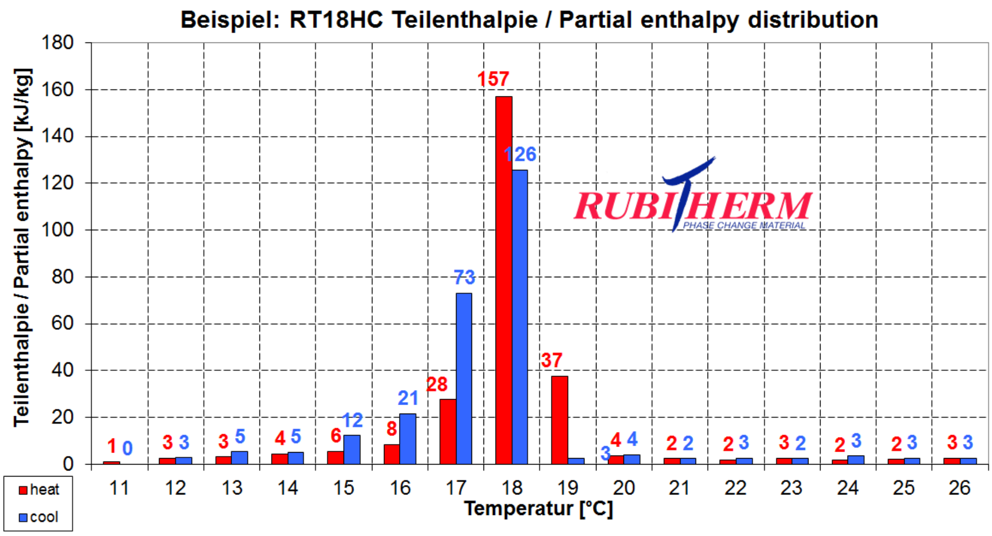
RUBITHERM® RT is a pure PCM, this heat storage material utilising the processes of phase change between solid and liquid (melting and congealing) to store and release large quantities of thermal energy at nearly constant temperature. The RUBITHERM® phase change materials (PCM's) provide a very effective means for storing heat and cold, even when limited volumes and low differences in operating temperature are applicable.

We look forward to discussing your particular questions, needs and interests with you.

Properties for RT-line:
- high thermal energy storage capacity
- heat storage and release take place at relatively constant temperatures
- no supercooling effect, chemically inert
- long life product, with stable performance through the phase change cycles
- melting temperature range between -9 °C and 100 °C available

The most important data:

	Typical Values	
Melting area	**17-19** main peak: 18	**[°C]**
Congealing area	**19-17** main peak: 17	**[°C]**
Heat storage capacity ± 7,5%	**260**	**[kJ/kg]***
Combination of latent and sensible heat in a temperatur range of 11°C to 26°C.	**72**	**[Wh/kg]***
Specific heat capacity	**2**	**[kJ/kg·K]**
Density solid at 15 °C	**0,88**	**[kg/l]**
Density liquid at 25 °C	**0,77**	**[kg/l]**
Heat conductivity (both phases)	**0,2**	**[W/(m·K)]**
Volume expansion	**12,5**	**[%]**
Flash point	**135**	**[°C]**
Max. operation temperature	**50**	**[°C]**



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D-12307 Berlin
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Fax: +49 (30) 7109622-22
E-Mail: info@rubitherm.com
Internet: www.rubitherm.com

The product information given is a non-binding planning aid, subject to technical changes without notice. Version: 06.08.2018

Measured with 3-layer-calorimeter.

Manual – BW-series

ELECTRICAL BALL VALVES

Energy efficient and robust electrical ball valve with wide field of application. Common applications include ventilation, heating systems, solar water heaters, irrigation systems and industrial equipment.

Features	Value
Media	Neutral liquids and gases.
Medium Temperature	-10..110°C
Ambient Temperature	-10..50°C
Operating pressure	0..10 bar
IP-rating	IP54

All ball valves of the BW series are compatible with the actuators from the AW1 series. The tables below are showing the different versions. The product code of a complete electric ball valve is composed of the code for the actuator and the ball valve.

Example Product Code:

2-way Valve — Actuator — 230V AC Voltage

BW2 – 012 – AW1 – R230AC

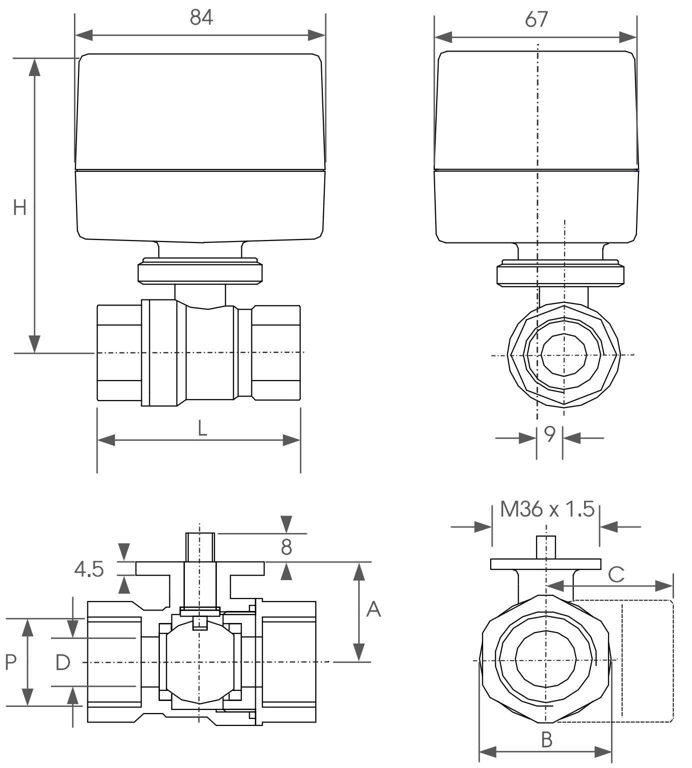
Pipe Thread G1/2" — Internal Relay On/Off

Overview Actuators

Product Code	Power Supply	Operation	P (W)	Open	T (Nm)
AW1-230AC	230V~50Hz	3 way	5W	16s	4
AW1-R230AC	230V~50Hz	On/Off	5W	16s	4
AW1-024AC	24V~50Hz	3 way	5W	16s	4
AW1-R024AC	24V~50Hz	On/Off	5W	16s	4
AW1-024DC	24V DC	3 way	3W	6s	2.5
AW1-R024DC	24V DC	On/Off	3W	6s	2.5
AW1-012DC	12V DC	3 way	3W	6s	2.5
AW1-R012DC	12V DC	On/Off	3W	6s	2.5

Overview Ball Valves

Code	Pipe (P)	Function	Orifice (D)	Kv (m^3/h)	AxBxC (mm)	LxH (mm)
BW2-012	G1/2"	2/2 way	12 mm	8.6	28x28	50x113
BW2-034	G3/4"	2/2 way	15 mm	21	30x35	58x115
BW2-100	G1"	2/2 way	20 mm	26	35x45	73x120
BW3-012	G1/2"	3/2 way	10 mm	6.4	28x28x28	54x113
BW3-034	G3/4"	3/2 way	13 mm	10	30x35x40	70x115
BW3-100	G1"	3/2 way	18 mm	16	35x45x45	83x120



1.

2. TECHNICAL OVERVIEW

1.1. Principle of operation

Ball valves control the flow of a fluid or gas by means of a rotating ball with a hole. By rotating the ball 90° around its axis, the valve will for example open or close. The valve can have two or three connection ports (2-way or 3-way). The three-way balls have a T-shaped hole. Therefore, different switching schemes are possible. Electric ball valves are actuated with an electric motor. The AW1 actuator features a transmission to arrange a smooth and slow opening and closing with a high torque. The AW1 actuator is equipped with two limit switches. Once the actuator reaches one of the two end positions (90° rotation), the power supply to the electric motor shuts down and no electrical power is needed to stay in the end positions.

The AW1 actuator is available with 3-point control or On/Off control with internal relay (see Chapter 3.3).

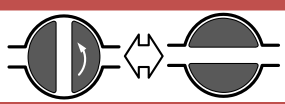
1.2. Materials

Component	Material
Valve body	Brass (EN: CW617N, CuZn40Pb2)
Ball seal	PTFE
O-ring	EPDM
Actuator housing	PC GF10 (polycarbonate)
Actuator coupling	POM (Polyoxymethylene)

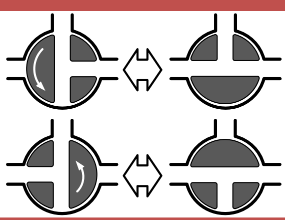
1.3. Circuit Diagram

The table below shows the circuit functions of the ball valves. The 2-way ball valves are open or closed. The 3-way ball valves can be arranged in two different ways (by rotating the ball 180°).

2-way

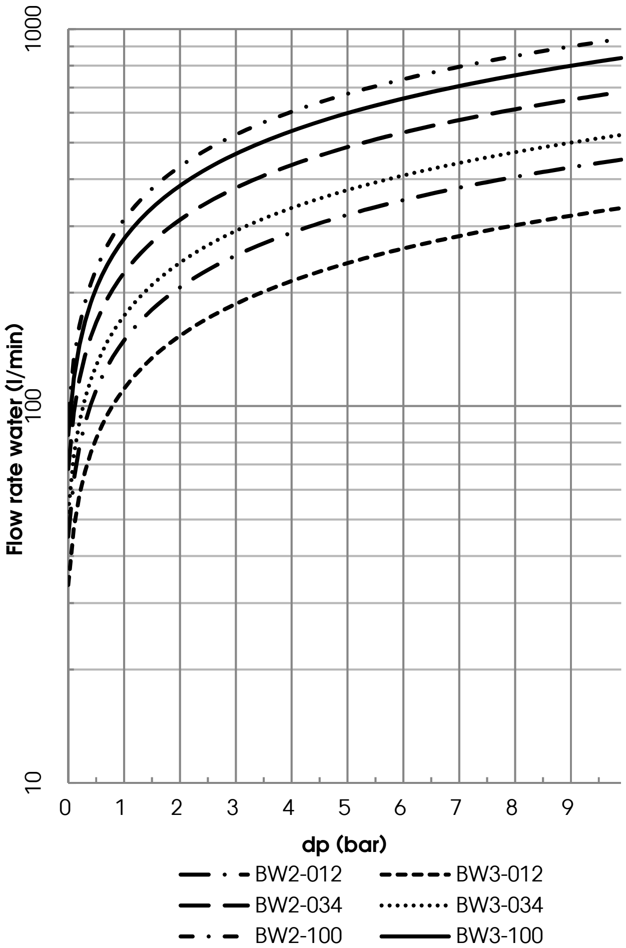


3-way (T-bore)



1.4. Flow chart

The following graph shows the flow rate (l/min) of the ball valves as a function of the differential pressure across the inlet and outlet of the valve. The scale of the vertical axis is logarithmic.



1.5. Duty Cycle

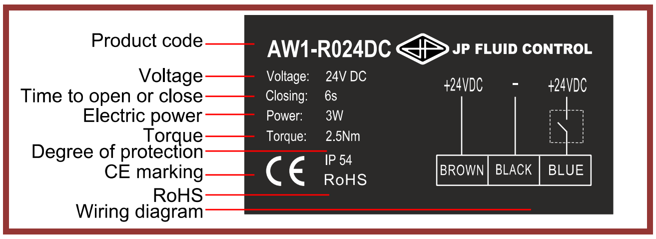
The BW-series are suitable for continuous use. High switching frequencies and high pressures can reduce the lifespan.

1.6. Compliance

The actuators are CE marked and comply with the LVD Directive (2006/95/EC) and EMC Directive (2004/108/EC), provided that the cables and connectors are properly connected.

1.7. Description Type Plate

The following figure shows an example of the type plate of the actuator. Observe the specifications and the connection diagram before using the product.



3. GENERAL SAFETY INSTRUCTIONS

Please read the safety instructions before installing, using or maintaining the device.

- This device will contain gas and/or liquid under pressure. The actuator only complies protection class IP54 (according to IEC 60529), if the device is properly connected. Improper use may be hazardous.
- This product is not a safety device and may not be used as such.
- Never put your hands/body parts or other objects into ports of the valve. The rotating ball can cause serious injuries or damages.
- Correct transport, proper storage and installation, and proper use and maintenance, are essential for reliable and error-free operation. The product may not function properly as a result of dirt, wear, damage (for example, by dropping) or improper use. Therefore, the product should not be used in applications where a malfunction can cause danger or damage.
- Check the compatibility of the medium used, temperature and other operating conditions with the materials and specifications of the product. It is the responsibility of the user to select the right product for the application.
- This product is not intended or approved for medical applications, food and/or application in gas appliances.
- Never exceed the limits for pressure, temperature or voltage as indicated on the product and/or in the technical documentation.
- It is not allowed to change the construction of this device.
- Beware of electric shock when working with electrical equipment.

4. INSTALLATION AND MAINTENANCE

3.1. Safety Instructions

- It is recommended to install the electric ball valve in a dry environment. In moist environments, make sure that no moisture can penetrate the actuator. Install the ball valve in a safe way to avoid electric shock, burning or other injuries. Make sure the electric ball valve is not in contact with or in the vicinity of flammable materials. Ensure that the product is protected from frost. Frost may damage the product and/or block the moving parts, causing the electric ball valve to malfunction.
- Maintenance may only be performed when the system is not pressurized, electrically disconnected and cooled down.
- Turn off the power supply before performing any work on the electric ball valve to prevent the risk of electrical shock and to prevent activation of the actuator.
- The product is only safe when properly installed and operated by qualified persons. Please read the safety instructions and technical documentation carefully before installation, use or maintenance.
- Ensure a controlled commissioning after installation or maintenance.

3.2. Installation

Clean fluids and gases

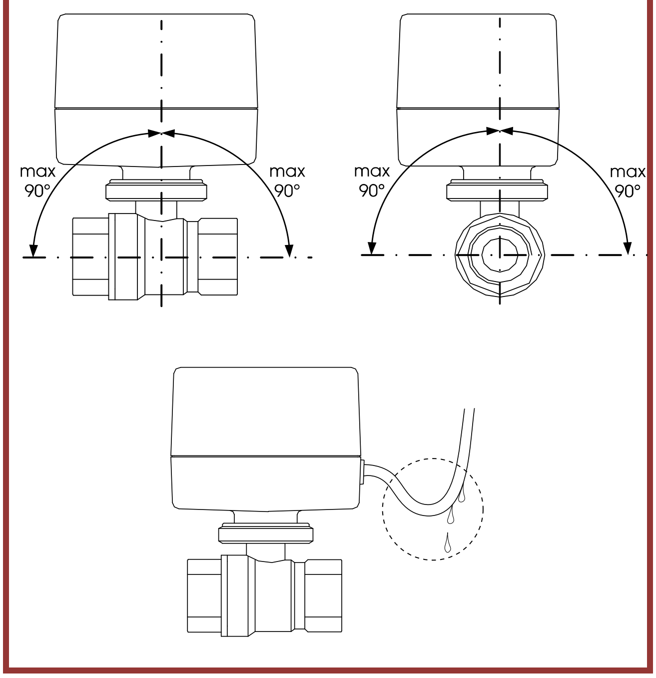
It is recommended to use electrical ball valves in combination with clean liquids or gases. Dirt can cause excessive wear. Make sure that the pipes don't contain dirt before installing the device. Optionally, install a filter (500 μm) upstream of the electric ball valve.

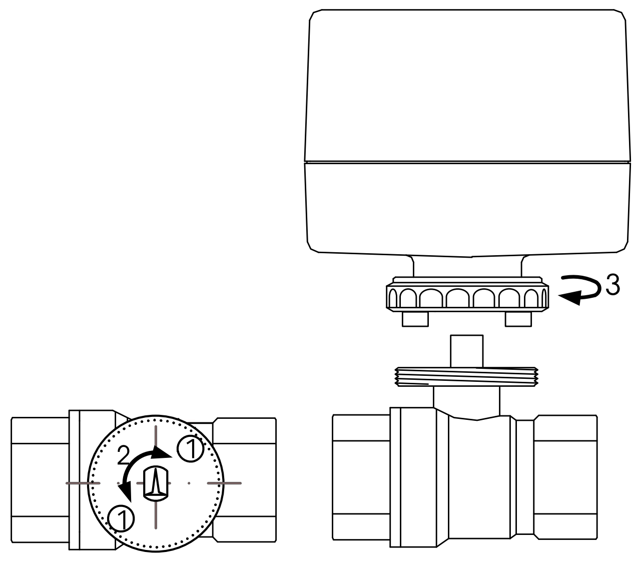
Mounting the valve

The pipes on both sides of the valve must be securely fastened. During installation, make sure that force may only be exercised at designated areas on the valve, such as the hexagon; never on the actuator. Avoid vibration in the pipes. Use a suitable sealant for threaded connections of the ball valve. Avoid the entry of thread sealing material in the valve, this can lead to malfunctioning of the valve.

Position

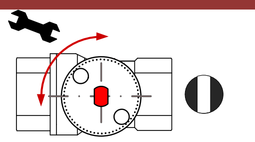
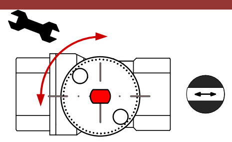
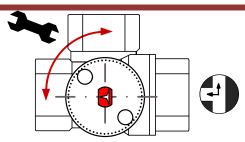
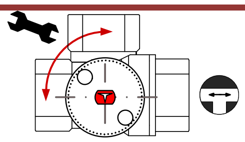
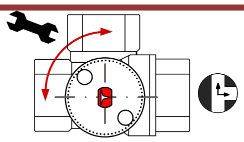
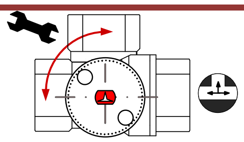
It is recommended to install the electric ball valve in vertical position with the actuator facing upwards. This reduces the probability of the collection of moisture in the actuator. When the electric ball valve is mounted at an angle, it is recommended to deviate maximally 90° from the vertical position. Ensure that drops cannot slip along the cable and enter the actuator.





Installation of the actuator on the coil

- The device can be damaged by the use of unsuitable tools.
- The 3-way valves can be installed in two different ways by rotating the ball 180°.

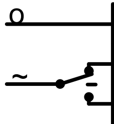
	Off / closed	On / open
2-way		
3-way		
		

- The actuator needs to be attached with the aid of the nut present.
- Make sure that the ball is in the correct position. If necessary, adjust the position (2) using a wrench.
- The actuator is into the valve body (two ways) with 2-pin (1). Tighten the nut securely (3), so there is no clearance between the actuator and the valve.

3.3. Electrical Wiring Diagram

Verify that the actuator code matches the connection diagram. Improper installation can permanently damage the actuator or lead to dangerous situations. The actuators have internal position switches, which results that only energy consumed during opening or closing.

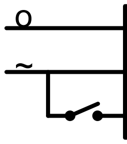
AW1-230AC, AW1-024AC (3-point)



BLACK	Neutral
BLUE	Phase (close)
BROWN	Phase (open)

Connecting the blue control wire opens the valve in 16s. Connecting the blown control wire close the valve in 16s. If both control wires are disconnected, the valve will remain In the current position. In this way, the position of the valve can be regulated. **Never connect the blue and brown control wires at the same time!** This will damage the actuator. The actuator consumes energy only during opening and closing.

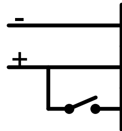
AW1-R230AC, AW1-R024AC (ON/OFF, INTERNAL RELAIS)



BLUE	Neutral
BROWN	Phase
BLACK	Phase (open)

Connecting the control wire (black) opens the valve in 16s. Once the control wire shuts down, the valve closes in 16s. The actuator consumes energy only during opening and closing.

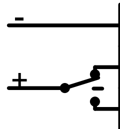
AW1-R024DC, AW1-R012DC (ON/OFF, INTERNAL RELAIS)



BLACK	Minus
BROWN	Plus (close)
BLUE	Plus (open)

Connecting the control wire (blue) opens the valve in 6s. Once the control wire shuts down, the valve closes in 6s. The actuator consumes energy only during opening and closing.

AW1-024DC, AW1-012DC (3-point)



BLUE	Minus
BLACK	Plus (close)
BROWN	Plus (open)

Connecting the brown control wire, the valve closes in 6s. Connecting the black control wire, the valve opens in 6s. If both control wires are connected, the valve will remain in the current position. In this way, the position of the valve can be regulated. **Never connect the black and brown control wires at the same time!** This will damage the actuator. The actuator consumes energy only during opening and closing.

5. SPARE PARTS

The valve bodies and actuators of the BW and AW1 series are exchangeable. If only one component is defective, this part can be replaced.

6. DISPOSAL

The removal of the product should be performed in accordance with the applicable laws. Keep in mind the media that are still present in the valve.

Firma naam:
Gemaakt door:
Telefoon:

Datum: 21-5-2019

Aantal	Omschrijving
1	**ALPHA1 L 15-40 130** Artikelnr.: 99160550

Grundfos ALPHA1 L 15-40 130 is a high-efficiency circulator pump with permanent-magnet motor (ECM technology).

The pump features three control modes; radiator heating mode, underfloor heating mode and constant curve/constant speed.

Furthermore, the speed can be controlled by a low-voltage PWM (Pulse Width Modulation) signal.

The pump has a ceramic shaft and radial bearings, carbon thrust bearing, stainless-steel rotor can, bearing plate and rotor cladding, composite impeller, all of which contribute to long life, and the pump is self-venting, which contributes to easy commissioning as well as simple selection of control mode.

The compact design featuring pump head with integrated control box and control panel fits into most common installations as well as boilers.

The pump and motor form an integral unit without shaft seal. The pump is of the wet-runner design. This means the bearings are lubricated by the pumped liquid. These constructions ensure maintenance-free operation.

The pump housing is made of cast iron and is electrocoated to improve the corrosion resistance.

The motor is a synchronous permanent-magnet rotor/compact-stator motor. The pump controller is incorporated in the control box, which is fitted to the stator housing and connected to the stator via a terminal plug.

Features ALPHA1 L
- Three constant curves/constant speed.
- Radiator heating mode.
- Underfloor heating mode.
- PWM profile for heating applications (profile A). The PWM signal is a method for generating an analog signal using a digital source.
- Energy-optimised, complies with the ErP directive
- Unblocking screw, accessible from the front of the control box.
- Runs reliably and efficiently under even the most demanding conditions
- Adjustable and flexible installer plug, with two possible cable gland positions.

Vloeistof:
Te verpompen medium: Water
Bereik vloeistoftemperatuur: 2 .. 95 °C
Medium temperatuur tijdens bedrijf: 20 °C
Dichtheid: 998.2 kg/m³

Technisch:
Berekende flow: 1.318 m³/u
Resultaat in opvoerhoogte van de pomp: 0.89 m
TF klasse: 95
Keurmerken op typeplaat: CE,VDE,EAC

Materialen:
Pomphuis: Gietijzer
EN 1561 EN-GJL-150
ASTM A48-150B
Waaier: Composite/PES 30 % GF

Installatie:

Firma naam:
Gemaakt door:
Telefoon:

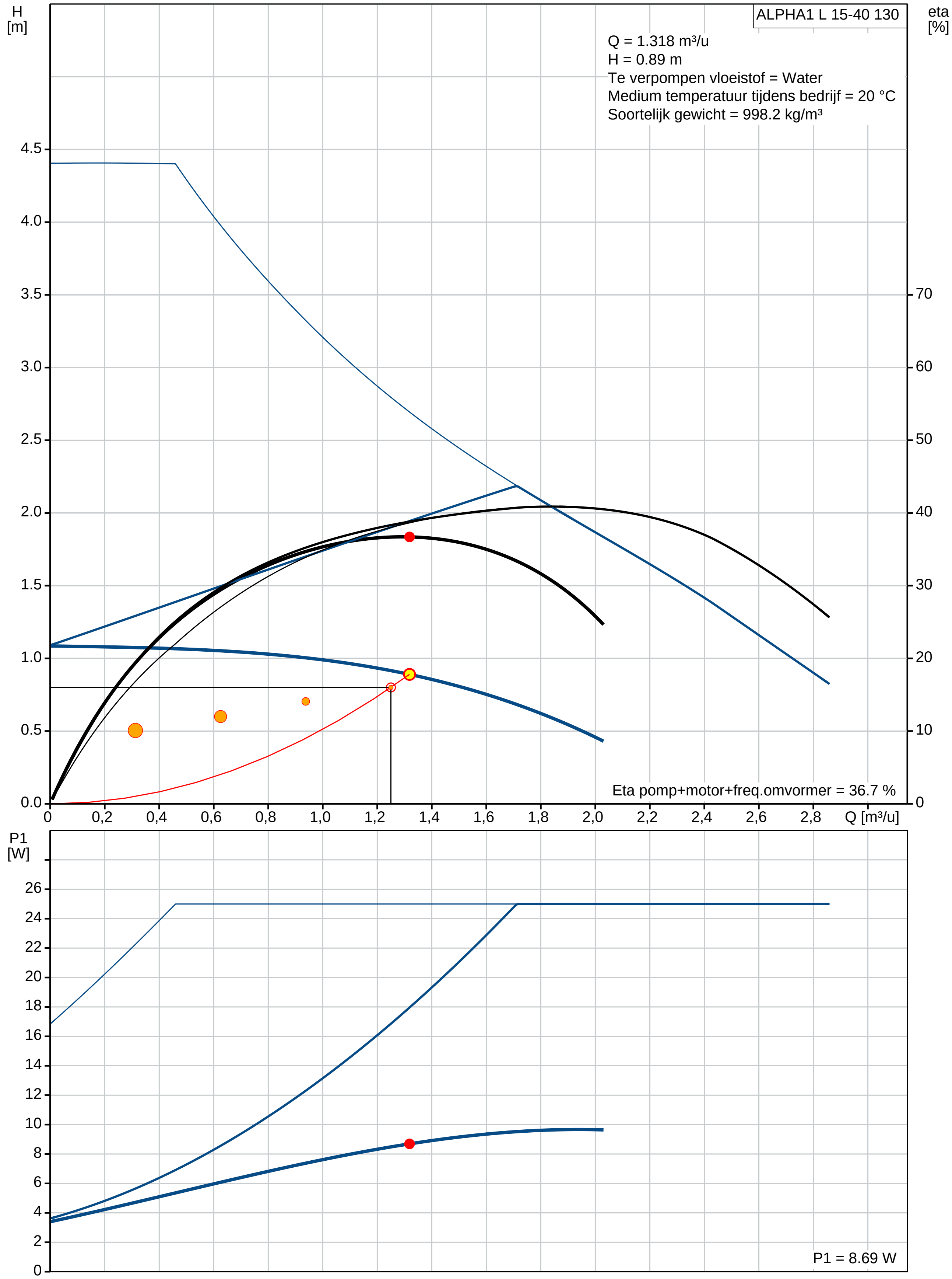
Datum: 21-5-2019

Aantal	Omschrijving	
	Reeks van omgevingstemperaturen:	0 .. 55 °C
	Maximale bedrijfsdruk:	10 bar
	Leidingaansluiting:	G 1
	Druktrap:	PN 10
	Inbouwlengte:	130 mm
	Elektrische gegevens:	
	Vermogen - P1:	4 .. 25 W
	Netfrequentie:	50 / 60 Hz
	Nominale spanning:	1 x 230 V
	Maximum stroomverbruik:	0.05 .. 0.26 A
	Dichtheidsklasse (IEC 34-5):	X4D
	Isolatie klasse (IEC 85):	F
	Overige:	
	Energie (EEI):	0.20
	Netto gewicht:	1.88 kg
	Bruto gewicht:	1.98 kg
	Transportvolume:	0.004 m³
	Land van herkomst:	DK
	HS code:	84137030

Firma naam:
Gemaakt door:
Telefoon:

Datum: 21-5-2019

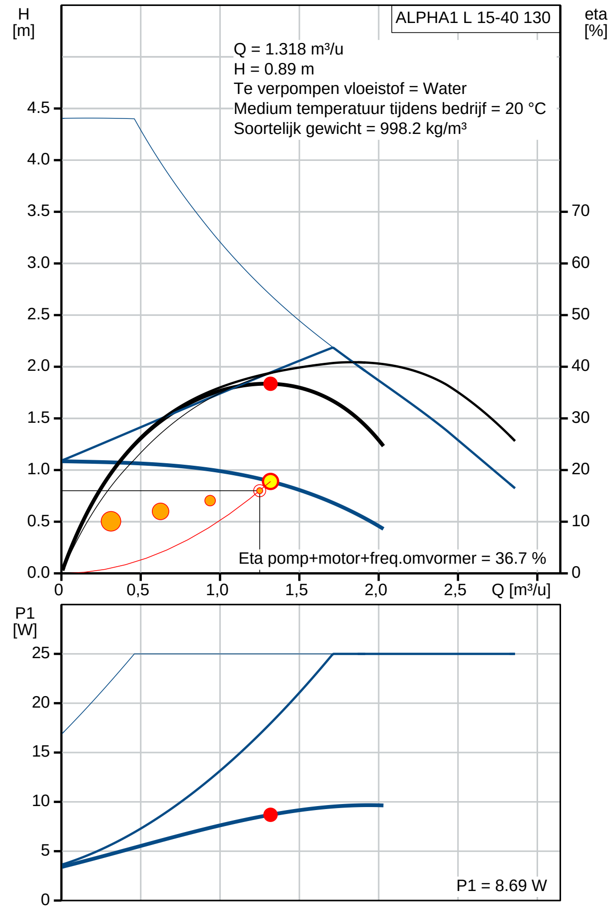
99160550 ALPHA1 L 15-40 130

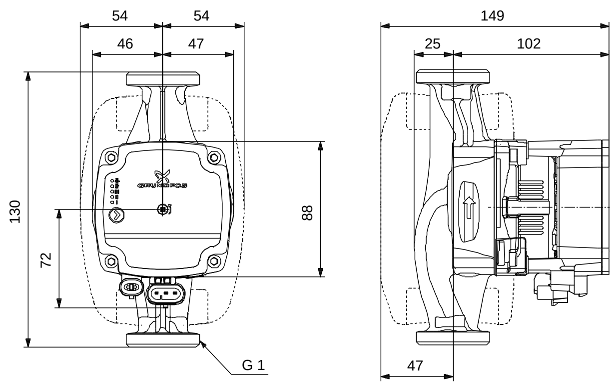


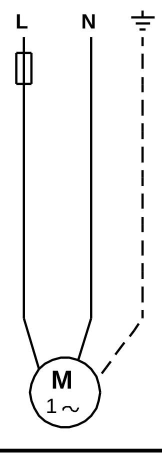
Firma naam:
Gemaakt door:
Telefoon:

Datum: 21-5-2019

Omschrijving	Specificatie
Algemene informatie:	
Productnaam::	ALPHA1 L 15-40 130
Artikelnummer::	99160550
EAN nummer::	5712607862435
	5712607862435
Prijs:	€ 311,00
Technisch:	
Berekende flow:	1.318 m³/u
Resultaat in opvoerhoogte van de pomp:	0.89 m
Max. opvoerhoogte:	40 dm
TF klasse:	95
Keurmerken op typeplaat:	CE,VDE,EAC
Model:	C
Materialen:	
Pomphuis:	Gietijzer
	EN 1561 EN-GJL-150
	ASTM A48-150B
Waaier:	Composite/PES 30 % GF
Installatie:	
Reeks van omgevingstemperaturen:	0 .. 55 °C
Maximale bedrijfsdruk:	10 bar
Leidingaansluiting:	G 1
Druktrap:	PN 10
Inbouwlengte:	130 mm
Vloeistof:	
Te verpompen medium:	Water
Bereik vloeistoftemperatuur:	2 .. 95 °C
Medium temperatuur tijdens bedrijf:	20 °C
Dichtheid:	998.2 kg/m³
Elektrische gegevens:	
Vermogen - P1:	4 .. 25 W
Netfrequentie:	50 / 60 Hz
Nominale spanning:	1 x 230 V
Maximum stroomverbruik:	0.05 .. 0.26 A
Dichtheidsklasse (IEC 34-5):	X4D
Isolatie klasse (IEC 85):	F
Motorbeveiliging:	GEEN
Thermische beveiliging:	ELEC
Regeling:	
Positie klemkast:	6H
Overige:	
Energie (EEI):	0.20
Netto gewicht:	1.88 kg
Bruto gewicht:	1.98 kg
Transportvolume:	0.004 m³
Land van herkomst:	DK
HS code:	84137030







GRUNDFOS

Firma naam:
Gemaakt door:
Telefoon:

Datum: 21-5-2019

Aantal	Omschrijving
1	**ALPHA1 L 15-40 130**

Opm. De foto kan afwijken van het eigenlijke product

Artikelnr.: 99160550

Grundfos ALPHA1 L 15-40 130 is a high-efficiency circulator pump with permanent-magnet motor (ECM technology).

The pump features three control modes; radiator heating mode, underfloor heating mode and constant curve/constant speed.

Furthermore, the speed can be controlled by a low-voltage PWM (Pulse Width Modulation) signal.

The pump has a ceramic shaft and radial bearings, carbon thrust bearing, stainless-steel rotor can, bearing plate and rotor cladding, composite impeller, all of which contribute to long life, and the pump is self-venting, which contributes to easy commissioning as well as simple selection of control mode.

The compact design featuring pump head with integrated control box and control panel fits into most common installations as well as boilers.

The pump and motor form an integral unit without shaft seal. The pump is of the wet-runner design. This means the bearings are lubricated by the pumped liquid. These constructions ensure maintenance-free operation.

The pump housing is made of cast iron and is electrocoated to improve the corrosion resistance.

The motor is a synchronous permanent-magnet rotor/compact-stator motor. The pump controller is incorporated in the control box, which is fitted to the stator housing and connected to the stator via a terminal plug.

Features ALPHA1 L
• Three constant curves/constant speed.
• Radiator heating mode.
• Underfloor heating mode.
• PWM profile for heating applications (profile A). The PWM signal is a method for generating an analog signal using a digital source.
• Energy-optimised, complies with the ErP directive
• Unblocking screw, accessible from the front of the control box.
• Runs reliably and efficiently under even the most demanding conditions
• Adjustable and flexible installer plug, with two possible cable gland positions.

Vloeistof:
Te verpompen medium: Water
Bereik vloeistoftemperatuur: 2 .. 95 °C
Medium temperatuur tijdens bedrijf: 20 °C
Dichtheid: 998.2 kg/m³

Technisch:
Berekende flow: 1.804 m³/u
Resultaat in opvoerhoogte van de pomp: 2.082 m

Firma naam:
Gemaakt door:
Telefoon:

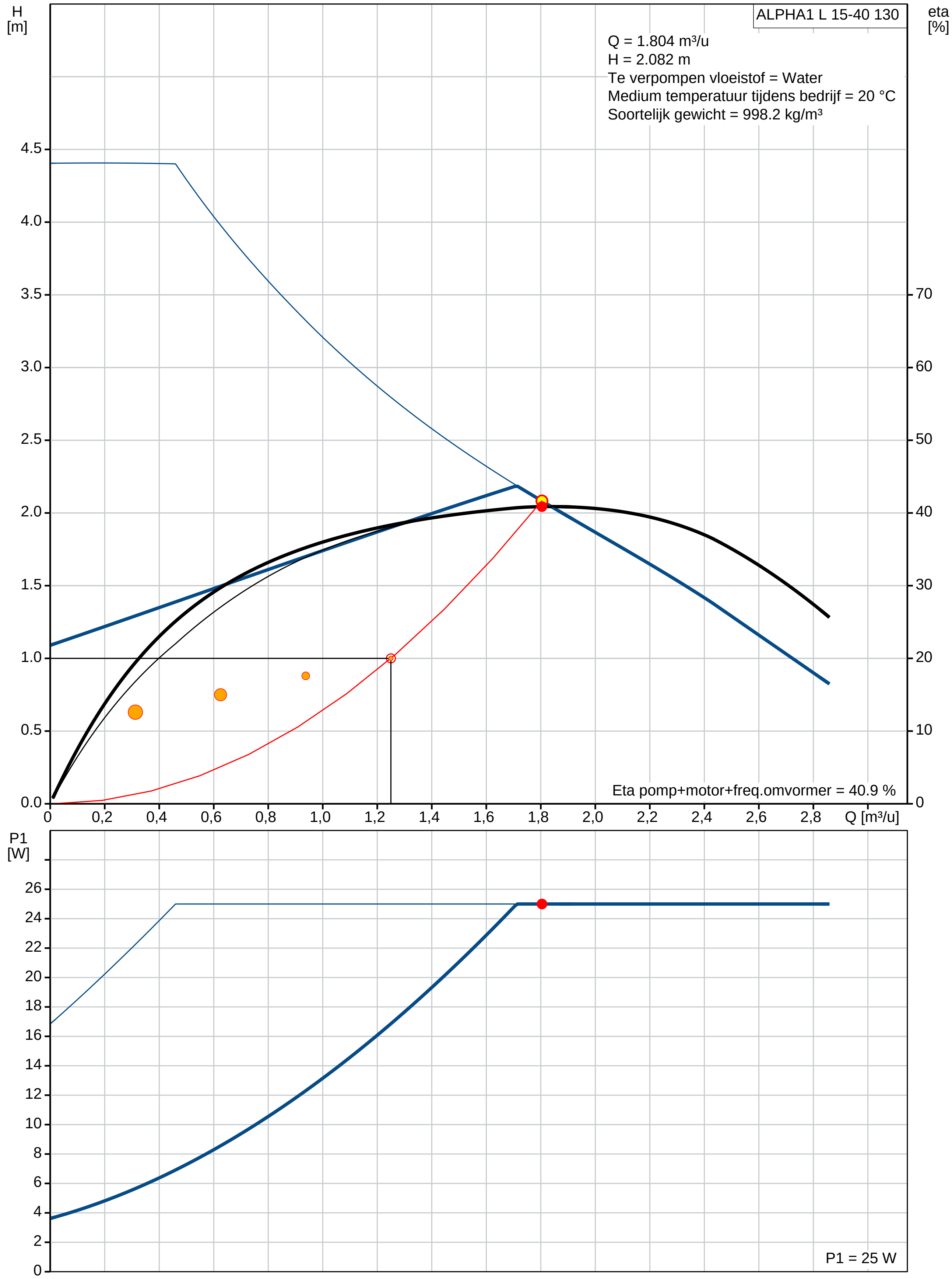
Datum: 21-5-2019

Aantal	Omschrijving	
	TF klasse:	95
	Keurmerken op typeplaat:	CE,VDE,EAC
	Materialen:	
	Pomphuis:	Gietijzer EN 1561 EN-GJL-150 ASTM A48-150B
	Waaier:	Composite/PES 30 % GF
	Installatie:	
	Reeks van omgevingstemperaturen:	0 .. 55 °C
	Maximale bedrijfsdruk:	10 bar
	Leidingaansluiting:	G 1
	Druktrap:	PN 10
	Inbouwlengte:	130 mm
	Elektrische gegevens:	
	Vermogen - P1:	4 .. 25 W
	Netfrequentie:	50 / 60 Hz
	Nominale spanning:	1 x 230 V
	Maximum stroomverbruik:	0.05 .. 0.26 A
	Dichtheidsklasse (IEC 34-5):	X4D
	Isolatie klasse (IEC 85):	F
	Overige:	
	Energie (EEI):	0.20
	Netto gewicht:	1.88 kg
	Bruto gewicht:	1.98 kg
	Transportvolume:	0.004 m^3
	Land van herkomst:	DK
	HS code:	84137030

Firma naam:
Gemaakt door:
Telefoon:

Datum: 21-5-2019

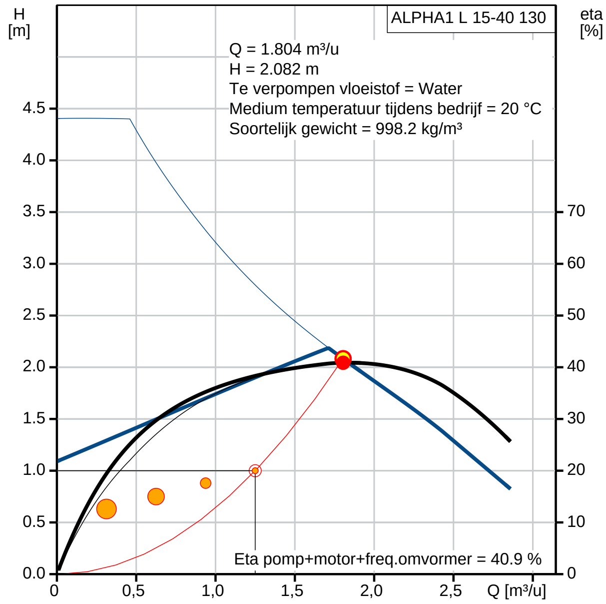
99160550 ALPHA1 L 15-40 130

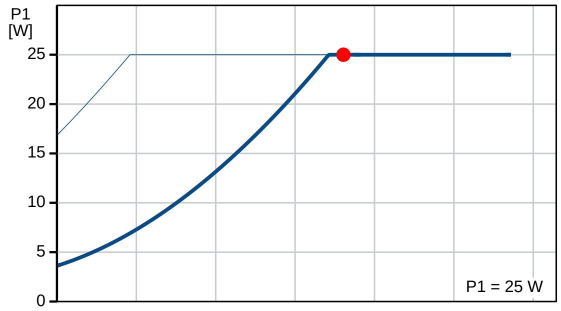


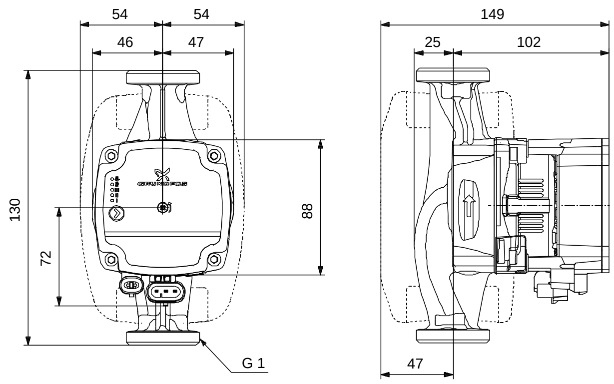
Firma naam:
Gemaakt door:
Telefoon:

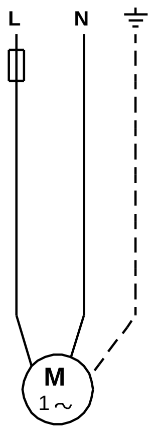
Datum: 21-5-2019

Omschrijving	Specificatie
Algemene informatie:	
Productnaam::	ALPHA1 L 15-40 130
Artikelnummer::	99160550
EAN nummer::	5712607862435
	5712607862435
Prijs:	€ 311,00
Technisch:	
Berekende flow:	1.804 m³/u
Resultaat in opvoerhoogte van de pomp:	2.082 m
Max. opvoerhoogte:	40 dm
TF klasse:	95
Keurmerken op typeplaat:	CE,VDE,EAC
Model:	C
Materialen:	
Pomphuis:	Gietijzer
	EN 1561 EN-GJL-150
	ASTM A48-150B
Waaier:	Composite/PES 30 % GF
Installatie:	
Reeks van omgevingstemperaturen:	0 .. 55 °C
Maximale bedrijfsdruk:	10 bar
Leidingaansluiting:	G 1
Druktrap:	PN 10
Inbouwlengte:	130 mm
Vloeistof:	
Te verpompen medium:	Water
Bereik vloeistoftemperatuur:	2 .. 95 °C
Medium temperatuur tijdens bedrijf:	20 °C
Dichtheid:	998.2 kg/m³
Elektrische gegevens:	
Vermogen - P1:	4 .. 25 W
Netfrequentie:	50 / 60 Hz
Nominale spanning:	1 x 230 V
Maximum stroomverbruik:	0.05 .. 0.26 A
Dichtheidsklasse (IEC 34-5):	X4D
Isolatie klasse (IEC 85):	F
Motorbeveiliging:	GEEN
Thermische beveiliging:	ELEC
Regeling:	
Positie klemkast:	6H
Overige:	
Energie (EEI):	0.20
Netto gewicht:	1.88 kg
Bruto gewicht:	1.98 kg
Transportvolume:	0.004 m³
Land van herkomst:	DK
HS code:	84137030









	Firma naam: **Gemaakt door:** **Telefoon:** **Datum:** 21-5-2019

Aantal	Omschrijving
1	**ALPHA1 L 15-40 130**

Opm. De foto kan afwijken van het eigenlijke product

Artikelnr.: 99160550

Grundfos ALPHA1 L 15-40 130 is a high-efficiency circulator pump with permanent-magnet motor (ECM technology).

The pump features three control modes; radiator heating mode, underfloor heating mode and constant curve/constant speed.

Furthermore, the speed can be controlled by a low-voltage PWM (Pulse Width Modulation) signal.

The pump has a ceramic shaft and radial bearings, carbon thrust bearing, stainless-steel rotor can, bearing plate and rotor cladding, composite impeller, all of which contribute to long life, and the pump is self-venting, which contributes to easy commissioning as well as simple selection of control mode.

The compact design featuring pump head with integrated control box and control panel fits into most common installations as well as boilers.

The pump and motor form an integral unit without shaft seal. The pump is of the wet-runner design. This means the bearings are lubricated by the pumped liquid. These constructions ensure maintenance-free operation.

The pump housing is made of cast iron and is electrocoated to improve the corrosion resistance.

The motor is a synchronous permanent-magnet rotor/compact-stator motor. The pump controller is incorporated in the control box, which is fitted to the stator housing and connected to the stator via a terminal plug.

Features ALPHA1 L
• Three constant curves/constant speed.
• Radiator heating mode.
• Underfloor heating mode.
• PWM profile for heating applications (profile A). The PWM signal is a method for generating an analog signal using a digital source.
• Energy-optimised, complies with the ErP directive
• Unblocking screw, accessible from the front of the control box.
• Runs reliably and efficiently under even the most demanding conditions
• Adjustable and flexible installer plug, with two possible cable gland positions.

Vloeistof:
Te verpompen medium: Water
Bereik vloeistoftemperatuur: 2 .. 95 °C
Medium temperatuur tijdens bedrijf: 60 °C
Dichtheid: 983.2 kg/m³

Technisch:
Berekende flow: 1.185 m³/u
Resultaat in opvoerhoogte van de pomp: 0.938 m

Firma naam:
Gemaakt door:
Telefoon:

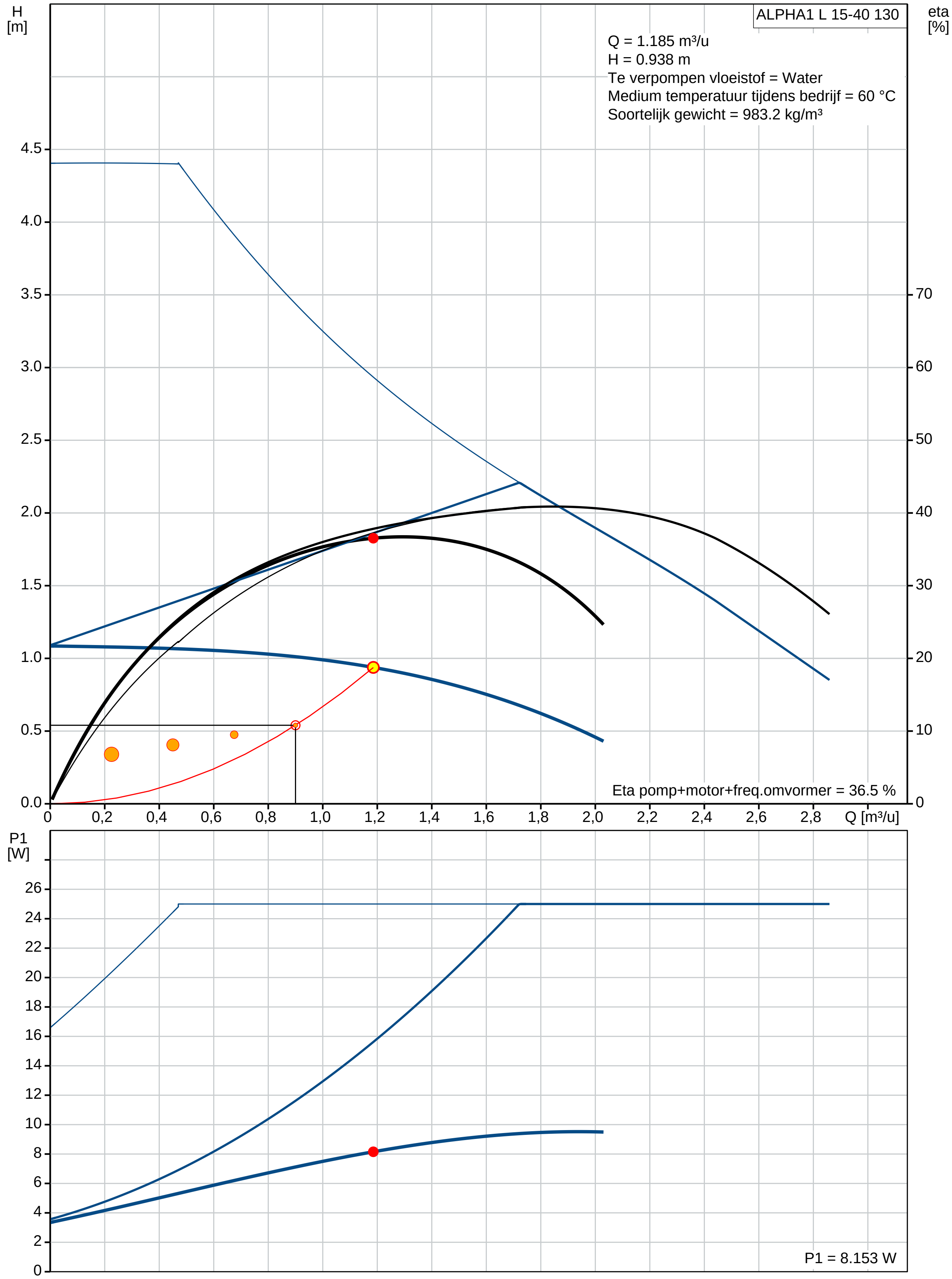
Datum: 21-5-2019

Aantal	**Omschrijving**	
	TF klasse:	95
	Keurmerken op typeplaat:	CE,VDE,EAC
	Materialen:	
	Pomphuis:	Gietijzer EN 1561 EN-GJL-150 ASTM A48-150B
	Waaier:	Composite/PES 30 % GF
	Installatie:	
	Reeks van omgevingstemperaturen:	0 .. 55 °C
	Maximale bedrijfsdruk:	10 bar
	Leidingaansluiting:	G 1
	Druktrap:	PN 10
	Inbouwlengte:	130 mm
	Elektrische gegevens:	
	Vermogen - P1:	4 .. 25 W
	Netfrequentie:	50 / 60 Hz
	Nominale spanning:	1 x 230 V
	Maximum stroomverbruik:	0.05 .. 0.26 A
	Dichtheidsklasse (IEC 34-5):	X4D
	Isolatie klasse (IEC 85):	F
	Overige:	
	Energie (EEI):	0.20
	Netto gewicht:	1.88 kg
	Bruto gewicht:	1.98 kg
	Transportvolume:	0.004 m³
	Land van herkomst:	DK
	HS code:	84137030

Firma naam:
Gemaakt door:
Telefoon:

Datum: 21-5-2019

99160550 ALPHA1 L 15-40 130

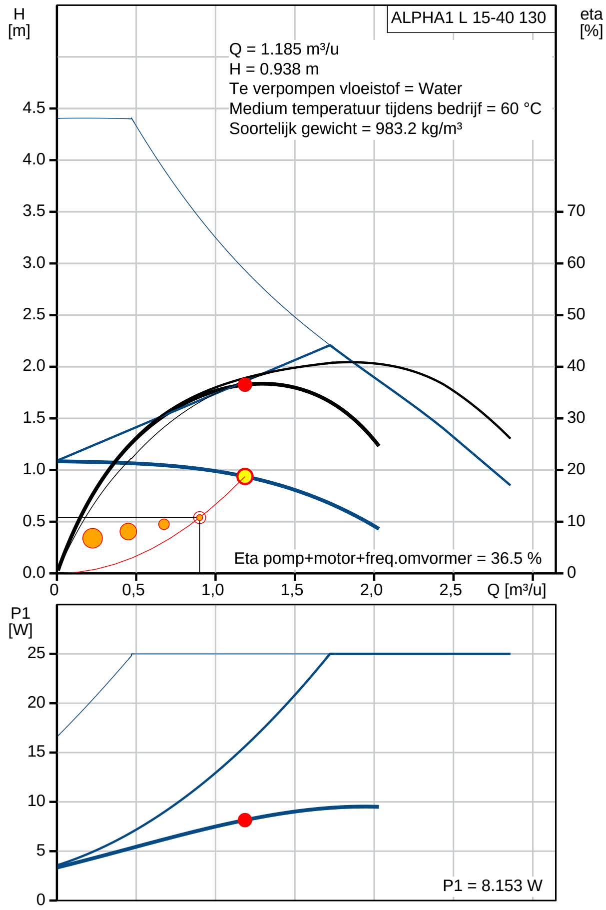


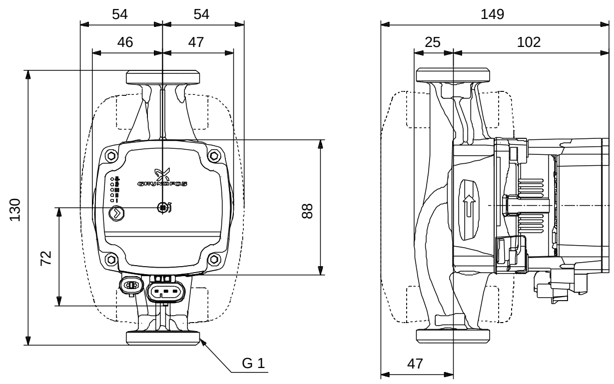
GRUNDFOS

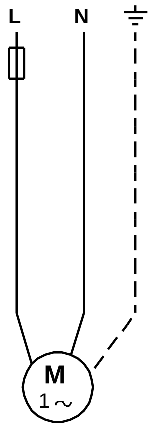
Firma naam:
Gemaakt door:
Telefoon:

Datum: 21-5-2019

Omschrijving	Specificatie
Algemene informatie:	
Productnaam::	ALPHA1 L 15-40 130
Artikelnummer::	99160550
EAN nummer::	5712607862435
	5712607862435
Prijs:	€ 311,00
Technisch:	
Berekende flow:	1.185 m³/u
Resultaat in opvoerhoogte van de pomp:	0.938 m
Max. opvoerhoogte:	40 dm
TF klasse:	95
Keurmerken op typeplaat:	CE,VDE,EAC
Model:	C
Materialen:	
Pomphuis:	Gietijzer
	EN 1561 EN-GJL-150
	ASTM A48-150B
Waaier:	Composite/PES 30 % GF
Installatie:	
Reeks van omgevingstemperaturen:	0 .. 55 °C
Maximale bedrijfsdruk:	10 bar
Leidingaansluiting:	G 1
Druktrap:	PN 10
Inbouwlengte:	130 mm
Vloeistof:	
Te verpompen medium:	Water
Bereik vloeistoftemperatuur:	2 .. 95 °C
Medium temperatuur tijdens bedrijf:	60 °C
Dichtheid:	983.2 kg/m³
Elektrische gegevens:	
Vermogen - P1:	4 .. 25 W
Netfrequentie:	50 / 60 Hz
Nominale spanning:	1 x 230 V
Maximum stroomverbruik:	0.05 .. 0.26 A
Dichtheidsklasse (IEC 34-5):	X4D
Isolatie klasse (IEC 85):	F
Motorbeveiliging:	GEEN
Thermische beveiliging:	ELEC
Regeling:	
Positie klemkast:	6H
Overige:	
Energie (EEI):	0.20
Netto gewicht:	1.88 kg
Bruto gewicht:	1.98 kg
Transportvolume:	0.004 m³
Land van herkomst:	DK
HS code:	84137030







D-FLOW ventilation

HET NIEUWE OXYGEN SYSTEEM

PER KAMER EEN PERFECT GEREGELDE VENTILATIE

Jaga D-Flow, het nieuwe D-systeem van Jaga, zorgt voor CO_2-gestuurd ventileren per ruimte en een energie-efficiënte kringloop van zuivere lucht in de woning. Goed voor de gezondheid, het wooncomfort én de woning zelf.

Jaga D-Flow is geen traditionele ventilatie, maar een intelligent gestuurd en energiezuinig verluchtingssysteem. Het systeem bestaat uit gedecentraliseerde luchttoevoerunits en een centrale extractiebox. In combinatie met een intelligente sturing zorgt dit voor een perfecte balansventilatie en een daling in de warmteverliezen van de woning. De rechtstreeks aangevoerde buitenlucht komt per ruimte via een efficiënt filtersysteem. Lange luchttoevoerkanalen zijn niet meer nodig.
De intelligente sturing met ingebouwde CO_2-sensoren zorgt voor een perfect gedoseerde ventilatie per vertrek. Het Jaga D-Flow systeem werkt volledig automatisch en is uitstekend toepasbaar in renovatieprojecten én nieuwbouw.

"D-FLOW werkt volledig vraaggestuurd:
met een kleinere luchtverplaatsing en een lager energieverbruik
wordt een veel beter geregelde ventilatie bekomen."


jaga

DE MEEST COMFORTABELE VENTILATIE

HET LAAGSTE GELUIDSNIVEAU

Via geluidsmetingen van Peutz is gebleken dat Jaga D-Flow het stilste ventilatiesysteem is op de markt. Zowel in Nederland als in België wordt een geluidsniveau tot 30 dB(A) toegestaan en beschouwd als normaal akoestisch comfort. Met D-Flow kan in de slaapkamers zelfs 25 dB(A) gehaald worden met een voldoende ventilatiecapaciteit! Bovendien zijn de toestellen voorzien van een doorgedreven akoestische isolatie waardoor ze een zeer hoge dempingswaarde van buitengeluiden behalen. In vergelijking met een open raam of met standaard raamroosters is het in uw slaapkamer heerlijk stil.

EEN ZUIVER EN GEZOND BINNENKLIMAAT

De aangevoerde lucht komt rechtstreeks van buiten en niet via een centraal aanvoerkanaal dat zich naar de kamers vertakt. Gecombineerd met het filtersysteem en de intelligente afvoer van vochtige lucht, garandeert Jaga D-Flow een zuiver binnenklimaat.

filteren van stof, stuifmeel en pollen

zeer goede demping van buitengeluid

nauwelijks hoorbaar eigen geluid

100% mechanisch = 100% controleerbaar

koude tocht wordt vermeden

onafhankelijk van windrichting of weersomstandigheden

DE IDEALE OPLOSSING BIJ RENOVATIE

SNEL GEÏNSTALLEERD BIJ NIEUWBOUW EN RENOVATIE

D-Flow is een gedecentraliseerd ventilatiesysteem voor een perfect gedoseerde ventilatie per kamer. De voornaamste component is de gloednieuwe D-Flow REFRESH unit: een technisch hoogstandje dat met het laagste geluidsniveau en energieverbruik voor de best mogelijke luchtkwaliteit zorgt. In balans met de luchttoevoer van de Refresh units zorgt de centrale extractiebox EXHAUST voor de verwijdering van de vervuilde lucht vanuit de natte ruimtes. De Refresh units zijn leverbaar voor inbouw of met een neutrale Jaga design bekleding die zich makkelijk laat integreren in elk interieur.

Bovendien is er de unieke combinatie van Refresh units en Low-H_2O radiatoren, waarbij de Refresh onzichtbaar ingebouwd is in de radiator ! De radiator wordt gewoon aangesloten op het C.V.-circuit en het ventilatiegedeelte op het elektriciteitsnet (230 VAC). Voor de luchttoevoer wordt achter de radiator een ronde perforatie gemaakt in de bouwschil. Niet alleen is op deze manier het ventilatiesysteem volledig onzichtbaar, maar de radiator zorgt ook voor voorverwarmde verse lucht gedurende het stookseizoen.

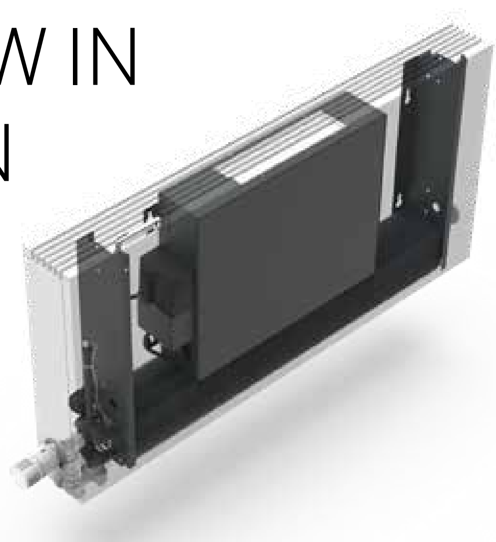
"Omdat er voor de luchttoevoer geen kanalen of verlaagde plafonds nodig zijn is Jaga D-Flow de makkelijkste oplossing bij renovatie-projecten."

- plug&play inclusief CO_2-sturing en bediening
- geen raamroosters nodig
- bijna onzichtbare afwerking van de geveldoorvoer
- gebruiks- en onderhoudsvriendelijk

ONZICHTBARE INBOUW IN LOW-H_2O RADIATOREN

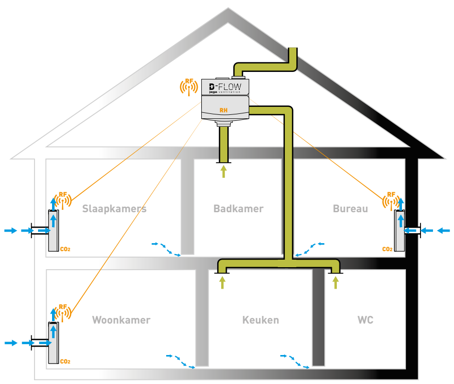
VOORVERWARMDE VERSE LUCHT

De D-Flow Refresh Units kunnen volledig onzichtbaar ingebouwd worden in de Jaga Low-H_2O radiatoren. Deze combinatie zorgt het hele jaar door voor een comfortabel binnenklimaat met voorverwarmde verse lucht in iedere kamer.



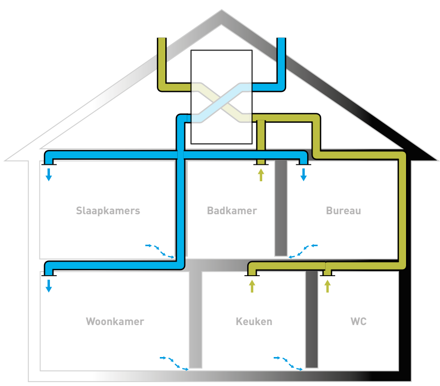
DE VERSCHILLENDE SYSTEMEN ONDER DE LOEP

Jaga D-Flow: het Oxygen systeem heruitgevonden



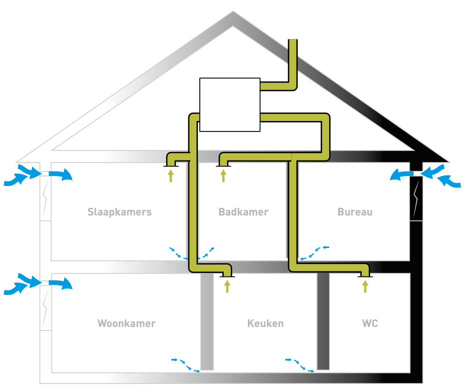
Het D-Flow systeem zorgt voor een gecontroleerde balansventilatie. Via CO_2-detectie krijgt elke ruimte de juiste hoeveelheid verse, gefilterde lucht en wordt een gelijke hoeveelheid gebruikte lucht afgevoerd. Geen enkel ander systeem kan het akoestisch comfort van D-Flow evenaren. Door de ver doorgedreven isolatie is zowel het eigen geluid als het buitengeluid maximaal gedempt. De toevoerunits kunnen onzichtbaar ingebouwd worden in de Jaga Low-H_2O radiatoren, waarbij de verse lucht in de winter voorverwarmd wordt. Door de makkelijke plaatsing en het lagere energieverbruik is het Jaga D-Flow systeem de juiste keuze voor nieuwbouw en renovatie. Het heeft enkel de voordelen van de andere systemen maar niet de nadelen.

"D-FLOW werkt volledig vraaggestuurd per ruimte: hierdoor bekomt men een gunstige F-reductie van 0.42."



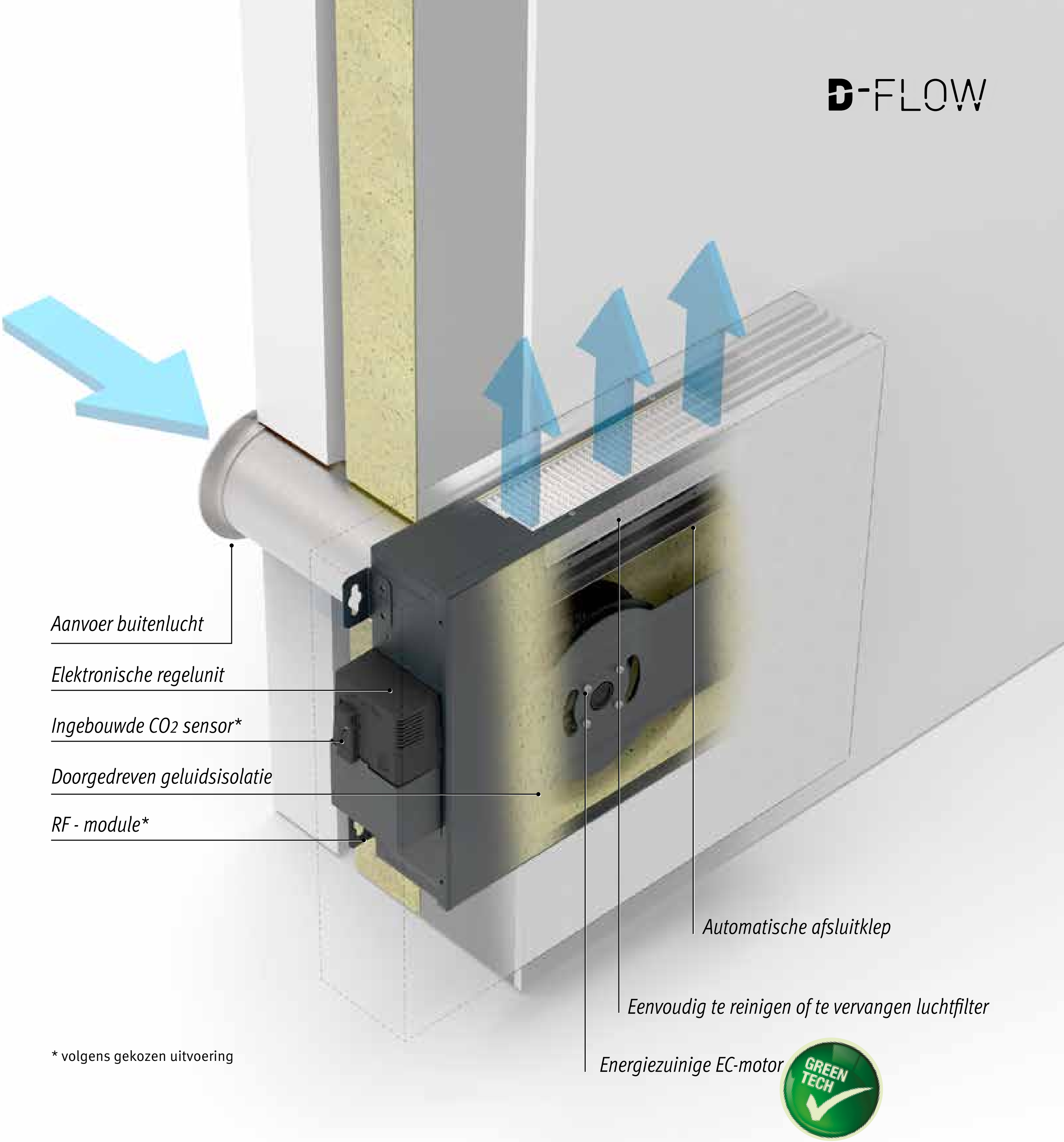
Het klassieke D-systeem

Het klassieke D-Systeem maakt gebruikt van een centrale unit met daarin 2 ventilatoren en een warmtewisselaar voor warmteterugwinning. Eén ventilator zorgt voor de afvoer in de natte ruimten en één voor de toevoer in de droge ruimten. Dergelijke units voor aan- én afvoer nemen veel meer plaats in, net zoals de extra luchtkanalen voor de luchttoevoer. Om alle lucht uit de woning, zowel toevoer als afvoer, door deze centrale unit te leiden zijn grotere en sneller draaiende ventilatoren nodig. Dit resulteert in een hoger energieverbruik en een hoger geluidsniveau. Het klassieke D-Systeem werkt enkel optimaal bij woningen met een doorgedreven isolatie en is bij renovaties vaak zeer moeilijk te implementeren/integreren in de woning.



Vraaggestuurd C-Systeem

Bij het klassieke C-systeem is er een ongecontroleerde toevoer, voornamelijk via de raamroosters die zichtbaar zijn. Dit zorgt vaak voor tocht en een onbehaaglijk gevoel. Raamroosters zijn onvoldoende akoestisch gedempt en laten veel buitengeluiden door. Omdat de roosters manueel bediend moeten worden, blijven ze vaak gesloten wanneer dat voor een goede luchtkwaliteit niet gewenst is. In vergelijking met het Jaga D-Flow systeem wordt de aangevoerde lucht niet gefilterd en zorgen stof en pollen voor een slechte luchtkwaliteit.

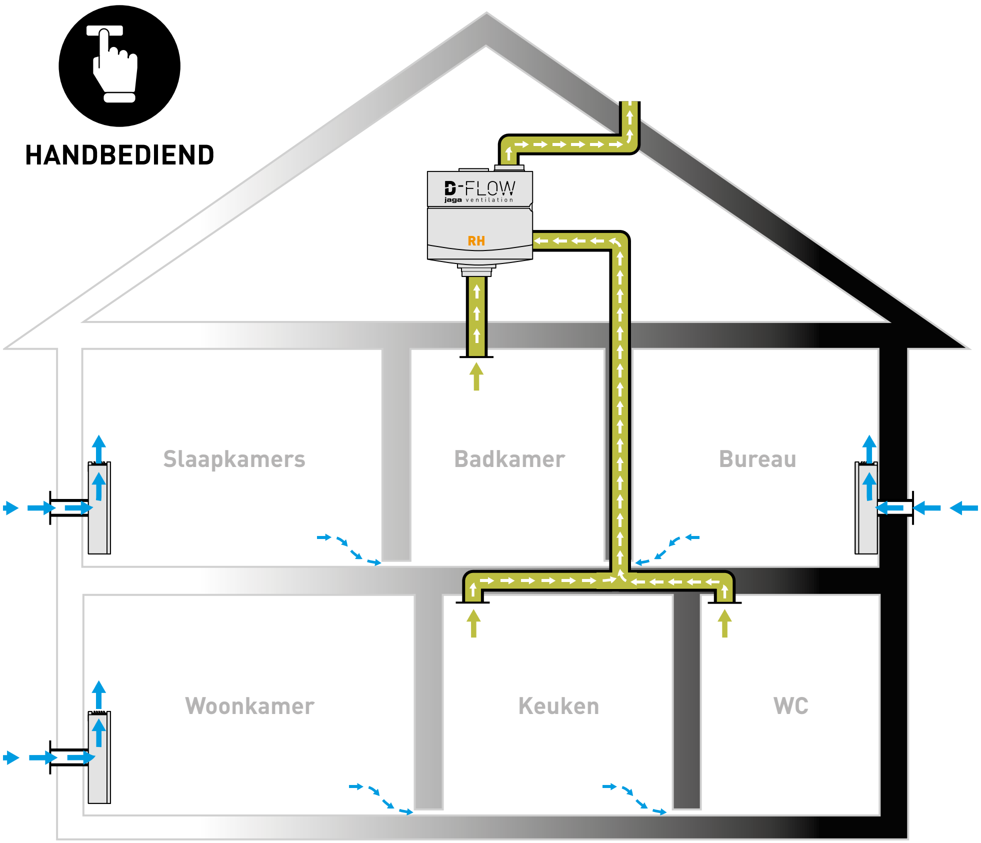


* volgens gekozen uitvoering

"In een onderzoek naar het energieverbruik door het TNO is naar voren gekomen dat Jaga Refresh het meest zuinige vraag-gestuurde mechanische ventilatiesysteem is."

D-FLOW **BASIC**

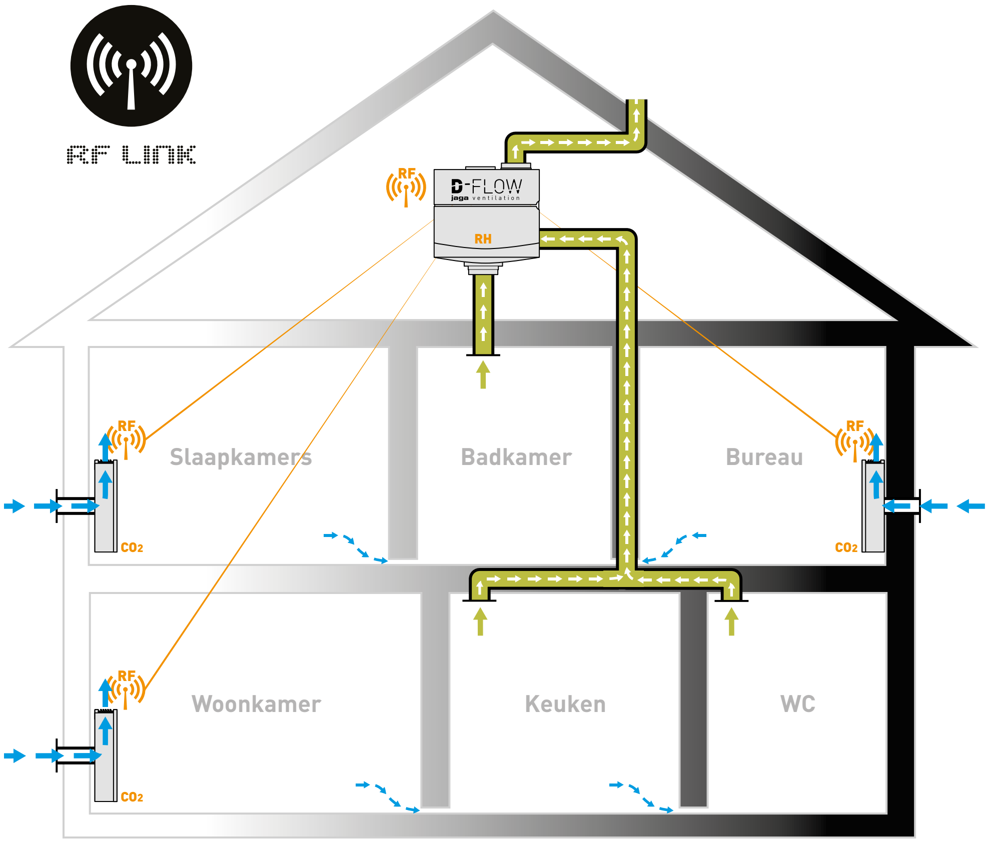
Handbediend systeem

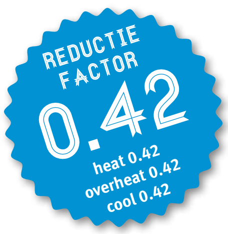


Het **BASIC** systeem is de manueel bediende D-Flow variant. Via de handbediening op de Refresh Unit kies je zelf wanneer je zuivere lucht wilt toevoeren. De extractiebox zorgt voor een constante afvoer volgens een minimaal debiet. Wanneer vocht wordt gedetecteerd uit de natte ruimtes zal het debiet automatisch verhoogt worden. De toevoer van verse lucht wordt door de bewoner manueel ingesteld op de tiptoets bediening van de Refresh en de afvoer van vuile lucht gebeurt automatisch op basis van de gemeten luchtvochtigheid in de extractiebox.

D-FLOW **SMART**

CO2 gestuurd, draadloos RF-systeem

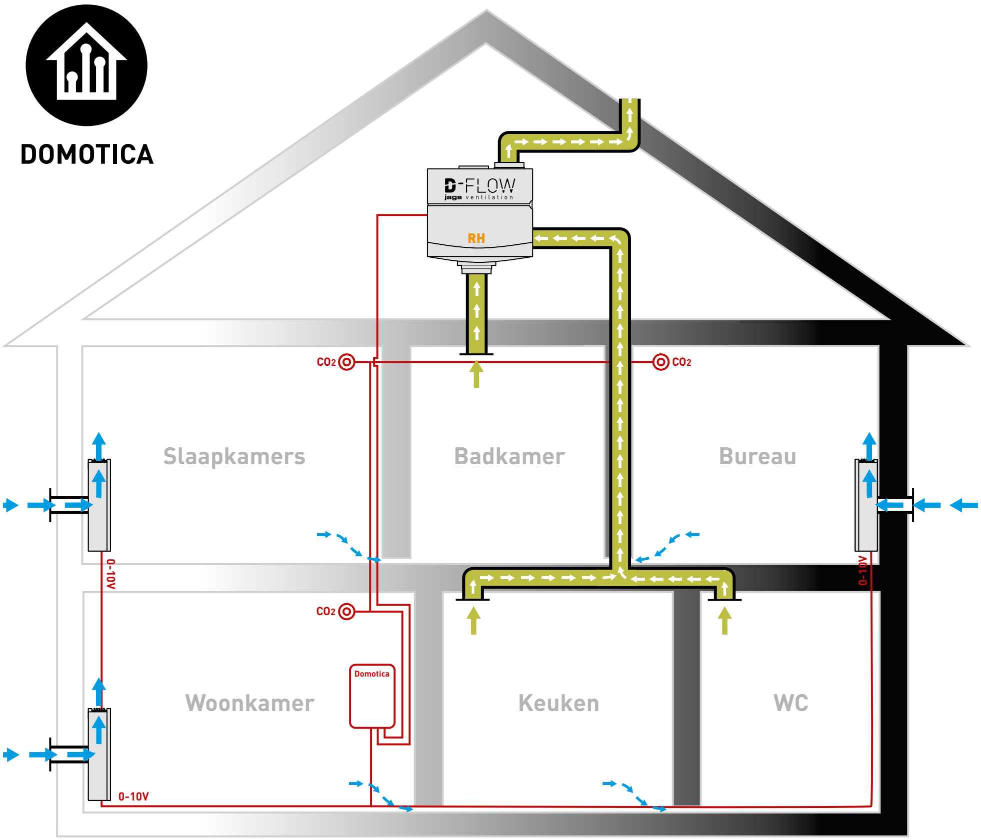


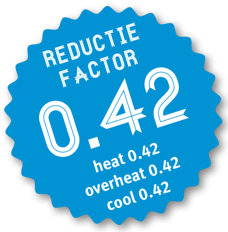


Het D-Flow **SMART** systeem werkt volledig automatisch. In de droge ruimtes detecteren de Refresh Units (aanvoerunits) het CO2 niveau en zorgen voor de nodige toevoer van verse lucht. Alle aanvoerunits communiceren via een RF-signaal met de extractiebox. Afhankelijk van de informatie van de Refresh Units en van de in de extractiebox geïntegreerde vochtsensor zal ten allen tijde de juiste hoeveelheid vervuilde lucht afgevoerd worden. D-Flow zorgt voor een perfect gebalanceerde ventilatie van de woning aan het laagste energieverbruik. Dit vertaalt zich in een uiterst gunstige F-reductie van 0.42!

D-FLOW **EXPERT**

CO2 gestuurd systeem voor domotica





Jaga D-Flow **EXPERT** is in wezen identiek aan het Smart systeem, maar volledig uitgerust voor centrale sturing via GBS (gebouw beheer systeem) of een domotica systeem. De Refresh units en de extractiebox worden aangestuurd via een 0 tot 10V signaal. Het domotica systeem is voorzien van sensoren en stuurt de ventilatie, samen met vele andere functies van het gebouw. Op deze manier kan het energiezuinige en gebalanceerde ventilatiesysteem van Jaga perfect geïntegreerd worden in het domotica systeem.

WAT IS CO_2?

CO_2 (koolstofdioxide) is één van de afvalstoffen van de mens, en één van de belangrijkste verontreinigingen van onze binnenlucht. Bij afwezigheid van ventilatie ontstaat er een benauwde atmosfeer. Een te hoge concentratie van CO_2 heeft ook gezondheid gerelateerde risico's: hoofdpijn, vermoeidheid, slijmvliesirritaties, overdracht van infecties, verergering van allergieën, een verhoogd risico op astma-aanvallen...
Het CO_2-gehalte wordt uitgedrukt in ppm (parts per million). Een goede kwaliteit binnenlucht bevat minder dan 0.1 volume procent CO_2 (1000 ppm). Als grenswaarde wordt 0.12 vol % (1200 ppm) gehanteerd.

jaga

BEN – BIJNA - ENERGIE - NEUTRAAL – bouwen is vooruitdenken – je mee ?

D-FLOW EN EPB

REDUCTIEFACTOR VOOR VRAAGGESTUURDE VENTILATIESYSTEMEN

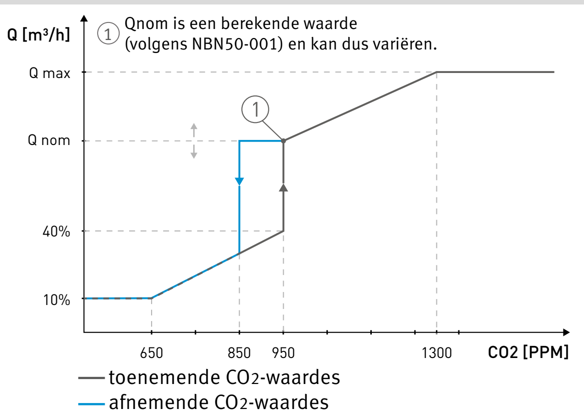
REDUCTIE FACTOR **0.42**
heat 0.42
overheat 0.42
cool 0.42

JAGA D-FLOW **SMART**

CO_2 gestuurd, draadloos RF systeem

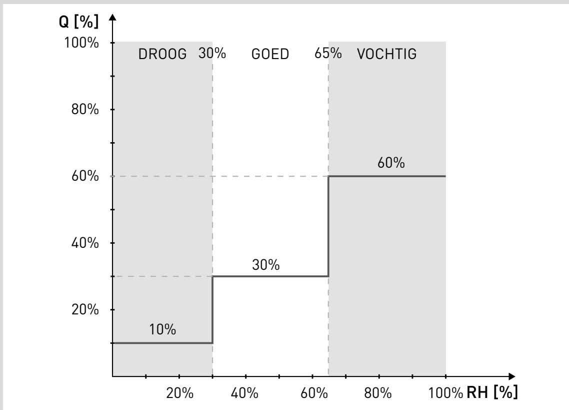
RF LINK	**TOEVOER IN DROGE RUIMTES** Woonkamer, Slaapkamer(s), Speelkamer, Studeerkamer Andere "droge" ruimte	**AFVOER IN NATTE RUIMTES** (Open) keuken, Wasplaats, Badkamer, Toilet Andere "natte" ruimte
TOESTELLEN	**REFRESH UNITS** OXRE.015 & OXRE.020 (75 - 90 - 110 - 150 m^3/h)	**EXHAUST BOX** OXEX.130 (250 - 350 - 450 m^3/h)
DETECTIE	**CO_2 LOKAAL** CO_2 sensor geïntegreerd in OXRE één of meerdere sensoren in elke droge ruimte	**RH CENTRAAL** RH module geïntegreerd in OXEX één sensor centraal in de afvoerbox
REGELING	**LOKAAL** elke droge ruimte afzonderlijk geregeld	**CENTRAAL** alle natte ruimtes samen geregeld
STURING	**CO_2-sturing via Refresh Unit**	**RH-sturing via Exhaust Box**

CO_2-sturing via Refresh Unit



CO_2 wordt constant gemeten door de refresh units. Het debiet van de aangevoerde lucht wordt verhoogt volgens ingestelde programma's.

RH-sturing via Exhaust Box



De Jaga extractiebox meet constant de luchtvochtigheid en zorgt voor de juiste debieten. Door de verschillende scenario's die standard geprogrameerd zijn in de sturing zorgt het intelligente systeem voor de meest optimale werking en het hoogste comfort.

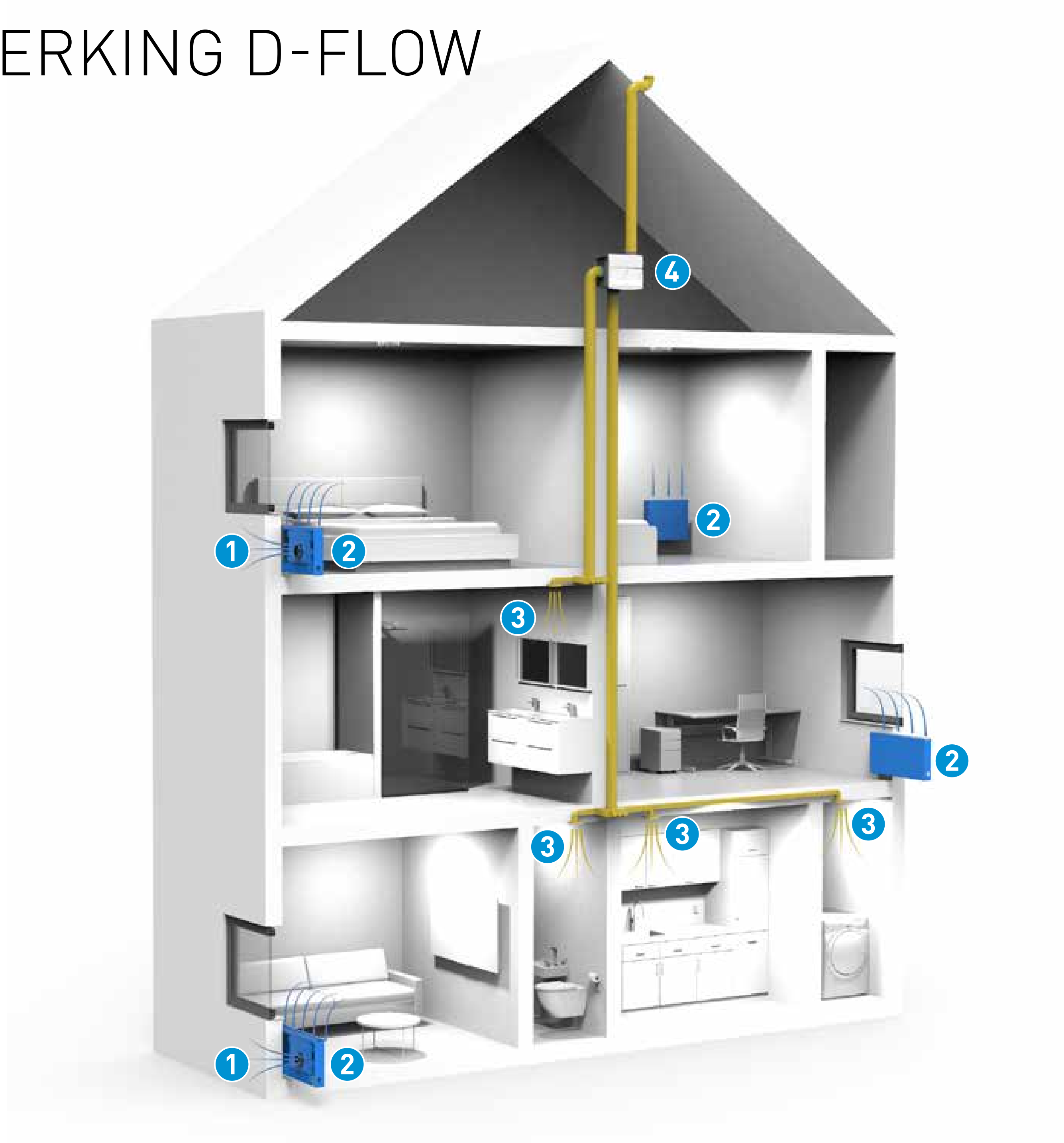
"Door CO_2 sensoren en de vraaggestuurde luchttoevoer per ruimte bekomt Jaga D-Flow een reductiefactor van 0.42. Dit volgens de forfaitaire tabel inzake F-reducties bij nieuwbouw vanaf 01/01/2015."

REDUCTIE FACTOR
0.42
heat 0.42
overheat 0.42
cool 0.42

JAGA D-FLOW **EXPERT**
CO_2 gestuurd systeem voor domotica

DOMOTICA	**TOEVOER IN DROGE RUIMTES** Woonkamer, Slaapkamer(s), Speelkamer, Studeerkamer Andere "droge" ruimte	**AFVOER IN NATTE RUIMTES** (Open) keuken, Wasplaats, Badkamer, Toilet Andere "natte" ruimte
TOESTELLEN	**REFRESH UNITS** OXRE.015 & OXRE.020 (75 - 90 - 110 - 150m³/h)	**EXHAUST BOX** OXEX.130 (250 - 350 - 450m³/h)
DETECTIE	**CO_2 LOKAAL** **CO_2 via aparte sensor GBS** één of meerdere sensoren in elke droge ruimte	**RH CENTRAAL** **RH via aparte sensor GBS*** één sensor in extratiekanaal of meerdere sensoren in elke natte ruimte
REGELING	**LOKAAL** elke droge ruimte afzonderlijk geregeld	**CENTRAAL** alle natte ruimtes samen geregeld
STURING	**CO_2-sturing via GBS** **Voorwaarden domotica systeem** CO_2-sensor: Tolerantie +/- 40ppm + 5% van de waarde (bereik 300-1200ppm) Manuele interventie: maximale periode van 12u	**RH-sturing via GBS*** **Voorwaarden domotica systeem** RH-sensor: Tolerantie +/- 5% van de waarde (bereik van 10 - 90%) Manuele interventie: maximale periode van 12u *** Aanbevolen door Jaga maar geen vereiste voor de reductiefactor**

WERKING D-FLOW



EENVOUDIG TE BEDIENEN INTELLIGENTIE

Centrale sturing is mogelijk via het SMART en EXPERT systeem. Dit verbindt alle aangesloten componenten met elkaar via RF of via een reeds aanwezig domotica systeem. Dit zorgt voor een vlekkeloze communicatie en aansturing van de ventilatie. Zo blijven de luchtkwaliteit en de relatieve vochtigheid in de verschillende vertrekken op het gewenste niveau. Het is dé oplossing om het binnenklimaat in alle ruimten te controleren en te beheren.
Op het eenvoudige bedieningspaneel kan men de werking aanpassen naar persoonlijke voorkeur.

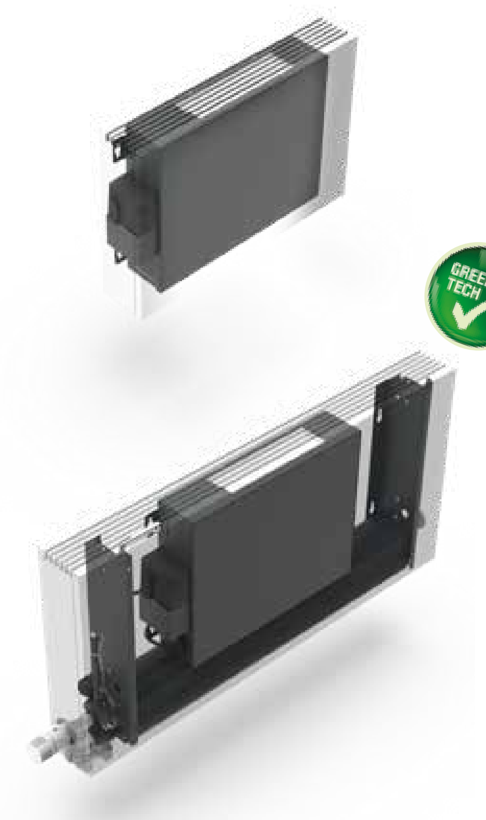
1

Aanvoer van verse buitenlucht

Via een ronde perforatie in de bouwschil en afgewerkt met een gevelrooster naar keuze. Beschikbaar in verschillende vormen en kleuren om zo één geheel te vormen met de buitengevel.

2

CO_2 gestuurde toevoer van verse lucht



Jaga Refresh Unit OXRE

Debiet 75 , 90, 110 of 150 m^3/h .
Het juiste debiet wordt voor u bepaald in het gratis ventilatie voorontwerp.

- eenvoudig te reinigen of te vervangen luchtfilter
- doorgedreven geluidsisolatie
- ingebouwde CO_2-sensor
- automatisch of handbediend
- automatische afsluitklep
- energiezuinige EC-motor

Jaga Refresh Unit & Low-H_2O radiator

Low-H_2O met ingebouwde Refresh Unit. Verse buitenlucht en binnenlucht worden vermengd / gefilterd en opgewarmd terug de kamer ingevoerd.

3

Ventielen in de natte ruimtes

Via luchtkanalen met ventielen in het plafond of in de muur worden de natte ruimtes aangesloten op de centrale extractiebox.

4

RH gestuurde afvoer van vervuilde lucht

Jaga Exhaust Box OXEX

Vochtige en gebruikte lucht wordt in balans met de toevoer via de extractiebox afgevoerd. OXEX is bij levering ingesteld op het maximum debiet van 450 m^3/h. Bij het Smart en het Expert systeem zal de afvoerbox zich automatisch instellen op het juiste balans-volume. Bij het Basic systeem kan het volume eenvoudig manueel ingesteld worden.

- met ingebouwde vochtsensor
- werkt modulerend voor een aangenaam comfort
- werkt in combinatie met de Refresh Unit
- energiezuinige EC-motor

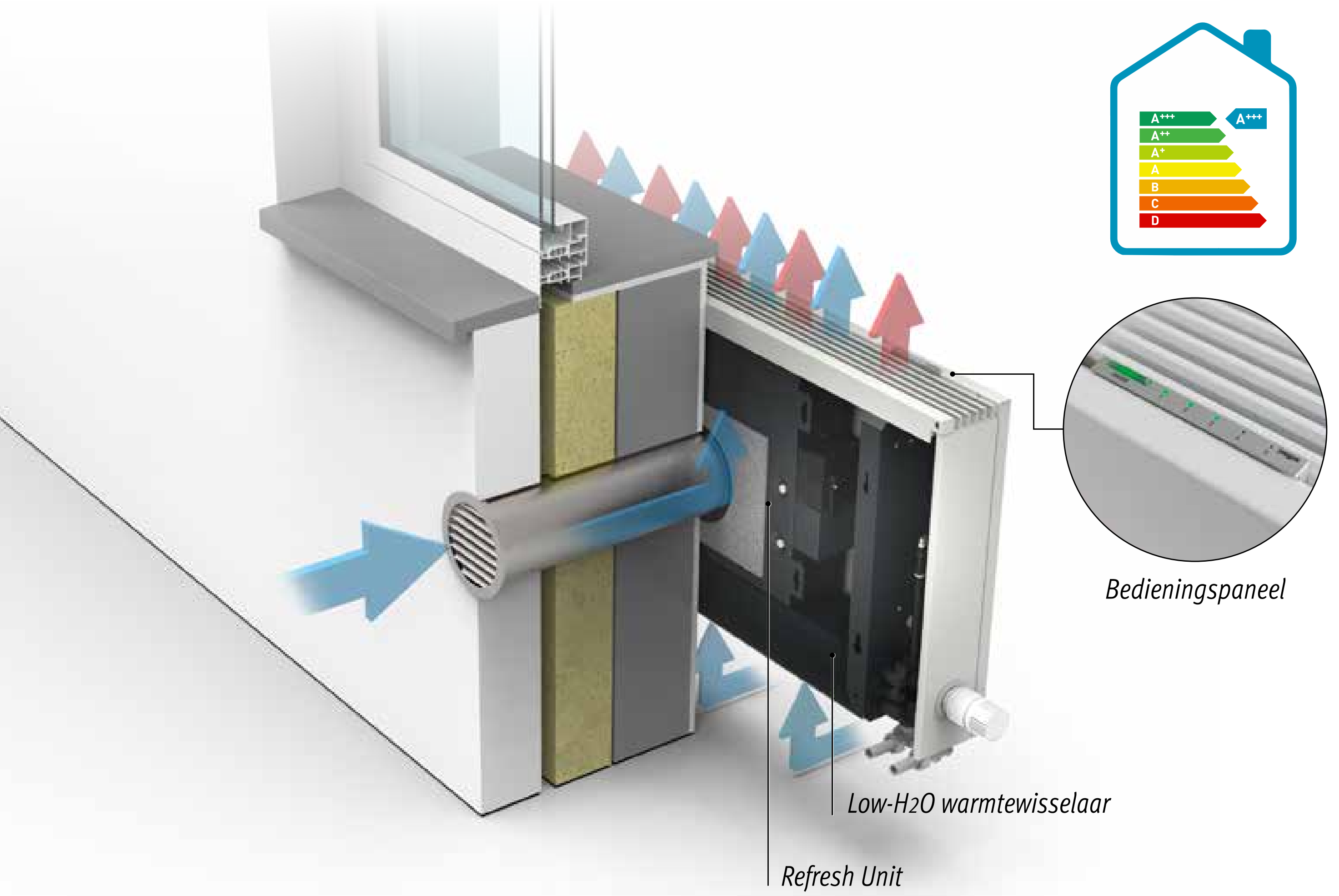
Steeds balans tussen toe- en afvoerdebiet (hoogste debiet is prioritair)

LOW-H2O RADIATOREN EN D-FLOW: EEN UNIEKE COMBINATIE

Het beste van twee werelden. D-Flow Refresh units kunnen onzichtbaar ingebouwd worden in de Jaga Low-H2O radiatoren. Deze unieke combinatie van verwarming en ventilatie zorgt voor een perfect klimaatsysteem met alleen maar voordelen:

- Behalve het kleine LED bedieningspaneeltje op de radiator is het ventilatiesysteem volledig onzichtbaar.
- Zowel de Low-H2O radiator als D-Flow behoren tot de meest energiezuinige systemen op de markt. Bewezen door diverse onafhankelijke laboratoria.
- Het hele jaar door verse lucht, die in het stookseizoen voorverwarmd wordt door de radiator.

Low-H2O radiator met ingebouwde Oxygen:
verse buitenlucht en binnenlucht worden vermengd / gefilterd en opgewarmd terug de kamer ingevoerd.



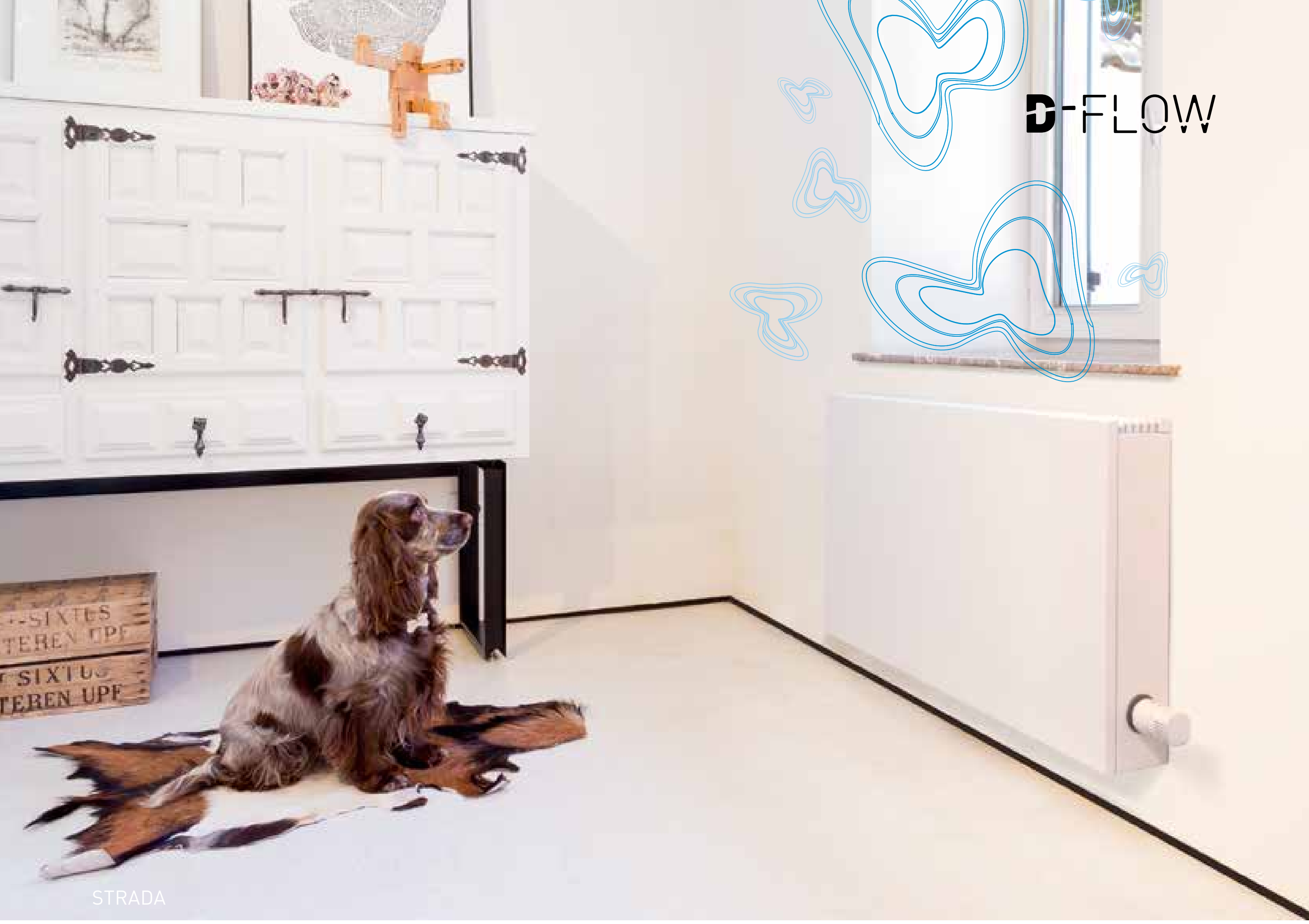
wtcb.be
Wetenschappelijk en Technisch Centrum voor het Bouwbedrijf
Brussel, 1981

TU/e
Technische Universiteit
Eindhoven, 2001

bre
Building Research Establishment
UK, 2003

Grenelle Environnement – Réglementation Thermique 2012
BBC bâtiments basse consommation
Frankrijk, 2012

kiwa – Partner for progress
Kiwa Certification
Apeldoorn, 2014



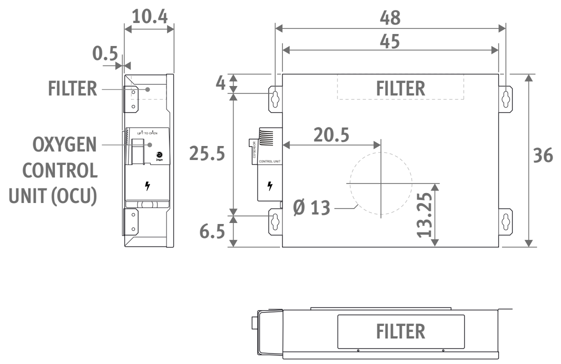
STRADA


LINEA PLUS

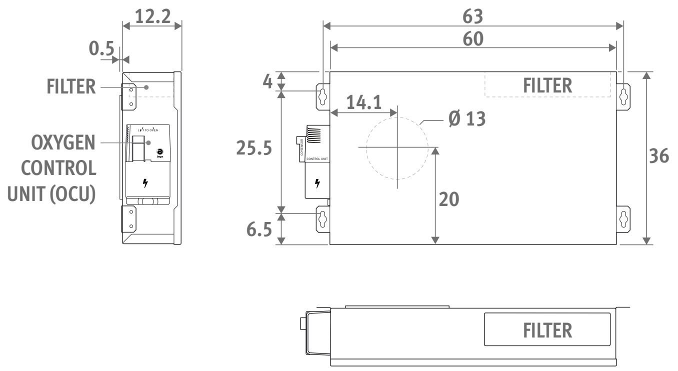

TEMPO

TECHNISCHE GEGEVENS

Refresh Unit OXRE.015

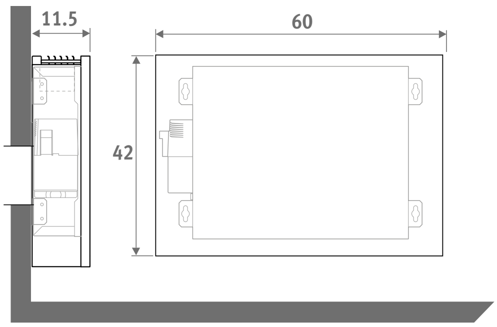


Refresh Unit OXRE.020



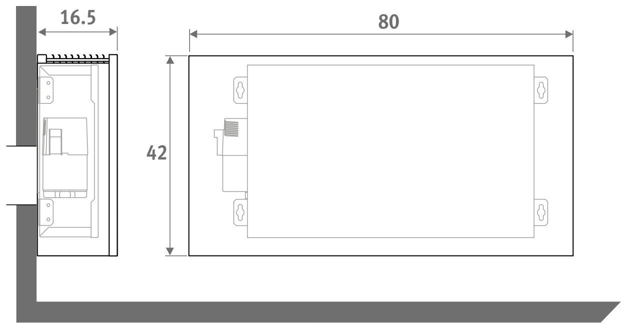
Stand-Alone OXRE.015

Refresh unit met bekleding



Stand-Alone OXRE.020

Refresh unit met bekleding



	OXRE.015				OXRE.020			
Debiet	75m³/h	90m³/h	110m³/h	150m³/h	75m³/h	90m³/h	110m³/h	150m³/h
Verbruik	5W	5W	7W	13W	5W	5W	8W	13W
Geluidsvermogen*	29.8 dB(A)	33.8 dB(A)	39.0 dB(A)	48.9 dB(A)	25.0 dB(A)	29.3 dB(A)	34.5 dB(A)	41.0 dB(A)
Dempingswaarde**	klep open: 44dB / klep gesloten: 51dB				klep open: 54dB / klep gesloten: 56dB			
Afmetingen (BxHxD)	55x36x10.4cm				70x36x12.2 cm			
Stand-Alone (BxHxD)	60x42x11.5cm				80x42x16.5cm			
Gewicht	9.1 kg				11.6 kg			
Diameter aansluiting	Ø12.5cm				Ø12.5cm			
Standaard filter	EN779: G3 / ISO16890: ISO coarse 50%				EN779: G3 / ISO16890: ISO coarse 50%			
Voedingsspanning	230V - 50Hz				230V - 50Hz			
CO_2-meetbereik***	400 - 2000ppm				400 - 2000ppm			
Beschermingsklasse	IP X1				IP X1			

* Volgens rapport Peutz A-3192-11E-RA-001 [ISO3741:2010]
** Volgens rapport Peutz A-3192-11E-RA-001 [ISO717-01:2013]
*** Enkel met optie CO_2 sensor

Refresh Unit

Stand-Alone

Standaard kleuren:

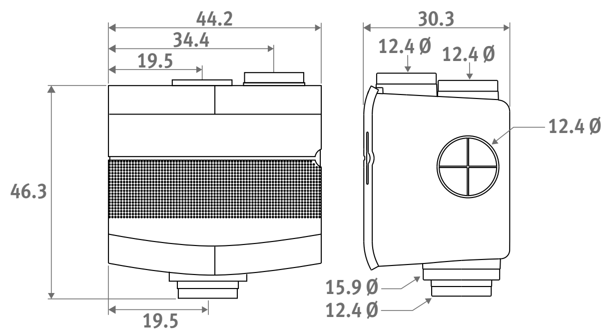
verkeerswit RAL 9016 (133),
soft touch licht gestructureerde satijn lak

zandstraalgrijs (001),
fine texture metallic lak

Andere kleuren: zie Jaga kleurenkaart.

Milieuvriendelijk gelakt met krasvaste poedercoating met hoge UV-bestendigheid.

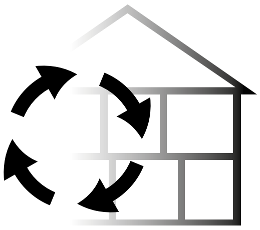
Exhaust Box OXEX



	OXEX.130		
Debiet	250 m³/h	350 m³/h	450 m³/h
Verbruik	25W	43W	82W
Geluid vermogen*	48 dB(A)	55 dB(A)	64 dB(A)
Afmetingen (BxHxD)	44.2x46.3x30.3 cm		
Gewicht	4,4 kg		
Diameter afvoer	3x Ø12.5 cm + 1x Ø12.5/16.0 cm		
Diameter toevoer	1 x Ø12.5 cm		
Voedingsspanning	230V - 50Hz		
Beschermingsklasse	IP X1		

GRATIS EPB VOORONTWERP

Bezorg ons uw bouwplannen en u krijgt een ventilatie voorontwerp én warmteverliesberekening.



Aan de hand van uw bouwplannen maakt de Jaga studiedienst een ventilatie-ontwerp met het Jaga D-Flow systeem volgens STS73-1 en een warmteverliesberekening volgens EN12831. Dit document kan men indienen als stavingsstuk in het EPB-dossier. Een offerte op maat waar ook alle afvoerkanalen en roosters vermeld worden, is eveneens inbegrepen in deze gratis service.

Refresh Unit

	Uitvoering	€	Bestelcode
OXRE.015	Basic	**567,50**	OXRE.015/075/C1/BE
	Smart + Optie RF	**700,00**	OXRE.015/075/C4/BE/RF
	Expert	**567,50**	OXRE.015/075/C2/BE
	Expert met bediening	**567,50**	OXRE.015/075/C3/BE
OXRE.020	Basic	**601,00**	OXRE.020/075/C1/BE
	Smart + Optie RF	**733,00**	OXRE.020/075/C4/BE/RF
	Expert	**601,00**	OXRE.020/075/C2/BE
	Expert met bediening	**601,00**	OXRE.020/075/C3/BE

Vervang 075 door 090,110 of 150 voor het gewenste debiet.
Het juiste debiet wordt voor u bepaald in het gratis ventilatie voorontwerp.

Stand-Alone bekleding

	Uitvoering	€	Bestelcode
Stand-Alone	voor OXRE.015	**76,80**	COXW.042.060.10/133/E
	voor OXRE.020	**95,00**	COXW.042.080.15/133/E

Voor standaard kleur zandstraalgrijs: vervang 133 door 001
Voor andere kleuren: vervang 133 door de gewenste kleurcode zie Jaga kleurenkaart

Standaard kleuren:
- verkeerswit RAL 9016 (133), soft touch licht gestructureerde satijn lak
- zandstraalgrijs (001), fine texture metallic lak

Andere kleuren: zie Jaga kleurenkaart.

Vervangfilter voor Refresh Unit

	Uitvoering	€	Bestelcode
EN779: G3*	ISO16890: ISO coarse 50%	**7,50**	8800.1284
EN779: M6	ISO16890: PM2.5 50%	**10,50**	8800.1285
EN779: F9	ISO16890: PM1 80%	**20,50**	8800.1289

*G3 filter standaard meegeleverd bij de Refresh Unit.

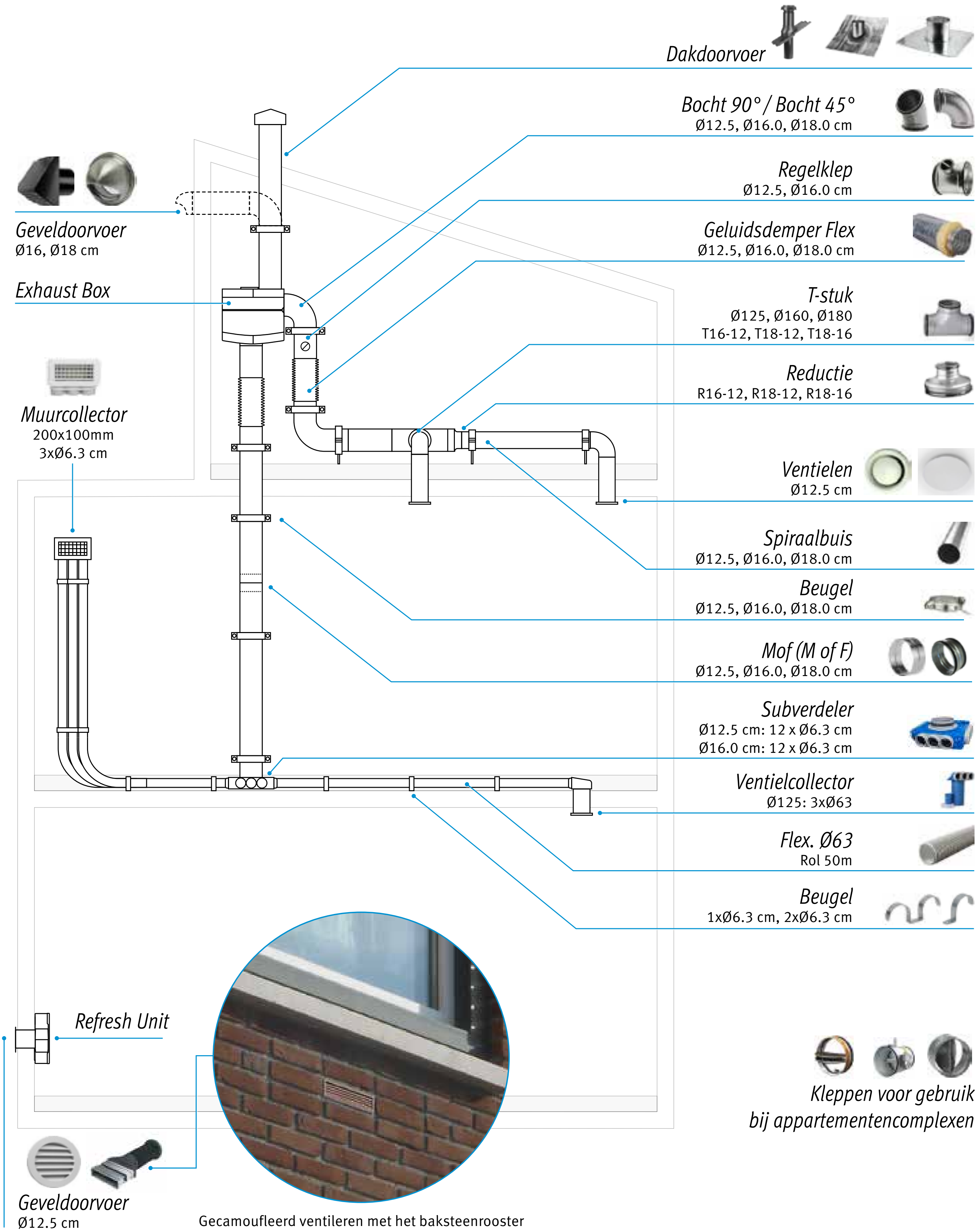
Exhaust Box

	Uitvoering	€	Bestelcode
OXEX.130	Exhaust box	**497,00**	OXEX.130/RFL

Bij levering ingesteld op het maximum debiet van 450 m^3/u. Bij het Smart en het Expert systeem zal de afvoerbox zich automatisch instellen op het juiste balans-volume. Bij het Basic systeem kan het volume eenvoudig manueel ingesteld worden.

TOEBEHOREN

Bij het Jaga D-Flow systeem zijn geen aanvoerkanalen nodig maar enkel afvoerkanalen. Om het u makkelijk te maken worden alle kanalen en toebehoren mee opgenomen in het gratis Jaga ventilatie-voorontwerp. Hieronder ziet u een overzicht van alle mogelijke toebehoren. Deze zijn niet bij Jaga te koop maar uw groothandel beschikt over een hoogwaardig gamma zodat uw systeem als een compleet pakket kan afgeleverd worden.



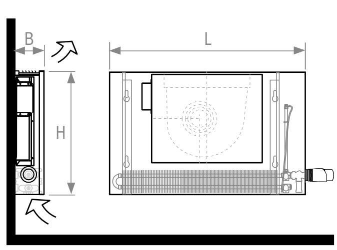
Gecamoufleerd ventileren met het baksteenrooster

LOW-H2O RADIATOREN: MINIMUM INBOUWMATEN

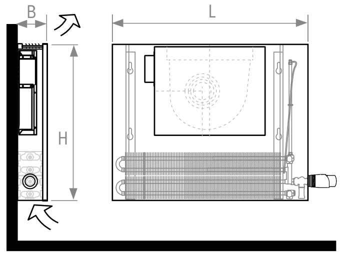
STRADA

Minimum lengte
vanaf L 80 cm voor OXRE.015
vanaf L 90 cm voor OXRE.020

Minimum hoogte



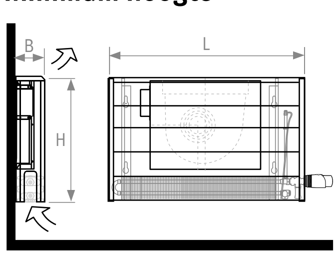
Type 10*/15/20: vanaf H 50 cm
* enkel geschikt voor OXRE.015.



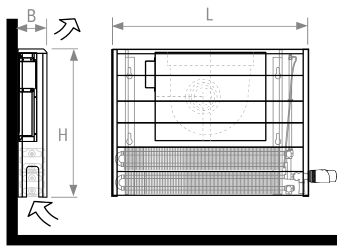
Type 11*/16/21: vanaf H 65 cm

TEMPO

Minimum hoogte



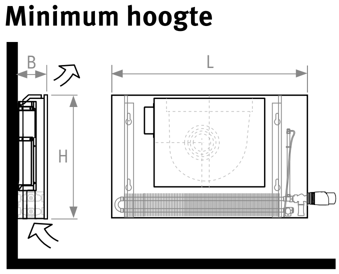
Type 10*/15/20: vanaf H 50 cm
* enkel geschikt voor OXRE.015.



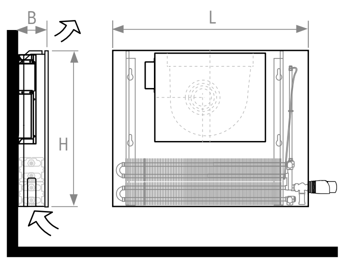
Type 11*/16/21: vanaf H 60 cm

LINEA PLUS

Minimum hoogte



Type 10*/15/20: vanaf H 50 cm
* enkel geschikt voor OXRE.015.



Type 11*/16/21: vanaf H 65 cm

Meer info over de zuinigste radiatoren vind je in de Jaga catalogus of op de website: **www.jaga.be**

JAGA VENTILATIE OOK VOOR UTILITEIT

OFFICE

Een betrouwbaar systeem met lage exploitatiekosten
Een goed binnenklimaat in kantoren is essentieel voor goede werkprestaties en een laag ziekteverzuim. Jaga D-Flow combineert de functies van verwarmen en ventileren in één bekleding. Dat leidt tot een aanzienlijke energiebesparing. Het gebouwbeheerssysteem past luchtkwaliteit, vochtigheid en temperatuur in iedere ruimte aan volgens de lokale omstandigheden. Het werkt volledig automatisch, maar kan in iedere ruimte ook eenvoudig door de gebruiker worden aangepast. Bovendien kan het systeem worden uitgebreid voor passieve of actieve koeling.

CARE

Met nadruk op comfort en gezondheid
Een systeem dat verder gaat dan alleen energiebesparing. Door de gebruikte Low-H_2O-techniek kent de verwarming altijd een veilige aanraaktemperatuur en betere warmtespreiding in het hele vertrek. De ventilatie unit zorgt voor frisse buitenlucht zonder tocht, omdat de verse lucht wordt opgewarmd tot de omgevingstemperatuur. CO_2-sensoren maken dagelijkse bediening overbodig. Het systeem werkt geheel autonoom. Bewoners en verzorgers hebben er geen omzien naar.

CAMPUS

Een schoolvoorbeeld van vraaggestuurde ventilatie
Het binnenklimaat in scholen staat al jaren in de belangstelling. Voldoende toevoer van frisse, schone buitenlucht en afvoer van vervuilde binnenlucht is noodzakelijk. Jaga D-Flow Campus houdt de CO_2-concentratie onder de 1200 ppm, terwijl het geluid op een laag niveau blijft. Standaard wordt het geïnstalleerd met een gebouwbeheersysteem, dat het volledige binnenklimaat meet en automatisch reguleert. Alle ruimtes zijn afzonderlijk te beheren. Speciaal voor het onderwijs kunnen de radiatoren worden voorzien van een penseel- en/of onderrooster.

Voor meer info betreffende Jaga ventilatie voor utiliteiten: info@jaga.be of 011 29 41 12

Jaga organiseert praktijkgerichte workshops over het D-Flow systeem, de Low-H_2O technologie en de software voor EPB berekening. Hier krijgt u meer inzicht in de evoluties die in de C.V. sector gaande zijn, en leert u hoe uzelf en de bewoners hieruit hun voordeel kunnen halen.

Bekijk het complete opleidingsaanbod op onze website: **www.jaga.be/academy**

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