HITACHI
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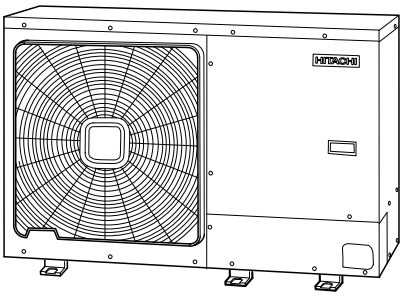
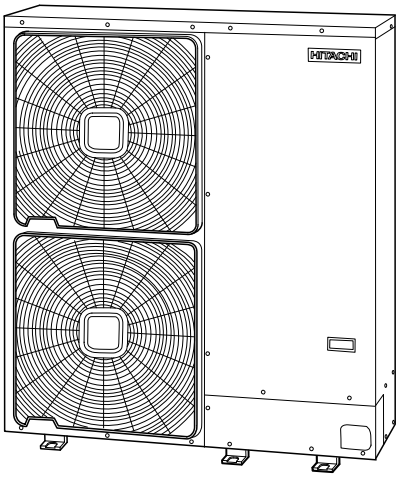
YUTAKI M SERIES





Technical Catalogue

RHUE-3AVHN1
RHUE-(3-6)A(V)HN-HM

HITACHI
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Contents

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1. General information

Index

1.1 Scope of this document

IMPORTANT NOTE

The information in this document refers to units produced from November 2013, with a serial number starting from "4KE26451 ".

The information related with formerly produced units can be found in the documents "TCGB0066 rev.1 - 03/2010" and "TCGB0072 rev.1 - 09/2011" .

Serial number	Related document
Before 4KE26451	TCGB0066 rev.1 - 03/2010 RHUE-(3-6)A(V)HN(-HM)
	TCGB0072 rev.1 - 09/2011 RHUE-(3-6)A(V)HN1
Starting from 4KE26451	TCGB0090 rev.0 - 12/2013 RHUE-(3-6)A(V)HN(1)(-HM)

1.2 General information

1.2.1 General notes

Within the policy of continuous improvement of its products, HITACHI Air Conditioning Products Europe, S.A.U. reserves the right to make changes at any time without prior notification and without being compelled to introducing them into products subsequently sold. This document may therefore have been subject to amendments during the life of the product.

HITACHI makes every effort to offer correct, up-to-date documentation. Despite this, printing errors cannot be controlled by HITACHI and are not its responsibility.

As a result, some of the images or data used to illustrate this document may not refer to specific models. No claims will be accepted based on the data, illustrations and descriptions included in this manual.

No type of modification must be made to the equipment without prior, written authorization from the manufacturer.

NOTE

This air conditioner has been designed for standard air conditioning for human beings. For use in other applications, please contact your HITACHI dealer or service contractor.

CAUTION

This unit is designed for commercial and light industrial application. If installed in house hold appliance, it could cause electromagnetic interference.

1.2.2 Introduction

YUTAKI M system is a high energy-efficiency household solution for space heating and water boiling.

YUTAKI M is designed to be installed outside of any kind of dwelling (house, apartment, villa,…), whether in a new construction or existing building. Only a few installation work is needed due to the lack of any chimney, fuel tank or gas connections. YUTAKI M is a monobloc system composed by only an outdoor unit, which carries out the function of an air-to-water heat pump. Thus being also an excellent solution when installation space available is limited.

YUTAKI M unit shall be always combined with either the Controller Pack or the Hydraulic Module (offered as accessories). Instead of burning fossil fuels as conventional boilers do, YUTAKI M extracts the heat present in the air, increases its temperature and then transmits this heat to the water of the installation by means of a heat-exchanger. Then, Hydraulic Module drives the water inside the building, to the heating elements (radiators, heating floor or fan-coils).

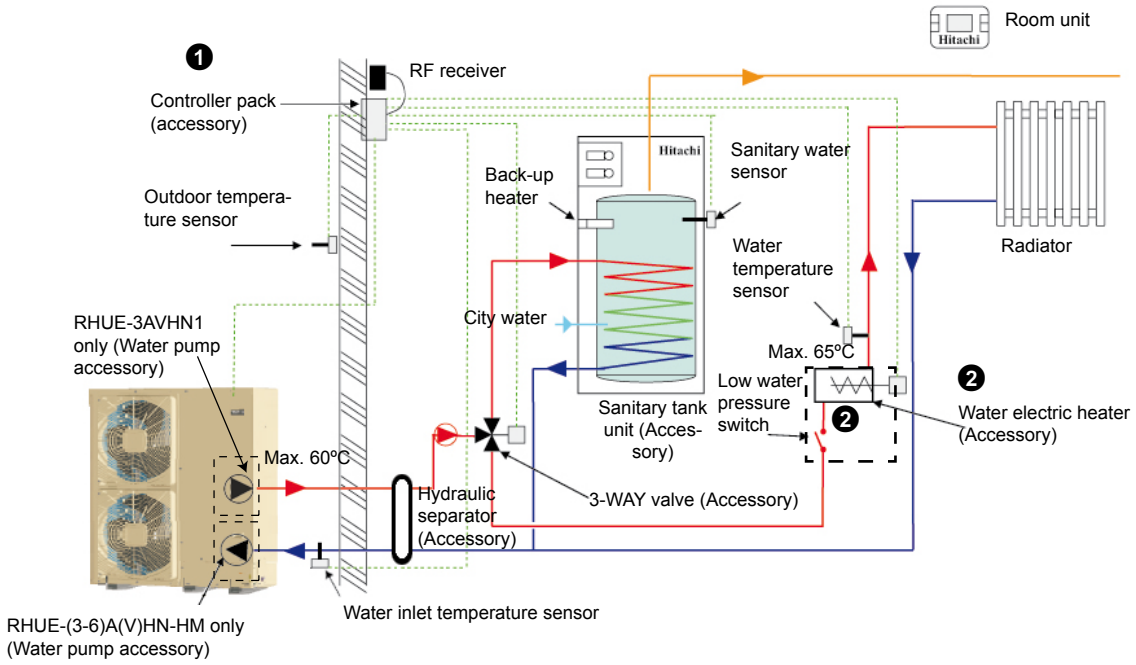
YUTAKI M also gives the option of sanitary hot water production, allowing the user to benefit from the heat pump's high efficiency and achieve hot water at 65ºC and above. This is made possible by a specific hot water tank, which is heated

in the heat pump from below using water pre-heated at 60ºC. An electrical resistance, at the top of the tank, increases the temperature in accordance with the user's needs.

As well as increased efficiency and reduced CO2 emissions due to the extraction of free heat from the outside air, the system also boasts proven reliability and minimum maintenance. YUTAKI M provides a comfortable atmosphere all year long, even in the coldest climates. The popular setting leaves the entire heating load in the heat pump's control for 90-95% of the year, and uses a back-up electrical resistance so that it is responsible for 5-10% of the load on the coldest days. This option usually results in an ideal balance between installation costs and future energy consumption, as proven by its popularity in colder climates than ours, such as Sweden and Norway.

The YUTAKI M system comes with many installation options. For instance, the heat pump can be set so that it provides all of the heating capacity itself, and it can also be connected in series to boilers supplied with fossil fuels to optimize the system's overall energy efficiency.

While conventional boilers can only achieve energy efficiency levels less than 1, the YUTAKI M system can attain efficiency of over 4. This means less electrical consumption and therefore a reduction in CO2 emissions.



1 For more information, refer to Installation and Operation manual of Advanced system controller (ATW-CPA-02)

2 For more information, refer to Installation and Operation manual of Water elecric heater (WEH-6E).

1.2.3 Environment-friendly units

The HITACHI's YUTAKI M series uses environmentally-friendly R410A gas refrigerant, and the RoHS and Green Dot regulations are applied throughout the manufacturing and installation process to reflect HITACHI's awareness of environmental respect and commitment.

R410A is totally environmentally-friendly since it does not contain any substances that damage the ozone layer: ODP (ozone depleting product) =0.

HITACHI's YUTAKI M series are very efficient and allow significant energy savings compared with conventional systems. This energy efficiency means less production of CO_2, which causes the greenhouse effect.

1.3 Applied symbols

During normal air conditioning system design work or unit installation, greater attention must be paid in certain situations requiring particular care in order to avoid damage to the unit, the installation or the building or property.

Situations that jeopardise the safety of those in the surrounding area or that put the unit itself at risk will be clearly indicated in this manual.

To indicate these situations, a series of special symbols will be used to clearly identify these situations.

Pay close attention to these symbols and to the messages following them, as your safety and that of others depends on it.

DANGER

- ***The text following this symbol contains information and instructions relating directly to your safety and physical wellbeing.***
- ***Not taking these instructions into account could lead to serious, very serious or even fatal injuries to you and others.***

In the texts following the danger symbol you can also find information on safe procedures during unit installation.

CAUTION

- *The text following this symbol contains information and instructions relating directly to your safety and physical wellbeing.*
- *Not taking these instructions into account could lead to minor injuries to you and others.*
- *Not taking these instructions into account could lead to unit damage.*

In the texts following the caution symbol you can also find information on safe procedures during unit installation.

NOTE

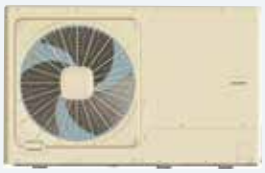
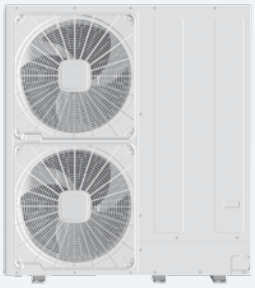
- *The text following this symbol contains information or instructions that may be of use or that require a more thorough explanation.*
- *Instructions regarding inspections to be made on unit parts or systems may also be included.*

1.4 Product guide

1.4.1 Classification of the units

RHUE	-	X	A	(X)	H	N	(X)
							1: Series 1
							-HM: Series 0 (version)
							R410A refrigerant
					Heating only		
				- = Three phase unit (3N~ 400V 50Hz)			
				V= Single phase unit (1~ 230V 50Hz)			
			Air-to-water unit				
		Compressor power (HP): 3/4/5/6					
	Position-separating hyphen (fixed)						
Unit type (made in Europe)							

1.4.2 Product guide

YUTAKI M UNITS					
AVHN1		AVHN		AHN	
1~		1~		3N~	
Unit	Code	Unit	Code	Unit	Code
RHUE-3AVHN1	9E311104	RHUE-3AVHN-HM	9E311103	-	-
-	-	RHUE-4AVHN-HM	9E411103	-	-
-	-	RHUE-5AVHN-HM	9E511103	RHUE-5AHN-HM	9E531103
-	-	RHUE-6AVHN-HM	9E611103	RHUE-6AHN-HM	9E631103
					

1.4.3 Accessory code list

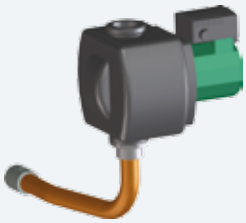
◆ Controller

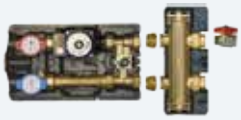
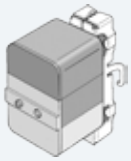
Accessory	Name	Code	Figure
ATW-CPA-02 NEW	Advanced system controller (Controller pack 2)	90500016	

◆ Hydraulic Module

Accessory	Name	Code	Figure
RHM-EH01E	Hydraulic module for electric heater combination (Controller pack 1 included)	9E500008	
RHM-BC01E	Hydraulic module for boiler combination (Controller pack 1 included)	9E500009	

◆ Other accessories

Accessory	Name	Code	Figure
ATW-PK1-01	Pump kit 1 (For RHUE-3AVHN1)	9E500012	
ATW-PK2-01	Pump kit 2 (For RHUE-3AVHN1)	9E500013	
ATW-PK3-01	Pump Kit 3 (For RHUE-3AVHN1)	9E500015	
Pump Kit A	Pump kit A (For RHUE-(3-6)A(V)HN-HM)	9E500006	
Pump Kit B	Pump kit B (For RHUE-(3-6)A(V)HN-HM)	9E500007	

Accessory	Name	Code	Figure
WEH-6E	Water Electric Heater	90500002	
ATW-HSK-01	Hydraulic separator	7E549905	
ATW-3WV-01	3-way valve (Internal thread and spring return)	7E549906	
ATW-2KT-02 NEW	2nd. temperature kit (*)	7E549917	
ATW-MVM-01	Mixing valve motor	7E549912	
ATW-AQT-01	Aquastat	7E549907	
ATW-WCV-01	Water check valve	9E500014	
ATW-2OS-02 NEW	2nd. outdoor temperature sensor	9E500017	
ATW-WTS-02Y	Universal water temperature sensor	9E500004	
DBS-26	Drain Boss	60299192	

Accessory	Name	Code	Figure
DHWT200E-2.5H1E	Domestic Hot Water Tank Enamelled (200 L.)	70544000	
DHWT300E-2.5H1E	Domestic Hot Water Tank Enamelled (300 L.)	70544001	
DHWT200S-2.5H1E	Domestic Hot Water Tank Stainless (200 L.)	70544100	
DHWT300S-2.5H1E	Domestic Hot Water Tank Stainless (300 L.)	70544101	
DHWT-CP-01	Permanent cathode protection for enamelled tank (200 L.)	70544900	
DHWT-CP-03	Permanent cathode protection for enamelled tank (300 L.)	70544903	
DHWT-CP-02	Permanent cathode protection for stainless tank (200 L.)	70544901	
DHWT-CP-04	Permanent cathode protection for stainless tank (300 L.)	70544904	
DHWT-SWG-01	Security water valve for DHW tank	70544902	
NEW ATW-DPOV-01	Differential pressure overflow valve	7E549916	

NOTE

- *For more information refer to the Installation and Operation Manual of each accessory.*
- *(*): The 2nd temperature kit (ATW-2KT-02) must be installed with the following accessories:*
  - *Mixing valve motor (ATW-MVM-01)*
  - *Universal water temperature sensor for second temperature control (ATW-WTS-02Y)*
  - *Aquastat for heating floor protection (ATW-AQT-01)*

  All these products are separately sold.

2. Features and benefits

Index

2.1 Main features

	YUTAKI M
1	Adaptability to the customer's / system's needs
2	Many available options and accessories
3	Maximum energy efficiency (COP)
4	Wide temperature range
5	Multiple operating conditions
6	Compact design (For RHUE-3AVHN1)
7	Minimum space requirement and low noise
8	Reduced pipe work
9	High efficiency refrigerant circuit
10	Highly efficient HITACHI scroll compressor

2.2 Selection benefits

2.2.1 Adaptability to the customer's/system's needs

Depending on the type of system (existing or new) and the user's needs, the most suitable system for each situation can be chosen.

- "Monovalent" Systems
- "Mono-Energy" Systems
- "Parallel Bivalent" Systems (Alternative)
- "Series Bivalent" Systems
- However, there are many programming options, depending on how the house is used (week programe, holiday -,...).

NOTE

For more information about the various systems, please refer to Chapter "11. System settings and control system".

2.2.2 Many available options and accessories

There is a large variety of hydraulic configurations, combining the different available accessories.

◆ **Advanced system controller (ATW-CPA-02)**

The System Controller is designed for controlling the Heat Pump in a mono-valent, mono-energetic or bi-valent heating system. It provides efficient control and reduces energy use while maintaining comfort in the building.

Features:

- Modulating Control of Heat Pump
- Control of an Auxiliary Heat Source (3-stage electric heater or boiler)
- Outside Temperature Compensated (OTC) Control
- Control of up to two Heating Circuits
- Control of Domestic Hot Water Storage with integrated time-program
- Control of DHW electric heater
- DHW Anti-Legionella Protection
- Frost Protection
- Automatic Summer Switch-Off
- RF interface to Room Units (user heating time-programs, setpoint adjustment, room temperature sensing)
- Communication with Heat Pump improves system performance, and reduces installation cost/effort
- Installation/Commissioning aids (manual overrides)

- Input for tariff switch device to switch between Heat Pump and boiler operation.
- Integrated simple multi-language user interface
- Installation mounting options
- Easy-to-wire (one-wire per terminal / one-plug per device)

NOTE

- *The functionality of the System Controller depends on the installed components and the selected configuration.*
- *The System Controller is designed in a way that it can be configured and upgraded to meet many application requirements.*

◆ Hydraulic Module (RHM-(EH/BC)01E)

The hydraulic module is a compact kit which includes all the water, refrigerant and control parts to allow all the different installation configurations.

Selection benefits

- "Plug and play" accessory for YUTAKI M series units.
- Compact cabinet with all hydraulic and control parts included.
- No need to calculate or install any hydraulic part outside the unit.
- Two different models for covering most of the common installations:
  - RHM-EH01E (model with electric heater of 6 kW)
    - For Mono-valent system configuration (disabled electric heater)
    - For Mono-energetic system configuration (enabled electric heater)
  - RHM-BC01E (model for boiler combination installation for Bi-valent system configuration)
- Integrated Timer for EJP (low electrical tariff) or for DHWT application.
- The system controller 1 is incorporated in both options.

Installation benefits

- Very easy and fast to install, just one cabinet (all hydraulic and control parts inside).
- Easy pipe connection (all pipes aligned at the bottom side).
- Easy wiring connection, the "System Controller 1" is wired from the factory (Installer only shall connect main source wires and control wires to the YUTAKI M unit).
- Pressure ports (factory supplied) for easy commissioning.

◆ Water pump (ATW-PK(1/2/3)-01 and Pump kit (A/B))

- 3 different pump sizes (ATW-PK(1/2/3)-01) for RHUE-3AVHN1 unit and 2 (Pump kit (A/B) for RHUE-(3-6)A(V) HN-HM units.
- 3 speeds to adapt the flow to the demand
- Internal thermal protection
- The pumps can be easily installed inside the unit

◆ Water Electric Heater (WEH-6E)

- Used for increasing the water supply temperature
- Regulation's relays (3 states)
- Electric power supply in single-phase and three-phase
- Safety: temperature limitor

◆ Domestic Hot Water Tank (DHWT(200/300)(E/S)-2.5H1E)

- Production of sanitary hot water
- Different capacities availabe
- Including Back-up heater

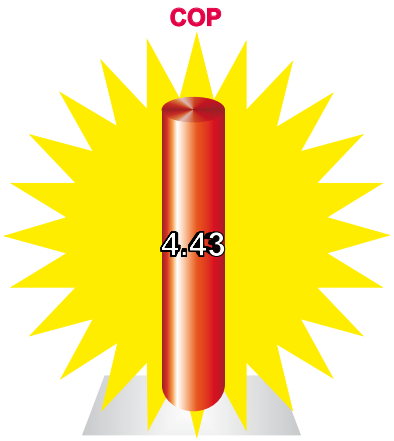
◆ Other accessories

- Hydraulic separator, 3 way valve, Aquastat,...

2.3 Operating benefits

2.3.1 Maximum energy efficiency (COP)

The inverter technology and HITACHI'S skilled compressor design and manufacture allow the maximum energy efficiency.



RHUE-3AVHN1

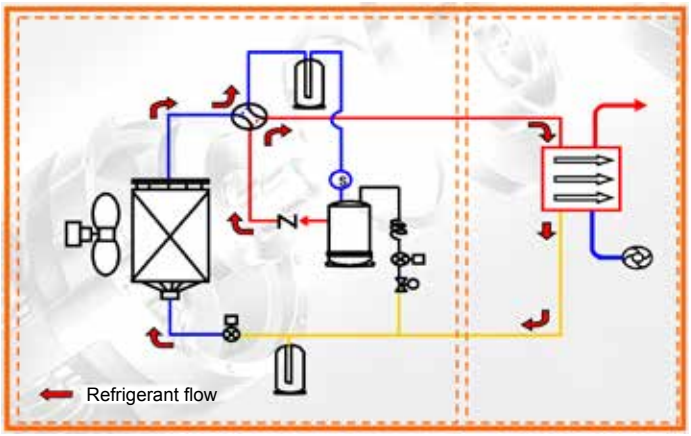
NOTE

COP temperature conditions:

- *Water inlet/outlet temperature: 30/35ºC*
- *Outdoor ambient temperature (DB/WB): 7/6ºC*

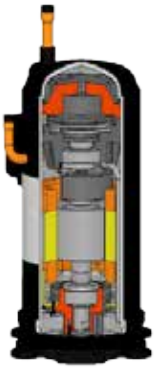
2.3.2 Maximum output

YUTAKI modules include more efficient heat exchangers and a liquid injection circuit that allows maximum output.

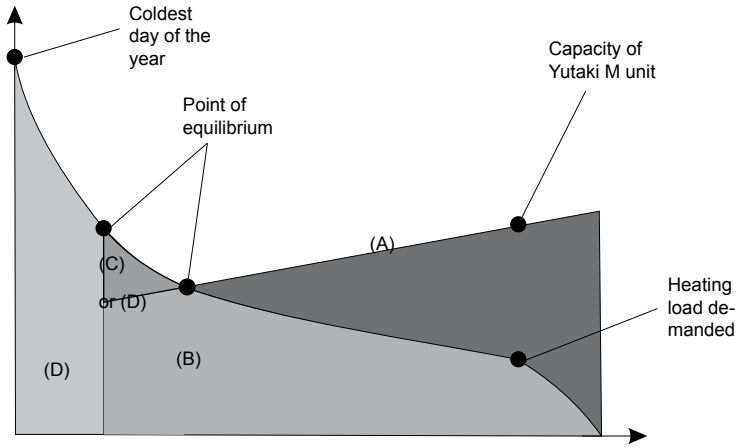


2.3.3 Reduced power consumption

Highly efficient DC scroll compressor Neodymium magnets in the rotor of the compressor motor. New inverter control.



2.3.4 Operating modes



NOTE

(A) Excess capacity on the Yutaki M unit

(B) Capacity covered by Yutaki M unit

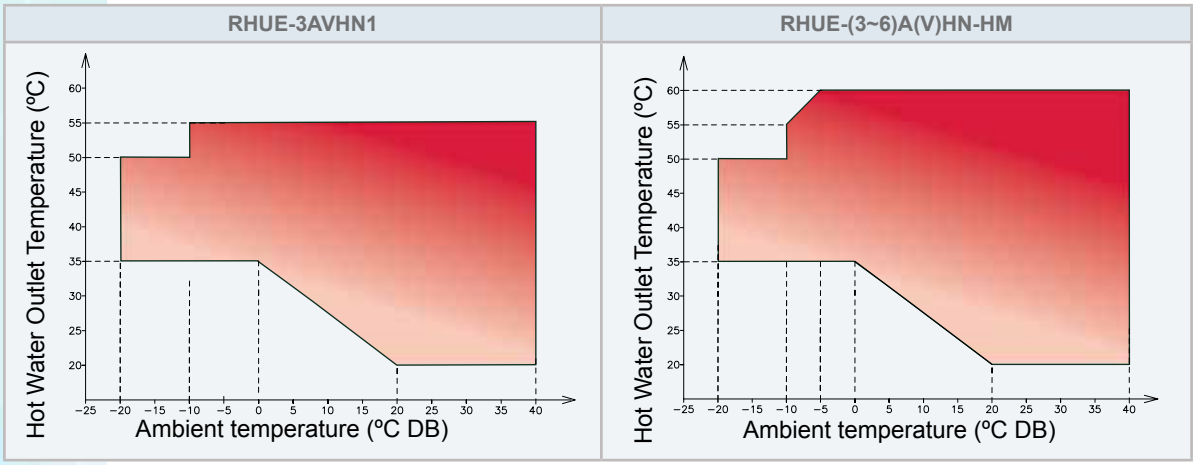
(C) Capacity covered by Heater or Boiler

(D) Capacity covered by the Boiler

Thanks to its inverter technology and its weather compensation function, Yutaki M unit ensures a comfortable room temperature with the lowest energy consumption. Even in extreme conditions (temperature down to -20ºC) Yutaki M will give exceptional performances all year long.

2.3.5 Wide temperature range

The YUTAKI module provides a broad temperature range.



NOTE

Tested at -15°C in the Building Research Establishment Laboratory for MCS Certification.

2.3.6 CO2 reduction

Installing an Air Source Heat Pump is a straightforward and cost effective method of using renewable energy to heat a home. Practical renewable energy use means reducing the use of fossil fuels and lowering carbon emissions.

2.4 Functionality benefits

2.4.1 Operating modes

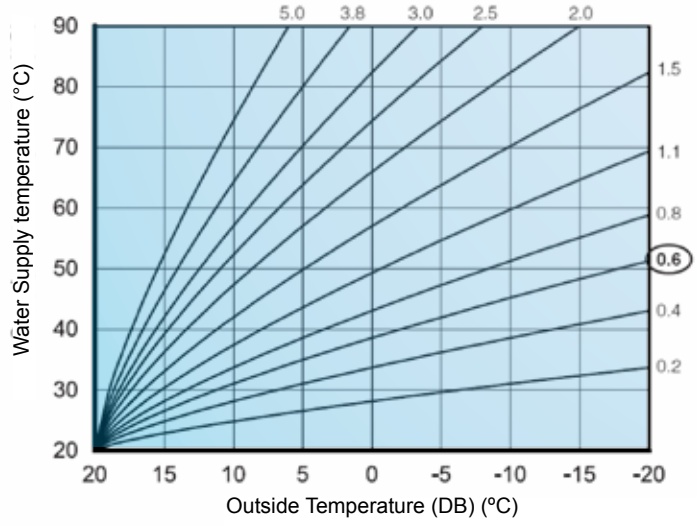
Hitachi's technology materializes into highly functional machines that are designed to provide maximum comfort for users.

An example of this are the new technologies used in the YUTAKI series heating systems.

The straightforward control system allows the user to set the target water temperature according to each system and the type of atmosphere.

2.4.2 Multiple operating conditions

The control system includes multiple operating conditions in order to optimize the YUTAKI module's output.



The graph shows the water supply temperature setpoint, when the room setpoint=20ºC and non room compensation iWs applied. The heating curve can be limited by the maximum supply setpoint parameter to prevent for example high temperatures going to the floor heating system.

2.4.3 Advanced system controller (ATW-CPA-02)

As previously mentioned, the Advanced System controller (ATW-CPA-02) is designed for controlling the YUTAKI M heat pump in a monovalent, mono-energetic or bivalent heating system. It provides efficient control and reduces energy use while maintaining comfort in the building.

◆ **Selection benefits**

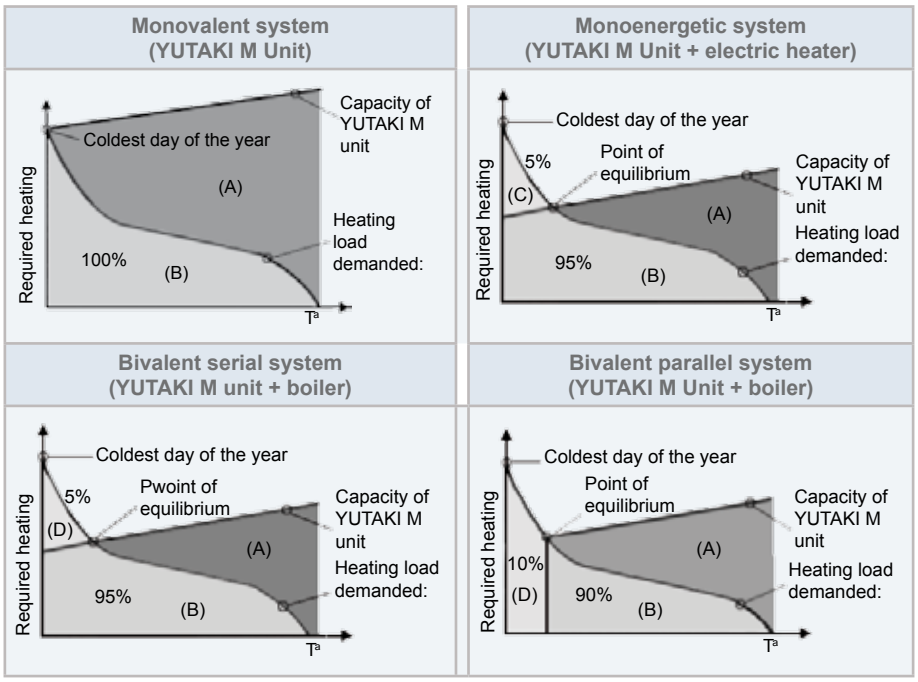
Adaptability to the customer's/system needs

Depending on the type of heating installation system (existing or new) and the user's needs, the most suitable system for each situation can be chosen from the following three main system configurations:

- Monovalent systems (Heater disabled)
- Mono-energy systems (Heater enabled)
- Parallel bivalent systems (For boiler combination)

Selecting the different configuration types it is possible to adapt the system to all customers' requirements, providing a wide application range from the simplest configuration to complete configuration, as shown below:

- Radiator/(fan coil), heating floor or both (2nd temperature area). Also combinable with the following options:
- Domestic Hot Water (DHW)
- Use of electric heater, boiler or both for low ambient temperature conditions.



◆ Installation benefits

The MVC housing is suitable for any installation situation. Installation is made easy thanks to a sophisticated fastening system and attractive plug-on housing panels that help to complete the work quickly, flexibly and efficiently.

Universal Mounting concept

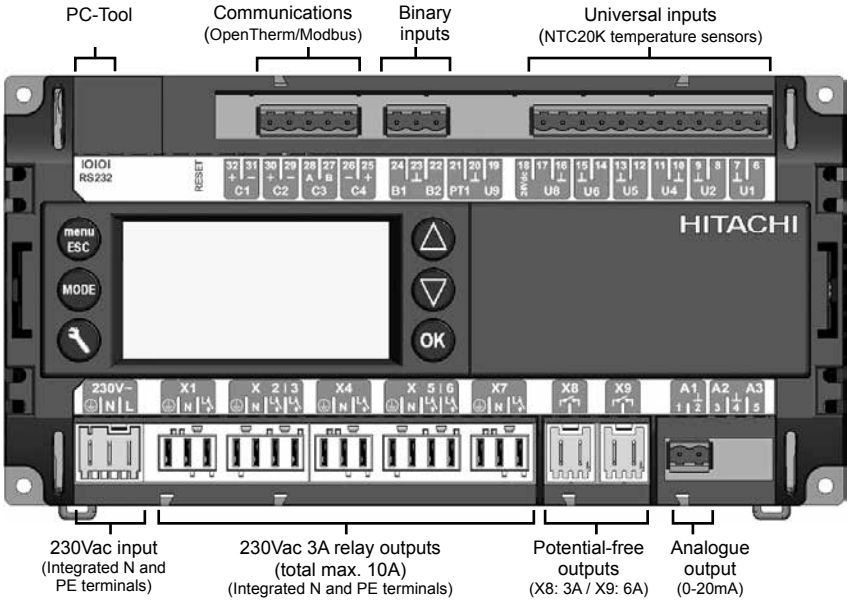
The System Controller is designed to be mounted either directly onto the wall or on a DIN-rail. It has three general mounting conditions:

Direct wall mounting with terminal cover	Door installation without tools	Installation in the standard fuse box
		

Easy Wiring

Thanks to codification of plug-in terminals by different type and colour, it is difficult to attach them in a wrong way.

Connection by areas



◆ Start-up benefits

the System Controller will normally operate in fully Automatic Mode, which means that domestic hot water follows the DHW time program and heating follows the schedule programmed in the Room Unit(s).

By pressing MODE from the home screen and then up/down, operation mode can be changed to:

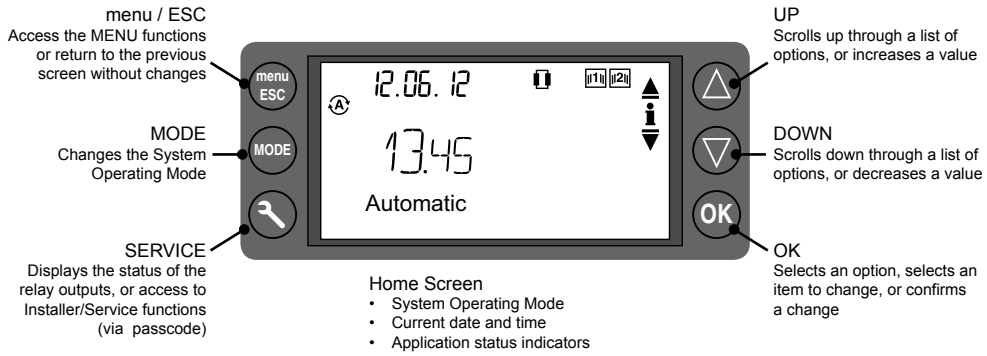
- **Holiday Mode:** When going on holiday, heating is switched to standby and domestic hot water is switched off until the set holiday return date. After selecting Holiday Mode, the return day can be programmed.
- **Standby Mode:** Heating and hot water are switched off, except for automatic frost protection.
- NEW **DHW Boost Mode:** It is possible to request a one-time heating up of the DHW tank by selecting DHW Boost Mode. This can be useful for example during a period when the DHW tank is not heated (for example, it is disabled with the time program, or when the system controller is in Standby Mode).
- NEW **Heat Boost Mode:** It is possible to request a one-time heating up of the supply temperature by selecting Heat Boost Mode. This can be useful during commissioning (first start up) and when the system water temperature is very low. When the supply water temperature (between 10 and 20ºC) and outdoor temperature (<10ºC) are too low, the heat pump can be damaged during defrosting

◆ Easy to use - new user interface

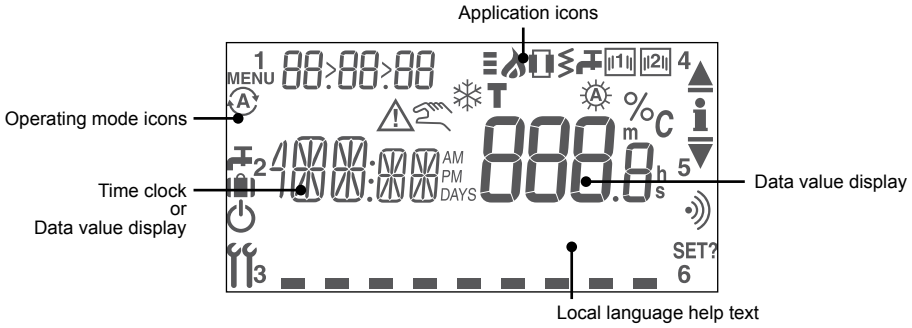
Integrated interface

Integrated interface provides access to the following functions:

- Display of status / measurements of all controller inputs and outputs
- Display of current alarms (failures) and recent alarm history
- Setting of all adjustable parameters
- Display of system internal data points (calculated set points)
- Two-levels of parameter access (installer and service level) with passcode entry
- Textual descriptions in local language
- Multi-language localization
- Setting of real-time-clock
- Setting of daily DHW time program
- Manual override of inputs or outputs for commissioning
- Display of Heat Pump status and error codes
- Display of icons showing current operating modes.
- Identification of heating zone during room unit RF binding process.



Display



The display of the System Controller is simple to understand and has extra segments to indicate the operating mode, failures and status.

The Home Screen shows the current operating mode of the system, the current date and time, and application status indicators.

The application status indicators are shown in the table below.

Icon	Meaning	Active Condition
	Electric heat power level 1	Electric Heater operating at power level 1
	Electric heat power level 2	Electric Heater operating at power level 2
	Electric heat power level 3	Electric Heater operating at power level 3
	Heat Pump	Heat Pump Control enabled
	Flame	Boiler Control enabled
	Heater	Electric Heater Control enabled
	DHW	DHW loading active
	HC1	Heating Circuit 1 enabled
	HC2	Heating Circuit 2 enabled
	ASSO	Automatic Summer Switch Off active
	Tariff	DHW or Heat Pump blocking active (blocking input)
	Frost	Frost Protection active

◆ Maintenance benefits

Complete operation display through LCD user interface

The LCD user interface display menu allows checking all the important parameters and the status of the unit in any moment.

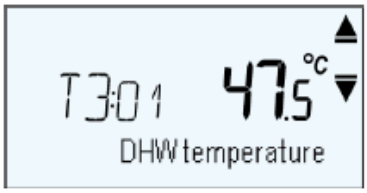
Most of these variables are the same ones that can be consulted at the 7-segment, fetching information from the YUTAKI M outdoor unit.

Quick System Information Display

Press ∨/∧ from the home screen.

The display shows important information about system temperatures and set points.

(Example)

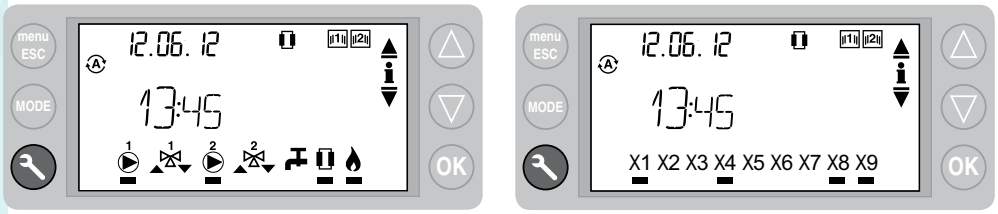


	Left side value	Right side value	Description
1	-	Actual Outside Temperature	
2	HC1 Room Setpoint	HC1 Room Temperature	Only if a room unit was bound for HC1
3	HC2 Room Setpoint	HC2 Room Temperature	Only if a room unit was bound for HC2
4	HC1 Supply Setpoint	HC1 Supply Temperature	Only if HC1 is a mixing Loop
5	HC1 Supply Setpoint	System Supply Temperature	Only if HC1 is a direct Loop
5	HC2 Supply Setpoint	HC2 Supply Temperature	Only if Heating Circuit 2 type is not = none
6	DHW Setpoint	DHW Temperature	Only if DHW Type is not = none
7	Heat Pump Supply Setpoint	Heat Pump Outlet Temperature	
8	Boiler Supply Setpoint	Boiler Supply Temperature	Only if Configuration= 3 or 4

Quick Relay Status Display

The display shows the relay output status using graphical icons

(Example)



Outdoor unit status shown in the system controller NEW

Yutaki M Information shown at the MVC display:

Nº	Name	Remarks
1	Operating Status	(Run/stop, Thermo ON/OFF, Alarm, Defrost)
2	Outdoor Temperature	(ºC)
3	Inlet Temperature	(ºC)
4	Outlet Temperature	(ºC)
5	Actual Water outlet Set point	(ºC)
6	Failure Status	Alarm code (Nº)

Alarm code display both YUTAKI M unit and system conroller NEW

When a failure occurs in the system it can be displayed on the screen:

NOTE

For detailed information about the alarm codes list, please refer to the capter "12. Troubleshooting"

Installer/Service Access

In order to access parameter settings and other information, it is necessary to log in with an installer or service access code.

◆ Wide variety of installation configurations

The system controller can be used for several different hydraulic system configurations, including mono-valent systems, mono-energetic systems with auxiliary electric heater, and bi-valent systems with gas/oil boiler.

Valid hydraulic configurations are:

Hydraulic configura-tion	Description	Heat pump	Electric heater	Boiler	Boiler pump	Boiler by-pass	DHW	DHW E-Heater	HC1 Circuit	HC2 Circuit
CONF 1.1	**Mono-Valent System** Heat pump only without hydraulic separator 1x Direct Circuit	✓	-	-	-	-	✓ DHW valve	✓	Direct circuit	-
CONF 1.2	**Mono-Valent System** Heat pump only 2x Mixing/Direct circuits	✓	-	-	-	-	✓ DHW pump	✓	Direct or mixing circuit	Direct or mixing circuit
CONF 2.1	**Mono-Energetic System** Heat pump & electric heater without hydraulic separator 1x direct circuit	✓	✓	-	-	-	✓ DHW valve	✓	Direct circuit	-
CONF 2.2	**Mono-Energetic System** Heat pump & electric heater 1x Mixing/Direct circuit 1x Direct circuit	✓	✓	-	-	-	✓ DHW pump	✓	Direct or mixing circuit	Direct circuit
CONF 3.1	**Bi-Valent Parallel System** Heat pump & boiler Boiler pump control 1x Mixing/Direct circuit 1x Direct circuit	✓	-	✓	✓	-	✓ DHW pump	-	Direct or mixing circuit	Direct circuit
CONF 3.2	**Bi-Valent Parallel System** Heat pump & boiler 2x Mixing/Direct circuits	✓	-	✓	-	-	✓ DHW pump	-	Direct or mixing circuit	Direct or mixing circuit
CONF 4.1	**Bi-Valent Series System** Heat pump & boiler 1x Mixing/Direct circuit 1x Direct circuit	✓	-	✓	-	✓	✓ DHW pump	-	Direct or mixing circuit	Direct circuit

NOTE

For detailed information about the alarm codes list, please refer to the chapter "11. System settings and control system"

◆ Control features for space heating

Second water temperature control NEW

New System controller allows the water temperature control of two zones with different required temperatures (radiators + heating floor for example) by means of the 2nd Temperature Room Thermostat.

The mixing valve is controlled to maintain the second supply temperature at the second temperature set point. The system control then decides how much to open or close the mixing valve to achieve the desired position for the valve (See System configurations for more detail).

Outdoor Temperature

The actual outdoor temperature is measured by the Yutaki M heat pump. The System Controller uses the actual value and time-averaged values for the control functions:

- Actual outdoor Temperature; used for frost protection
- Average outdoor Temperature (3hr rolling average); used for OTC function and heating source mode
- Daily Average outdoor Temperature (24hr rolling average); used for auto summer switch-off function.

Optional outdoor temperature sensor: NEW

An outdoor temperature sensor can be directly connected to the controller in case the heat pump is located in a position not suitable for this measurement.

If a wired outdoor sensor is selected, then use the wired outdoor temperature instead of the Yutaki M outdoor temperature. (See available optional functions)

System Frost Protection

The frost protection function helps to prevent the freezing of the heating system pipework. When the actual outdoor temperature falls below the Frost Protection Activation Temperature, both heating circuit supply water temperatures will be maintained at least at the Frost Protection HC Minimum Supply Set point. A switching differential of 1K is applied.

Automatic Summer Switch-Off

At higher outdoor temperatures it does not make sense to keep heating a building. The System Controller switches off the heating when the daily average outdoor temperature rises above the Summer Switch-Off Activation Temperature. A switching differential of -0.5K is applied. When Automatic Summer Switch-Off is active, the heating circuits are disabled.

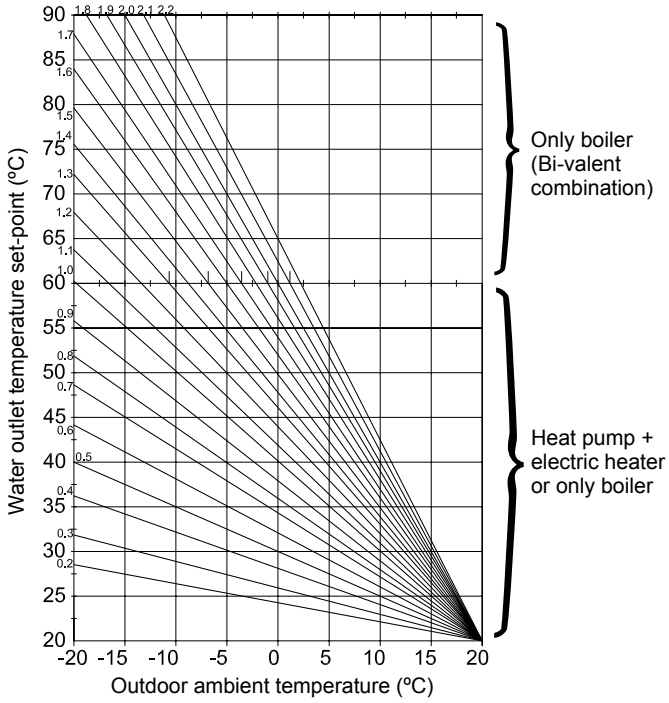
Pump and Valve Seizure Protection

The pump/valve seizure protection function helps to prevent these components from being stuck during long periods of inactivity.

Heating Circuit: OTC Control Characteristic Curve

The System Controller is an Outdoor Temperature Compensated (OTC) control system that uses the outdoor temperature, the room temperature set point, and optionally the room temperature, to calculate the correct supply water temperature for the system in order to maintain comfort conditions. A prerequisite for constant room comfort conditions is the correct setting of the heating characteristic curve as well as the correct design of the heating system by the heating installer according to heat demand calculations.

The heating curve should be selected according to the local climatic conditions, building structure and type of heating distribution system. The gradient of the heating curve describes the relation between the change in the supply temperature and the change in outdoor temperature. In the case of large heating surfaces (and therefore low supply temperatures) like floor heating systems, the heating characteristic curve is less steep compared to smaller heating surfaces (e.g. radiators). Typically a well-insulated, modern building with underfloor heating would use a heating curve value of 0.4-0.6 and one with radiator heating a value of around 1.6. The heating curve is affected by the room set point and the room compensation. In addition, the installer can set a heating curve parallel shift to move the heating curve up or down depending on circumstances.



Room Set point Heating Curve Shift

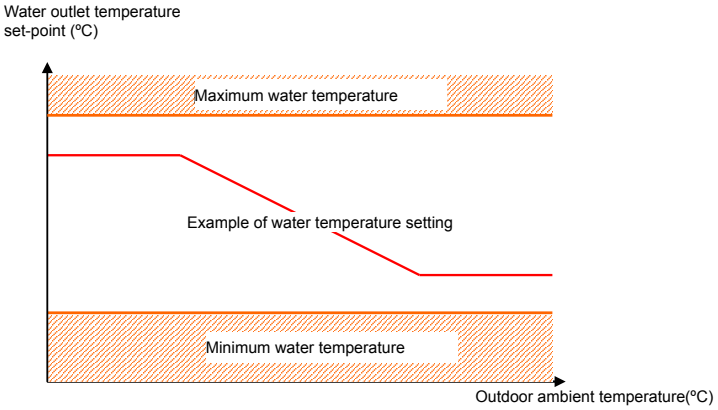
At different times of the day, according to the time programme in the Room Unit, the room temperature set point will cause a shift of the heating curve up or down to reflect the change in desired room temperature. The change in supply set point due to the room set point is dependent on the value of the outdoor temperature and the selected heating curve.

Room Temperature Compensation

If room compensation is enabled, the calculated supply set point is adjusted based on the difference between room temperature and room set point in order to reduce the room error. The amount of room influence can be adjusted by the room temperature compensation factor setting. The amount of room compensation can be increased or decreased by adjusting the room compensation factor. A higher value gives more priority to the room temperature error, and a lower value means that the controller follows more closely the selected heating curve.

Heating Circuit: Minimum/Maximum Temperature Limits

The maximum temperature limit can be used for example to prevent high temperature water from going to floor heating systems. The minimum temperature limit can be used when it is desired to keep a minimum level of heat in the heating circuit.



Heating Circuit: Pump

Normally, the heating circuit pump runs when the heating circuit is enabled. A pump overrun occurs before switching the pump off. For mixed circuits, the over-temperature limit protection switches the pump off. The type of DHW system affects the heating pump operation.

Heating Circuit 1: Automatic No-Load Detection Function (Improved)

When the calculated heating supply set point or the room set point (depending on the parameter setting) is less than the room temperature, then the heating circuit can be switched off to save energy.

- Automatic No-Load Detection Function activation:

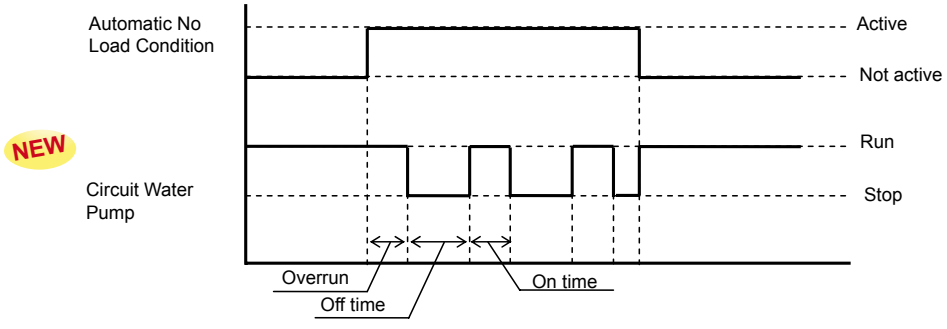
  a. In case of set point by water supply

  - If OTC Supply Set point ≤ Room Temperature → Heating circuit is switched OFF

  b. In case of set point by room temperature NEW

  - If Room Set point ≤ Room Temperature + offset → Heating circuit is switched OFF

If the Automatic No-Load Condition is active, the pump performs an ON/OFF cycle after running time, for a certain period as long as the Automatic No-Load condition remains active. NEW

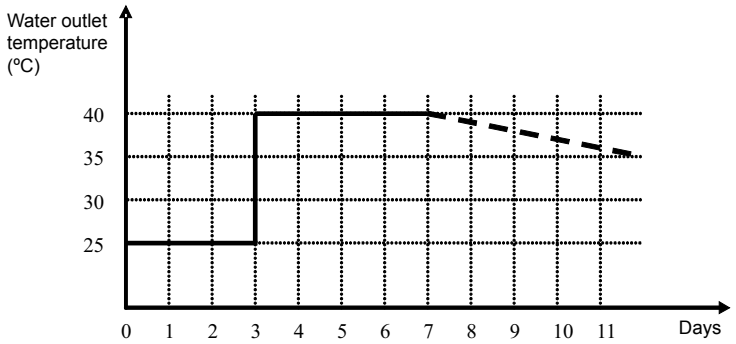


Screed Drying Function

The screed function is used exclusively for the process of drying of newly applied screed on floor heating systems. The process is based on EN 1264 part 4.

When the Screed Function is activated, the HC1 Screed Set point follows a predetermined schedule:

1 HC1 Screed Set point is kept constant at 25°C for 3 days,
2 HC1 Screed Set point is set to the HC1 Maximum Supply Set point (but always limited to ≤ 55°C) for 4 days



◆ Control features for domestic hot water tank combination

DHW Time Program NEW

A DHW time program is provided in the System Controller, and can be changed through the integrated HMI.

The user can set up to two time periods in the day when DHW control is enabled.

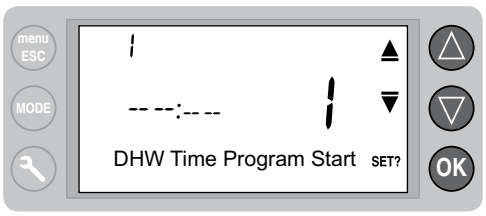
The time program is the same for every day (daily program only).

Operation method is explained below.

The System Controller normally operates in fully Automatic Mode, which means that the domestic hot water follows the DHW time program:

- Select '01 Set Time Programs' in the menu screens and press OK to enter the time program screen.

Display showing 1st switch point (ON)



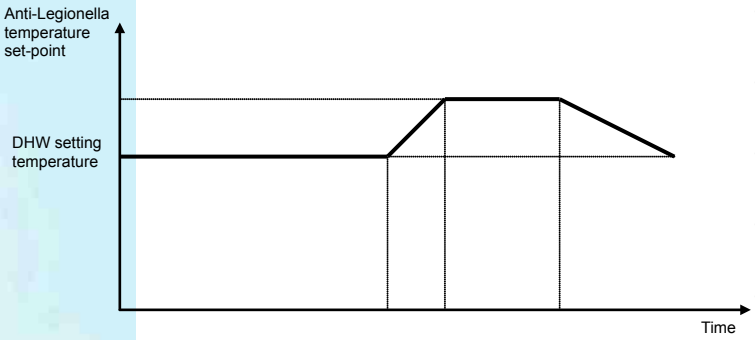
- The DHW time program has 4 switch points.
- The value of the first and third switch point is fixed to 1 = ON.
- The value of the second and fourth switch point is fixed to 0 = OFF.
- The time – hour and minute – of each switch point is changeable. The field – hour or minute - which is currently changeable appears blinking.
- Each press of ▲ increases hour or minute by 1.
- Press and hold ▲ increases hour or minute till ▲ is released.
- Each press of ▼ decreases hour or minute by 1.
- Press and hold ▼ decreases hour or minute till ▼ is released.
- Press of ▲ changes the dashes in the hour field, displaying 12.
- Press of ▼ changes the dashes in the hour field, displaying 11.
- Press of ▲ changes the dashes in the minute field, displaying 00.
- Press of ▼ changes the dashes in the minute field, displaying 59.
- There is a wraparound when changing hour value and minute value.
- Press of OK confirms the input and change to the next field to be set.

- Press of ESC cancels all changes made so far and returns to the menu screen.
- After pressing OK at the minute field of the fourth switch point the display returns to the menu screen.
- The switch points are saved if all switch points have been confirmed by pressing OK.
- A switch point is only valid if hour and minute contain valid values.
- A valid switch point can be changed to invalid by setting dashes for hour or minute or both fields.

DHW Anti-Legionella Protection Function NEW

In order to prevent against Legionella into the DHW system, it is available a specific setting which will raise up the DHW periodically over the normal DHW tank temperature setting (it has to be at least 65°C for legionella protection)..

The following parameters should be configured for the Anti-Legionella function:



- Operation interval: Day(s) of the week at which the domestic water should be heated.
- Status: Defines whether the disinfection function is turned ON or OFF.
- Start time: Time of the day at which the DHW should be heated.
- Anti-Legionella temperature: High water temperature to be reached.
- Interval: Time period during the Anti-Legionella temperature remains constant.

DHW Boost Operation Mode NEW

It is possible to request a one-time heating up of the DHW tank by selecting DHW Boost Mode. This can be useful for example during a period when the DHW tank is not heated (for example, it is disabled with the time program, or the system controller is in Standby Mode).

It is also possible to activate the DHW boost via the “D2 DHW boost Input”

The DHW boost is activated once if the “D2 DHW boost Input” =1

DHW boost input

In DHW Boost Mode, DHW Boost is cancelled when DHW temperature ≥ DHW Control set point.

NOTE

When DHW Boost is cancelled, the Operating Mode returns to the previously selected value.

DHW defrost protection NEW

If DHW Defrost Control (P316) is set to 1 (Standard), then defrosting operation is always performed in Heating Circuit (HC1/2) upon reception of Yutaki M Defrost signal.

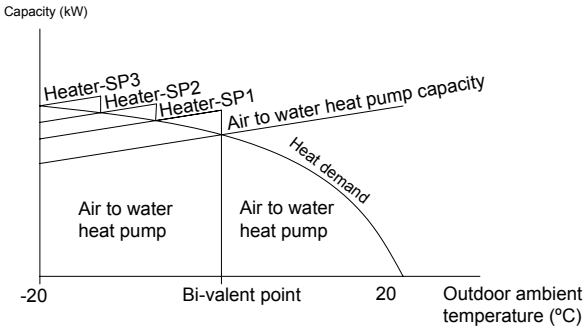
If DHW Defrost Control (P316) is set to 0 (Tank), then defrosting operation is always performed in DHW Tank upon reception of Yutaki M Defrost signal.

◆ Supplementary capacity heating

Electric heater

The electric heater is enabled under the lowest ambient temperature conditions, in order to provide the necessary supplementary heating, but only when the unit is operating in space heating mode.

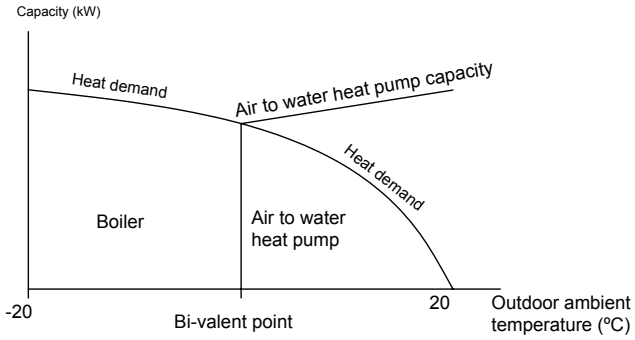
- 3-step heater control: The desired heating supplied by heater is determined by the Load factor, which is calculated by a P+I function ranging from 0 to 100%. Actual heater output is translated from percentage to a 3 step output using hysteresis system.



- Electric heater for emergency mode (Optional function): In case of outdoor unit malfunction, the required heating can be provided by the electric heater. NEW
- One step heater for 3-phase unbalance (Optional function): This option is used in 3-phase units to switch the 3 steps at the same time, thus preventing unbalance of the 3 phases of the installation cause by the steps of the electric heater. NEW

Boiler combination

The unit stops when it is not able to provide the necessary heating capacity in low ambient temperature conditions, and then the boiler starts to operate providing the necessary heating capacity. The unit should be sized in order to operate mainly with the air to water heat pump, as the boiler only activates in low ambient temperature conditions.



Boiler for emergency mode (Optional function): In case of failure of the outdoor unit, the required heating can be provided by the boiler. NEW

◆ Other optional functions

Blocking Input (Heat Pump/DHW blocking)

This function can be used to block the heat pump OR the DHW loading.

It allows an external tariff-switch device to switch off the heat pump during peak times of electricity demand, or it can be used with an external device (e.g. solar controller) to block the DHW loading.

Value	Configurations 1,2	Configurations 3,4
1	-	Closed contact: Heat Pump blocking is active
2	-	Open contact: Heat Pump blocking is active
3	Open contact: DHW blocking is active	Open contact: DHW blocking is active
4	Closed contact: DHW blocking is active	Closed contact: DHW blocking is active

NOTE

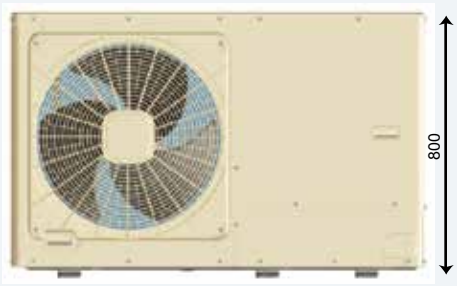
For more information about control functions, refer to the Installation and Operation manual of the System Controller.

2.5 Installation benefits

2.5.1 Compact design (For RHUE-3AVHN1)

The new compact design with only one fan (Height = 800m) ease its installation in very reduced spaces.

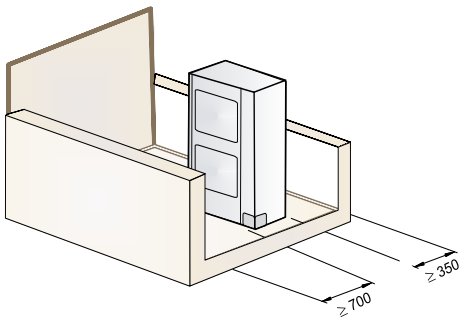
RHUE-3AVHN1



2.5.2 Minimal space requirement and low noise

Both outdoor and indoor units are combined in a single unit installed outside.

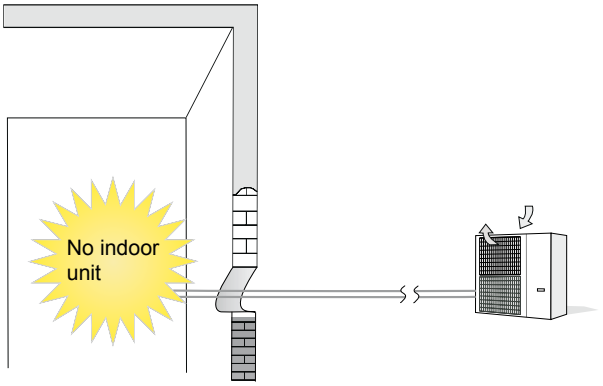
For this reason, the necessary space and the noise inside the house are highly reduced.



2.5.3 Reduced pipe work

Only water pipes needed to be installed, since the refrigerant is charged from factory side and the circuit is closed.

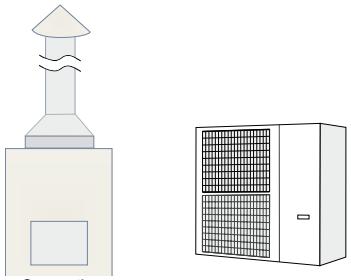
As a result, installation costs are reduced (fewer pipes, less installation time,...)



2.5.4 Energy source

The use of electricity as the energy source instead of fossil fuel means a series of benefits from the point of view of installation.

- High efficiency
- Without needing a conduit pipe for the combustion smoke fumes.



2.5.5 Easy and flexible communication

Since the remote control is a radio-frequency device, it requires no connecting wire (wire-less system).

As for the System Controller, only a non-polarity main wire is required.

2.6 Start-up benefits

2.6.1 Easy start-up

◆ **Selection switches**

Start-up is via an intuitive configuration interface for the different system parameters.

◆ **Independent test run**

Using a special configuration (see the Service Manual for more details), it is possible to make a test run of the module, as well as of the water pump, independently from the central control of the system. This selection allows correct operation (installation and connection) of the module and the pump to be checked, without having to connect and configure the rest of the system (central control, remote control, RF Receiver, ACS Tank, etc).

◆ **Alarm system**

Yutaki M modules are fully equipped with alarm systems that detect any irregularities during start-up, permitting detection of any errors in assembly.

2.6.2 Service checking tool

The remote control has a liquid crystal screen that permits starting a communication interface with the user. This enables the user to consult a range of different information about the system status.

In case of abnormal operation, the same screen will show an alarm signal so that a quick diagnosis can be made of the installation.

2.7 Maintenance benefits

◆ **Easy accessibility**

All of the unit's components can be accessed easily to undertake the necessary operations. The entire system is designed to undertake the maintenance operations in an easy and straightforward manner.

◆ **Alarm codes for easy maintenance**

These units use very precise alarm codes in order to rapidly locate any problem that might occur.

The alarms are grouped by elements within the system in order to facilitate maintenance work and optimize the fitter's job.

2.8 Main features of the components

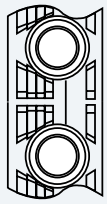
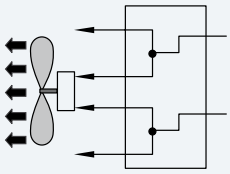
The high energy efficiency and low noise level are the result of the combination of a high-efficiency refrigerant circuit and components made with the latest-generation HITACHI technology.

2.8.1 High-efficiency refrigerant circuit

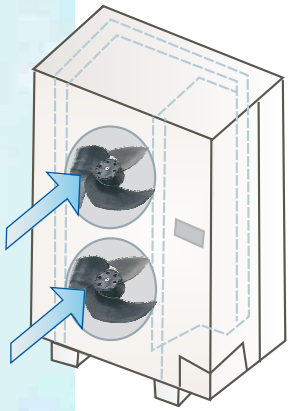
HITACHI has developed a new and more efficient heat exchanger. The refrigerant circuit also includes a superheating stage that increases the system's efficiency even further.

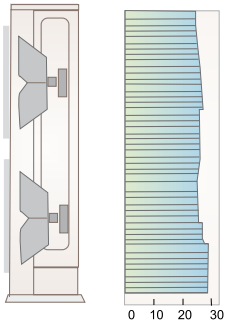
◆ **New aluminium fins for the heat exchanger**

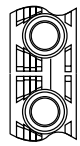
The new aluminium fin heat exchanger allows less resistance to the air flow and loss of pressure in the pipes.

	Air flow resistance decreased by 20%. The optimized slit shape minimizes noise by reducing air intake resistance.	
	Pressure drop in heat exchanger pipe has been decreased.	

A lower flow resistance provides more silent operation.







New three-blade fan

◆ **Larger heat exchanger**

The new and larger heat exchanger increases energy efficiency due to the greater exchange surface.

2.8.2 Highly efficient HITACHI scroll compressor

◆ **The most relevant features of the scroll compressor in YUTAKI M modules are:**

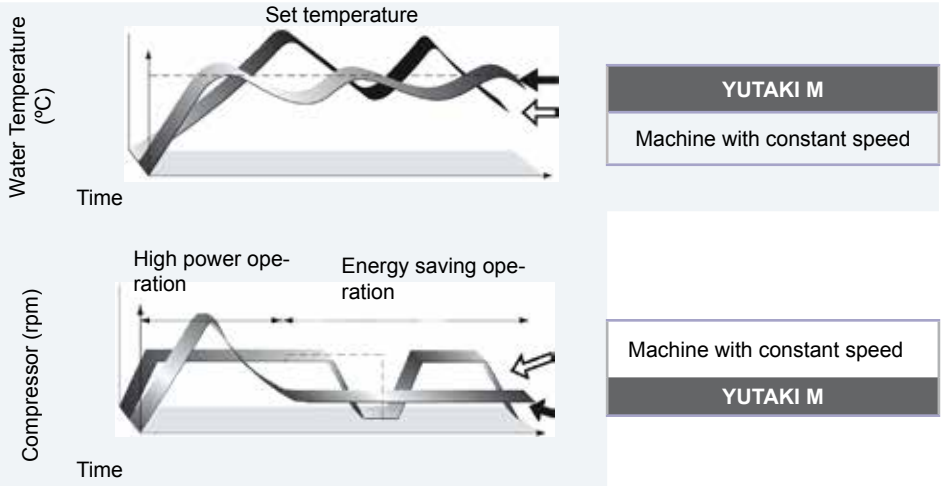
High-efficiency compressor

- Optimum compressor shaft rotation system, which has two bearings located on the ends of the shaft which allow for greater system reliability.
- New scroll coil which enables the overlap between the two scrolls to be optimized, thus greatly reducing intake loss due to leakage.
- Oil return circuit design largely reduces heat loss.
- Improved lubrication system to provide more accurate oiling for the compressor.

◆ **Compressor control by means of an inverter**

Control by inverter provides a very fine control of the compressor which allows the set temperature to be reached quickly and a stable operation to be maintained which saves energy and reduces the noise level. This operation is possible because the compressor operates continuously and self-adjusts itself depending on the system's needs. This prevents the energy waste of conventional systems when stopping and starting up when the set temperature is reached. Compressor breakages due to the high number of stop-start sequences are also eliminated.

- Operation description (heating mode):



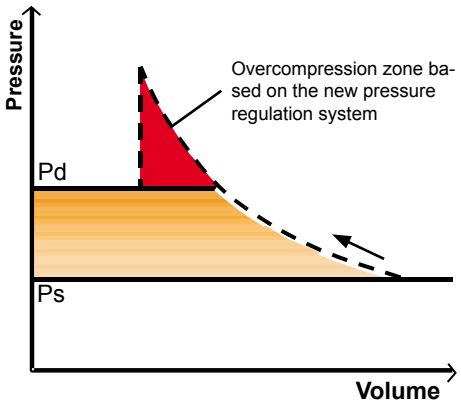
◆ High pressure shell

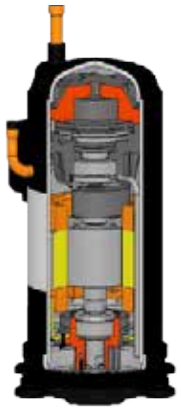
It acts as an oil separator reducing the amount of oil circulating in the refrigerant system giving better heat exchanger efficiency.

Motor heat is not added to the suction gas before compression, which reduces the discharge gas temperature. This is particularly important at low suction temperatures. The discharge gas adequately cools the motor.

Refrigerant cannot enter the shell during the off cycle causing oil dilution and oil foaming at start up.

System of regulating pressure, increasing the compressor's efficiency and reliability in part load mode. This system ensures the work pressure of the compressor is always at optimum level regardless of the charge, so that the ratio between the discharge pressure (Pd) and the suction pressure (Ps) is optimum as in the following diagram:

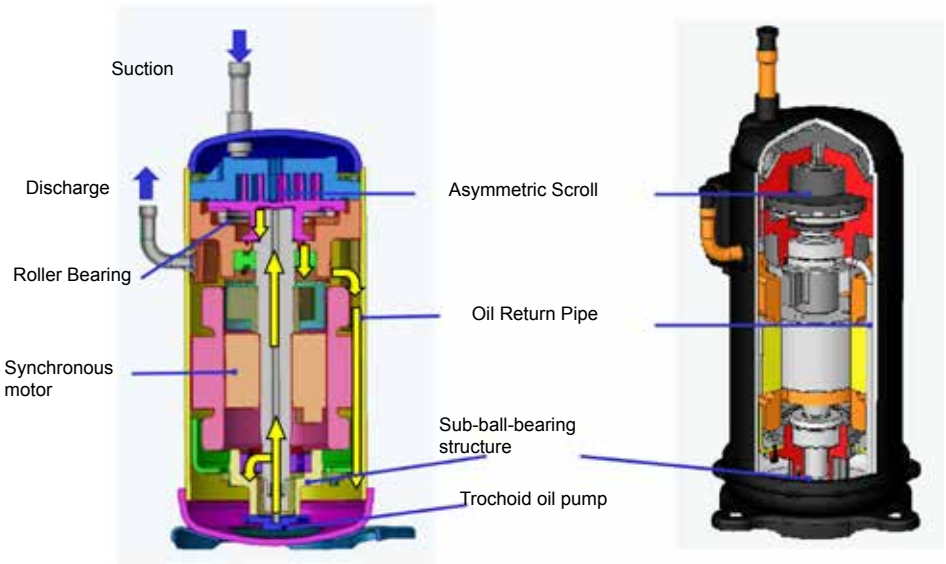




High-pressure shell compressor

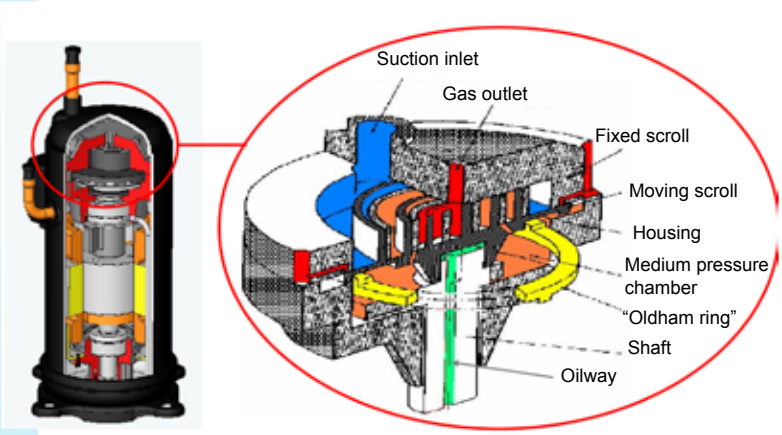
◆ Lubrication

Bearing in mind that lubrication is one of the most important factors in the service life of a compressor, HITACHI has developed a system based on the pressure differences between the suction and discharge using a secondary pump at the base of the compressor. As a result, all of the compressor's moving parts are lubricated evenly, ensuring high reliability in terms of its operating range, even at low frequencies.



◆ Protection against liquid return

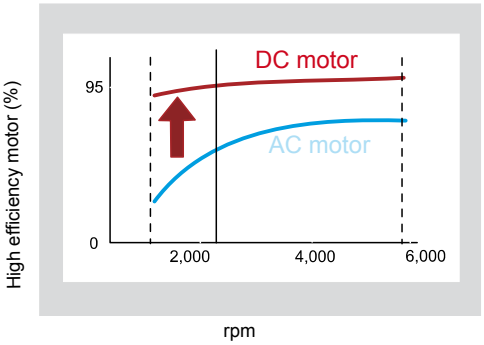
When the compressor is stopped, the moving scroll rests on the casing. When the compressor starts to run, the pressure in the chamber under the scroll builds up through two bleed holes in the medium pressure section of the compression stroke. This pressure then forces the scroll up against the housing and seals the compression chamber. If liquid returns to the compressor, the resulting increase in pressure forces the Scroll downwards breaking the seal and allowing the liquid to pass back into the compressor body where it will boil off due to the higher temperature.

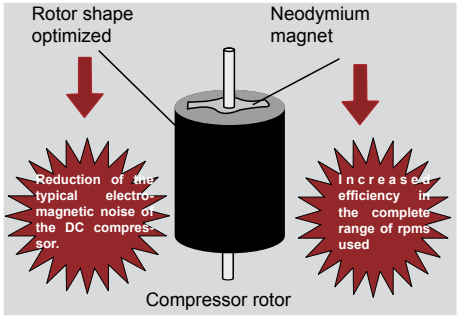


"Scroll" technology

◆ DC compressor with neodymium magnet

The use of a DC compressor improves the performance at around the 30-40 Hz range, where the inverter compressor operates for most of the time. Additionally, to suppress electromagnetic noise interference and achieve low noise, the rotor has been divided into two parts and the electric pole displaced.

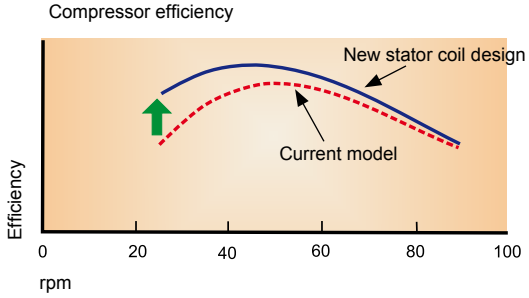




The Hitachi scroll compressor has been designed to provide maximum part load performance, resulting in a lower operating cost by reducing the energy consumption over the year.

◆ Optimized design of the stator coils

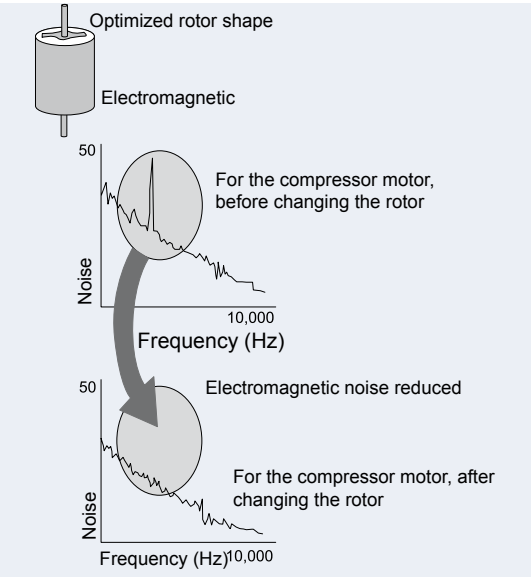
The stator coils have been positioned to optimize the magnetic field, significantly reducing heat losses and increasing the motor's efficiency at low speeds.



2.8.3 Reduced noise level

HITACHI YUTAKI M modules have been designed to reduce noise to a minimum. A scroll compressor has been designed, with the following main technological advances:

- Compression points evenly distributed along the compression stroke.
- Reduced number of components used
- Use of a high-pressure insulation shell

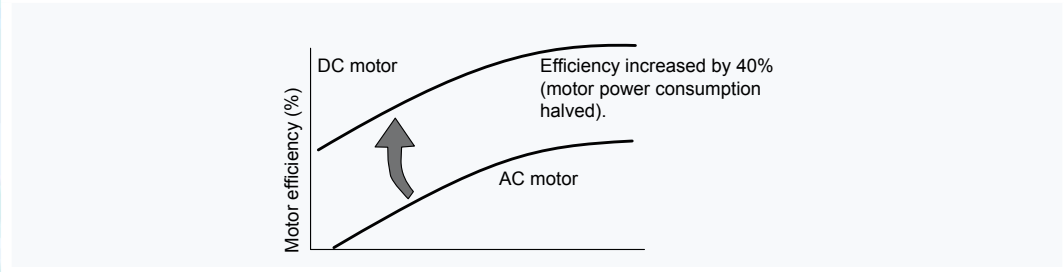


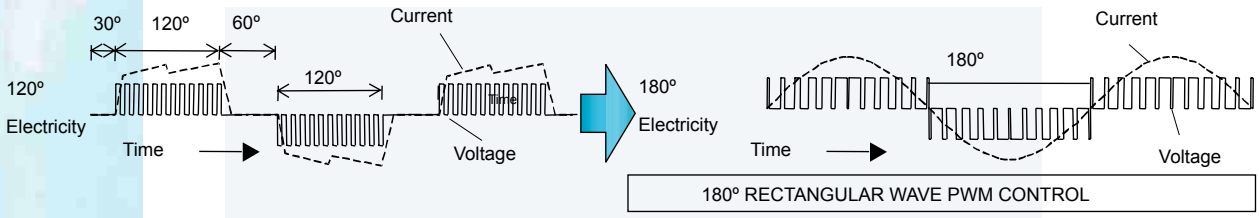
- Acoustically insulated compressor: The scroll compressor is insulated using an acoustical cover, providing minimum noise levels.


Soundproofed compressor

◆ Direct current (DC) motors in the fans

To supplement the scroll compressor, the fan is also designed specifically to reduce the noise level. Direct current motors have been used for this purpose. These incorporate pulse width control that allows the fan motor start-stop sequence to be controlled and adjusted.

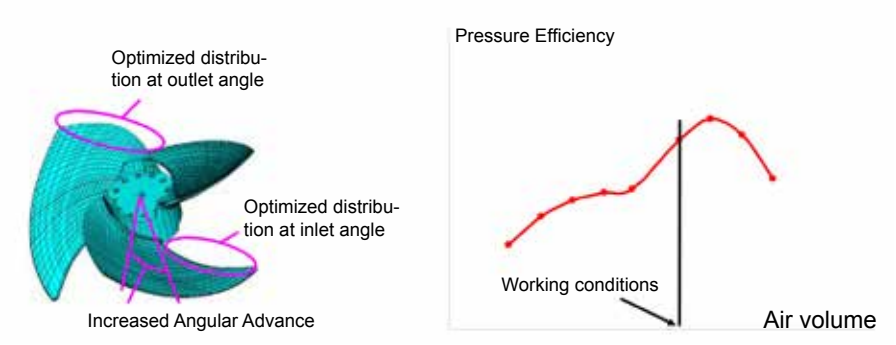




The combination of these two elements also reduces electromagnetic noise.

◆ New fan propeller

The new fan has three blades instead of four. It is designed to have a lower body than traditional fans, and achieves surprising results, with a noise reduction of up to 4dB (A).



3. General data

Index

3.1 Capacity-performance tables

	Model		RHUE-3 AVHN1	RHUE-3 AVHN-HM	RHUE-4 AVHN-HM	RHUE-5 AVHN-HM	RHUE-6 AVHN-HM	RHUE-5 AHN-HM	RHUE-6 AHN-HM
Heating capacity	Power supply		1~ 230V 50Hz					3N~ 400V 50Hz	
	(Min/Nom/Max) ❶ Conditions: Water Inlet/Outlet: 30/35ºC Outdoor temperature: (DB/WB): 7/6ºC	kW	6.2/7.5/11.0	4.6/7.1/8.4	6.1/9.5/10.9	7.9/12.0/15.0	7.8/14.0/17.5	7.9/12.0/15.0	7.8/14.0/17.5
	COP	-	4.43	4.28	4.06	4.01	4.31	4.01	4.31
	(Min/Nom/Max) ❷ Conditions: Water Inlet/Outlet: 40/45ºC Outdoor temperature: (DB/WB): 7/6ºC	kW	5.9/7.1/10.2	4.4/7.1/8.0	5.8/9.2/10.2	7.4/11.3/14.0	7.6/13.3/16.5	7.4/11.3/14.0	7.6/13.3/16.5
	COP	-	3.34	3.17	3.05	3.01	3.35	3.01	3.35
	(Min/Nom/Max) ❸ Conditions: Water Inlet/Outlet: 47/55ºC Outdoor temperature: (DB/WB): 7/6ºC	kW	5.3/6.4/9.3	4.1/6.4/7.5	5.1/8.2/9.5	6.6/10.2/13.1	7.1/12.5/15.5	6.6/10.2/13.1	7.1/12.5/15.5
	COP	-	2.71	2.57	2.46	2.44	2.82	2.44	2.82
	(Min/Nom/Max) ❹ Conditions: Water Inlet/Outlet: (*)/35ºC Outdoor temperature: (DB/WB): -7/-8ºC	kW	3.5/6.5/7.1	3.5/5.2/6.0	4.1/6.9/7.9	5.5/8.4/10.8	6.1/9.3/12.3	5.5/8.4/10.8	6.1/9.3/12.3
	COP	-	2.40	2.67	2.55	2.61	2.60	2.61	2.60
	(Min/Nom/Max) ❺ Conditions: Water Inlet/Outlet: (*)/45ºC Outdoor temperature: (DB/WB): -7/-8ºC	kW	3.4/6.2/6.9	3.4/5.0/5.8	3.7/6.5/7.6	5.2/8.1/10.3	5.8/9.0/12.0	5.2/8.1/10.3	5.8/9.0/12.0
	COP	-	2.01	2.27	2.22	2.28	2.21	2.28	2.21
	Min/Nom/Max) ❻ Conditions: Water Inlet/Outlet: (*)/55ºC Outdoor temperature: (DB/WB): -7/-8ºC	kW	3.3/5.9/6.6	3.3/4.8/5.5	3.2/6.3/7.0	5.0/7.8/9.6	4.9/8.3/10.6	5.0/7.8/9.6	4.9/8.3/10.6
	COP	-	1.70	1.79	1.67	1.66	1.75	1.66	1.75

NOTE

- *The table above shows the capacity and performance data in integrated values (with defrost factor included).*
- *The nominal heating capacity is based on the EN 14511 standard: Piping length: 7.5 meters; Piping lift: 0 meters.*
- *(*) Water inlet temperature is not fixed for additional conditions. The test is performed fixing the flow rate obtained during the test at nominal conditions:*
  - *Outdoor temperature: (DB/WB): 7/6 ºC*
- *DB: dry bulb; WB: wet bulb.*

3.2 YUTAKI M unit

3.2.1 General data

Model			RHUE-3 AVHN1	RHUE-3 AVHN-HM	RHUE-4 AVHN-HM	RHUE-5 AVHN-HM	RHUE-6 AVHN-HM	RHUE-5 AHN-HM	RHUE-6 AHN-HM
Power supply			1~ 230V 50Hz					3N~ 400V 50Hz	
Sound pressure level		dB(A)	49	48	49	51	52	51	52
Sound power level		dB(A)	68	64	65	67	68	67	68
External dimensions	Height	mm	800	1480					
	Width	mm	1250						
	Depth	mm	440	444					
Net weight		kg	110	150	150	155	159	160	164
Refrigerant		-	R410A						
Refrigerant	Quantity	kg	2.60	2.60	2.60	3.40	4.20	3.40	4.20
	Flow control	-	Microprocessor controlled expansion valve						
Compressor	Type		DC Inverter driven						
	Quantity		1	1	1	1	1	1	1
	Output power	kW	1.38	1.38	1.80	2.50	2.50	3.00	3.00
Heat exchanger		-	Multi-pass cross-finned tube						
Fan	Quantity	-	1	2	2	2	2	2	2
	Air flow rate	m^3/min	68	85	95	100	100	100	100
	Output power	W	138	70+70	70+70	70+70	70+70	70+70	70+70
Nominal water flow (condition ❶)		m^3/h	1.29	1.22	1.63	2.06	2.41	2.06	2.41
Pressure drop at heat exchanger (condition: ❶)		kPa	6.8	17.6	30.8	31.6	12.0	3.16	12.0
Maximum permissible water pressure		bar	10						
Water pipe connection		-	Rp 1”						
Maximum current		A	21.8	18.0	18.0	26.0	29.0	11.0	15.0
Packaging dimensions		m^3	0.56	0.97	0.97	0.97	0.97	0.97	0.97
Color (Munsell code)		-	Natural Grey (1.0Y8.5/0.5)						

NOTE

- *The sound pressure level is based on following conditions:*
  - *1 meter from the frontal surface of the unit*
  - *1.5 meter from floor level*
  - *The previous was measured in an anechoic chamber, so reflected sound should be taken into consideration when installing the unit.*
  - *Test according standard EN ISO 3741.*
- *The values of pressure drop at heat exchanger correspond to the maximum capacity (maximum compressor frequency) of the unit.*
- *Condition ❶ in table of selection ”3.1 Capacity-performance tables”.*

3.2.2 Component data

◆ Air side heat exchanger and fan

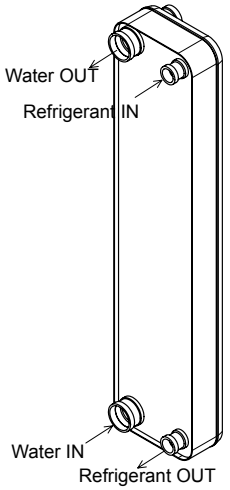
Model				RHUE-3 AVHN1	RHUE-3 AVHN-HM	RHUE-4 AVHN-HM	RHUE-5 AVHN-HM	RHUE-6 AVHN-HM	RHUE-5 AHN-HM	RHUE-6 AHN-HM
Air side heat exchanger	Heat Exchanger Type		-	Multi-Pass Cross-Finned Tube						
	Piping	Material	-	Copper Piping						
		Outer Diameter	Ømm	7	7	7	7	7	7	7
		Rows	-	3	2	2	3	3	3	3
		Number of Tubes/Coil	-	114	132	132	198	198	198	198
	Fin	Material	-	Aluminum						
		Pitch	mm	1.9	1.9	1.9	1.9	1.9	1.9	1.9
	Maximum Operating Pressure		MPa	4.15	4.15	4.15	4.15	4.15	4.15	4.15
	Total Face Area		m^2	1.28	1.35	1.35	1.35	1.35	1.35	1.35
	Length		m	1.01	1.01	1.01	1.01	1.01	1.01	1.01
	Number of Coils/Unit		-	1	1	1	1	1	1	1
Fan	Fan	Type	-	Multi-Blade centrifugal fan						
		Number/Unit	-	1	2	2	2	2	2	2
		Outer Diameter	mm	544	544	544	544	544	544	544
		Revolutions	rpm	730	413+505	465+568	483+591	483+591	483+591	483+591
		Nominal air flow/ unit	m^3/min	68	85	95	100	100	100	100
	Motor	Type	-	Drip-Proof Enclosure						
		Starting Method	-	DC Control						
		Input power	W	138	70+70	70+70	70+70	70+70	70+70	70+70
		Quantity	-	1	2	2	2	2	2	2
		Insulation Class	-	E	E	E	E	E	E	E
Compressor			-	EK306AHD-27A2			EK406AHD-36A2		EK405AHD-36D2	
Water side heat exchanger			-	A	B	B	C	D	C	D

◆ Compressor

Model			EK306AHD-27A2	EK406AHD-36A2	EK405AHD-36D2
Compressor type		-	Hermetic scroll	Hermetic scroll	Hermetic scroll
Pressure resistance	Discharge	MPa	4.15	4.15	4.15
	Suction	MPa	2.21	2.21	2.21
Motor type	Starting method	-	Inverter-driven (I.D.)	Inverter-driven (I.D.)	Inverter-driven (I.D.)
	Poles	-	4	4	4
	Insulation class	-	E	E	E
Oil type		-	FVC68D	FVC68D	FVC68D
Oil quantity		L	1.2	1.2	1.2

◆ Water side heat exchanger

Type			A	B	C	D
Heat exchanger type			Brazed plate			
Dimensions						
	Height (H)	mm	526	526	526	526
	Width (W)	mm	119	119	119	119
	Depth (D)	mm	77.2	45.8	54.8	99.6
	Weight	kg	7.5	5.0	5.7	9.2
Maximum permissible pressure						
	Refrigerant side	MPa	4.15	4.15	4.15	4.15
	Water side	MPa	1.0	1.0	1.0	1.0
Internal water volume						
	Refrigerant side	L	0.78	0.78	1.0	2.11
	Water Side	L	0.89	0.89	1.11	2.22
Material			Stainless steel			



3.2.3 Electrical data

Model	Power supply	Applicable voltage		Compressor and fan motor			Max. IPT [kW]	MC[A]
		U min.[V]	U max.[V]	STC[A](*)	IPT [kW]	RNC [A]		
RHUE-3AVHN1	1~ 230V 50Hz	207	253	-	1.69	7.5	4.93 (**) (4.19)	21.8 (**)(18.5)
RHUE-3AVHN-HM				-	1.66	9.9	4.55 (**) (3.90)	21.0 (**)(18.0)
RHUE-4AVHN-HM				-	2.34	13.4	4.55 (**) (3.90)	21.0 (**)(18.0)
RHUE-5AVHN-HM				-	2.99	16.6	6.47 (**) (5.80)	29.0 (**)(26.0)
RHUE-6AVHN-HM				-	3.25	17.6	7.17 (**) (6.50)	32.0 (**)(29.0)
RHUE-5AHN-HM	3N~ 400V 50Hz	360	440	-	2.99	7.7	8.65 (**) (6.80)	14.0 (**)(11.0)
RHUE-6AHN-HM				-	3.25	8.2	8.76 (**) (7.30)	18.0 (**)(15.0)

Key words:

- U: Power voltage
- STC: Starting current
- RNC: Operating current
- IPT: Input power
- MC: Maximum current

NOTE

- *The compressor data shown in the table above are based on a combined capacity of 100% of the power supplied.*
- *This data is based on the following conditions:*
  - *Water Inlet/Outlet Temperature: 30/35 ºC*
  - *Ambient Temperature 6 ºC (WB)*
- *The "Maximum current" shown in the above table is the maximum total unit running current at the following conditions:*
  - *Supply voltage: 90% of the rated voltage*
  - *Unit capacity: 100% at max. operating conditions*
- *The power supply cables must be sized to cover this maximum current value.*
- *(*): Less than maximum current.*
- *(**): Values without connected pump.*

3.3 Accessories

3.3.1 Advanced system controller

◆ General data

System controller	
Power supply	230Vac +10%, -15%, 50Hz
Power Consumption	Max. 12VA
Ambient Operating Temperature	0 to 50°C (0 to 40°C with terminal covers)
Storage Temperature	-20 to 55°C
Humidity	0 to 90% RH non-condensing
Dimensions	215.5 x 110 x 57.5 mm, 215.5 x 147 x 57.5 mm with terminal covers
Material Base	Noryl HS2000X, color code GY2D015 (gray)
Material Cover, Terminal Covers	PC/ABS, C2950, color black (RAL 9011)
Degree of Protection	IP20 (IP30 with terminal covers)
Fire Class	V0
Protection class	Class I (according to EN60730-1)
Emissions Standards	Complies with EN61000-6-3
Immunity Standards	Complies with EN61000-6-1
Safety Standards	Complies with EN60730-1:2007
CE Compliance	93/68/EEC
WEEE Compliance	2002/96/EC
RoHS Compliance	2002/95/EC
A1: Heat Pump Control Signal	0-20mA, (max. 10V / 20mA @ 500Ω), cable length max. 20m (wire Ø 0.5mm²)
X8: relay	Potential free contacts (24V-230Vac, 3A)
X9: relay	Potential-free contacts (24V-230Vac, 6A)
X1-X7: all other output relays	Switched line voltage 230Vac, 3A (10A total)
B1: Blocking / Tariff Input	Input for potential-free contact (rated 24Vdc, switching current 1mA)
B2: DHW Boost Input	Input for potential-free contact (rated 24Vdc, switching current 1mA)
C2: RF Receiver connection	Device complies with OpenTherm™ Protocol Specifications 3.0. Serial communications according to OpenTherm™ technical specification V2.3 (max 18V, 23mA, 1000 baud)
C3: Heat Pump Modbus connection	RS485 two-wire twisted pair, 9600 baud, Max cable length 40m
U1-U8: Sensor Inputs	NTC 20k @ 25°C

Water temperature sensor	
Water temperature sensor element	Type NTC20k @ 25°C
Range, precision	+5 to +90 °C, +/-1 K
Cable length	2m cable, 2 core (max 100m)
Dimensions (cartridge)	Ø 6.5 mm, 50 mm long
Protection class	IP 62

◆ Electrical data

Model	Power supply	Applicable voltage		Max. current [A]
		U min. [V]	U max. [V]	
ATW-CPA-02	1~ 230V 50Hz	207	253	5.0

3.3.2 Hydraulic module

◆ General data

Model			RHM-EH01E	RHM-BC01E
Power supply			1~ 230V 50Hz	1~ 230V 50Hz
			3N~ 400V 50Hz	
Primary circuit pump input power (*1)		W	140	
Secondary circuit pump input power (*1)		W	90	
Electric heater power: 6 kW (step 1/ step 2/ step 3)		kW	2.0/4.0/6.0	-
Maximum current (1~ / 3N~)		A	32/11	5/-
Outer dimensions	Height	mm	890	
	Width	mm	520	
	Depth	mm	360	
Net weight		kg	62	61
Packaging dimensions		m³	0.36	
Sound pressure level (*2)		dB (A)	28	
Water pipe connection		-	(Union M)	
Primary circuit	Inlet	mm	G 1” (male)	
	Outlet	mm	G 1” (male)	
Secondary circuit	Inlet	mm	G 1” (male)	
	Outlet	mm	G 1” (male)	
Water pipe diameter (recommended)		mm	Ø25	
Minimum permissible water pressure		MPa	0.1	
Maximum permissible water pressure		MPa	0.3	
Expansion vessel volume		L	10.0	
Color		-	White (RAL 9016)	

NOTE

*(*1). Primary and secondary circuit pump input power values are given with the pump running at speed 3 with a water flow of 2.4 m³/h.*

*(*2). The sound pressure level is measured at 1 meter distance from the unit’s front surface with the pump running at speed 2. This data is measured in an anechoic chamber, so reflected sound should be taken into consideration when installing the unit.*

◆ Electrical data

Model	Power supply	Applicable voltage		Water pump motor (Pump 1 / Pump 2)			Electrical heater			Max. current [A]
		U min. [V]	U max. [V]	PH	RNC [A]	IPT [kW]	PH	RNC [A]	Max. IPT [kW]	
RHM-EH01E	1~ 230V 50Hz	207	253	1~	0.6/0.4	0.14/0.09	1~	26.1	6.0	31.5
	3N~ 400V 50Hz	360	440				3N~	8.7	6.0	11.2
RHM-BC01E	1~ 230V 50Hz	207	253	1~	0.6/0.4	0.14/0.09	-	-	-	1.12

Key words:

- U: Power voltage
- PH: Phase (φ)
- f: Frequency
- RNC: Operating current
- IPT: Input power

NOTE

- *Specifications in these tables are subject to change without notice in order that HITACHI may bring the latest innovations to their customers.*
- *Pump 1 and Pump 2 corresponds to the primary and secondary circuit respectively.*
- *Primary and secondary circuit pump input power values are given with the pump running at speed 3 with a water flow of 2.4 m³/h.*

3.3.3 Water pump

◆ General data

Pump kit			ATW-PK1-01	ATW-PK2-01	ATW-PK3-01	Pump kit A	Pump kit B
			For RHUE-AVHN1			For RHUE-(3-6)A(V)HN-HM	
Power supply		-	1~ 230V 50Hz				
Dimensions (HxWxD)		mm	180x136x168	180x149x197	180x123x129	180x160x221	180x136x168
Connections	Water inlet	inch	G1-1/2”	G1-1/2”	G1-1/2”	G1-1/2”	G1-1/2”
	Water outlet	inch	G1-1/2”	G1-1/2”	G1-1/2”	G1-1/2”	G1-1/2”
Net weight		kg	4.4	6.3	2.4	5.0	6.3
Selectable speeds		-	3	3	3	3	3
Protection class		-	IPX2	IPX4	IP42	IP44	IP44

◆ Electrical data

Unit	Model	Power supply	Stage	Input power (W)	Current (A)
RHUE-3AVHN1	ATW-PK1-01	1~ 230V 50Hz	1 (min)	110	0.51
			2	160	0.71
			3 (max)	165	0.73
	ATW-PK2-01	1~ 230V 50Hz	1 (min)	280	1.30
			2	340	1.50
			3 (max)	345	1.52
	ATW-PK3-01	1~ 230V 50Hz	1 (min)	80	0.39
			2	85	0.39
			3 (max)	98	0.44
RHUE-(3-6)AVHN-HM	Pump kit A	1~ 230V 50Hz	1 (max)	140-195	0.95
			2	110-175	0.87
			3 (min)	85-120	0.62
	Pump kit B	1~ 230V 50Hz	1 (max)	225-410	2.05
			2	185-345	1.95
			3 (min)	170-340	1.75

3.3.4 WEH - Water Electric Heater

◆ General data

Water electric heater			WEH-6E
Power supply		-	1~ 230V 50Hz or 3N~ 400V 50Hz
Dimensions (HxWxD)		mm	230x480x270
Connections	Water inlet	inch	1G”
	Water outlet	inch	1G”
Weight	Net	kg	6.5
	Gross	kg	7.0
Power input (step 1/step 2/step 3)		kW	6.0 (2.0/4.0/6.0)
Internal water volume		l	~3.17
Protection class		-	IP54

◆ Electrical data

Model	Power supply	Input power (kW)	Input power steps (kW)	Max. current (A)
WEH-6E	1~ 230V 50Hz or 3N~ 400V 50 Hz	6.0	2.0 / 4.0 / 6.0	10.0 / step

3.3.5 DHWT - Domestic Hot Water Tank

◆ General data

Domestic hot water tank			DHWT200E-2.5H1E	DHWT300E-2.5H1E	DHWT200S-2.5H1E	DHWT300S-2.5H1E
Power supply		-	1~ 230V 50Hz			
Tank water volume		l	200	300	200	300
Material		-	Enamelled steel (DIN 4753)		Stainless steel (DIN 14521)	
Dimensions (HxWxD)		mm	1450x640x640	1935x640x640	1450x640x640	1935x640x640
Connections	DHW inlet	inch	1” (male)			
	DHW outlet	inch	1” (male)			
	Coil inlet	inch	1” (female)			
	Coil outlet	inch	1” (female)			
	Recirculation	inch	1” (male)			
Weight	Net	kg	66	109	52	66
	Gross	kg	75	119	61	76
Internal electric heater input power		kW	2.5			
Internal coil area		m^2	1.4	3.1	1.1	1.4
Thermometer		-	Yes			
Mecanical thermostat (security)		-	Yes			
Protection		-	Cathodic protection		No	
Waterproof class		-	IPX0			

◆ Electrical data

	Power supply		
Model	Power supply	IPT (kW)	RNC (A)
DHWT(200/300)(E/S)-2.5H1E	1~ 230V 50Hz	2.5	11.0

Keywords:

- IPT: Input power
- RNC: Operating current

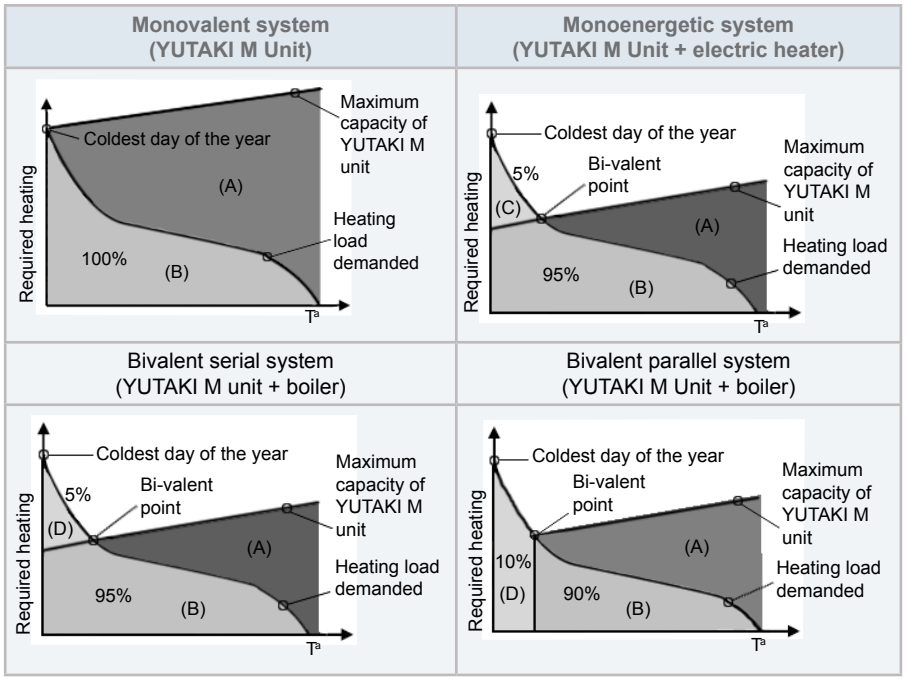
4. Capacity and selection data

Index

4.1 Selection procedure for YUTAKI M units

The following procedure gives an example of selection of YUTAKI M units combine with Controller Pack or Hydraulic Module and based on a series of previously defined installation requirements: heating load required, operating temperatures and special characteristics on the installation (energy system used, power supply, etc.).

Before proceeding with the selection calculation, first establish the type of system to be designed: Monovalent, monoenergetic, or bivalent (serial, direct parallel or mixed parallel). The energy systems with their capacity-time charts are shown below. For more information about the various energy systems, please refer to Chapter 7.



NOTE

(A) Excess capacity on the YUTAKI M unit

(B) Capacity covered by the YUTAKI M unit

(C) Capacity covered by the electric heater

(D) Capacity covered by the boiler

The example given in this chapter is based on a Monoenergetic system, allowing for an auxiliary electrical heater to be used (auxiliary unit available to cover temporary heating requirements on the coldest days of the year).

In installations which already have a conventional boiler (gas/oil), this can be kept for the same use and a bi-valent system installed (in series or parallel) which will help to increase the overall performance of the whole installation significantly.

In any case, the calculation example can be applied to all the energy systems mentioned.

4.1.1 Selection parameters

To calculate the YUTAKI M units, it will be necessary to consult and/or use a series of parameters shown in tables and graphics presented in the different chapters of this catalogue. A summarized list is shown below:

- General information: Chapter 1.
- Operation space possibilities: Chapter 7.
- Operating range: Chapter 6.
- Different possible energy systems: Chapter 10.
- Maximum heating capacities: Chapter 4.
- Different correction factors, see: Chapter 4.
- Partial load performance: Chapter 4.
- Circulating pump operating curves: Chapter 4.
- Noise data for the different units: Chapter 5.

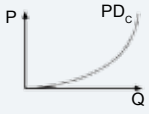
4.1.2 Selection procedure

The selection procedure given in this chapter is a simple example structured into three main blocks:

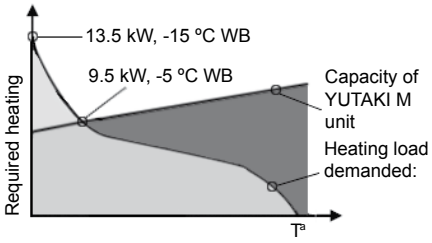
First, a) once the energy system to be used has been chosen (single-energy), a YUTAKI M unit is selected depending on the normal heating load. Next, b) a check is made to ensure that the combination (YUTAKI M + electric heater) covers the temporary needs of the coldest days of the year. The calculation will be completed by c) selecting a circulation pump for the system's water (water pump available as an accessory).

a) Selection for a regular heating load

- **Step 1: Initial pre-selection**

Proposed energy system	Monoenergetic
Regular ambient temperature WB/DB (HR = 85%)	-5/-4 °C
Required regular heating load	9.5 kW
Ambient temperature WB/DB on the coldest day of the year (HR = 85%)	-15 / -14.5 ºC
Heating load required on the coldest day of the year	13.5 kW
Inlet/outlet water temperature	40 / 45 ºC
Power supply	1~ 230V 50Hz
Type of glycol to use	Ethylene
Pressure loss on the client's hydraulic installation (PD_C)	

AVHN1



These conditions will determine the entry in the table of *"4.3 Maximum heating capacity table"* section, where we can identify which unit has heating capacity to cover the normal heating load required by the installation, (9.5 kW for an inlet/outlet water temperature of 40/45 ºC and an ambient temperature of -5ºC WB).

YUTAKI M Unit	Maximum heating capacity (kW)
RHUE-3AVHN1	7.9
RHUE-3AVHN-HM	6.6
RHUE-4AVHN-HM	8.2
☛ **RHUE-5AVHN-HM**	**11.3**
RHUE-6AVHN-HM	13.5

As can be seen in the table, the YUTAKI M unit immediately higher that covers the installation's heating requirements is the RHUE-5AVHN-HM. Therefore, this will be the pre-selected unit.

NOTE

In case of working with an ambient temperature value not included in the tables of "4.3 Maximum heating capacity table" (for example -3ºC), an interpollation is needed using the values above and below the ambient temperature.

- **Step 2: Heating capacity correction for defrost and/or use of glycol**

The actual heating capacity of the pre-selected unit must be calculated applying the necessary correction factors:

$$Q_h = Q_{Mh} \times f_d \times f_{gh}$$

Q_h: Actual heating capacity (kW)
Q_{Mh}: Maximum heating capacity (kW)
f_d: Defrosting correction factor
f_{gh}: Capacity correction factor owing to use of glycol

The maximum heating capacity (Q_{Mh}) of the RHUE-5AVHN-HM unit is 11.3 kW.

- Calculation of f_d:

  In situations where the ambient temperature is lower than 7 ºC DB, frost may build up on the heat exchanger. In the case, the heating capacity for the unit may be reduced because of the time spent by the unit in removing the build-up.

  The defrosting correction factor takes this time into account and applies the heating capacity correction.

  To calculate the correction factor, please refer to section *"4.4.1 Defrost correction factor"* which shows a table with different values of f_d depending on the ambient temperature (ºC DB). If the correction factor at an ambient temperature of -4 ºC DB does not appear on the table, an interpolation will be needed.

  Finally, the resulting defrosting correction factor is ***0.905***.

- Calculation of f_{gh}:

  When the ambient temperature is low in winter, the unit may be damaged by freezing water in the pipes during shutdown periods. To prevent this, use a mixture with glycol anti-freeze.

  On the other hand, the percentage of glycol used may affect the heating capacity of the unit.

  To calculate the capacity correction factor due to the use of glycol, please see section *"4.4.2 Correction factor owing to use of glycol"*, bearing in mind the type of glycol to be used. This example uses ethylene.

  The ambient temperature value of -4 ºC DB does not appear in the table. Therefore, the percentage of ethylene glycol to use will correspond to the ambient temperature immediately below in the table. In this case, it is -7 ºC.

  At this ambient temperature, the percentage of ethylene glycol necessary is 20%, for which there is a corresponding capacity correction factor, owing to the use of ethylene glycol, of ***1***.

- Calculation of Q_h:

  Once the correction factors to be applied have been determined, the formula for actual heating capacity of the unit RHUE-5AVHN-HM can be applied:

  Q_h= *11.3 kW x 0.905 x 1* = **10.23 kW**

As can be seen, the actual heating capacity of the RHUE-5AVHN-HM unit (10.23 kW) is greater than the heating load required by the installation (9.5 kW). Therefore, the pre-selection of this unit will be considered valid.

NOTE

If the actual heating capacity calculated is less than that provided by the pre-selected unit, the calculation must be done again with the unit immediately above. If there is no unit higher than the pre-selected one, some other system, or the regular use of an electrical heater, will have to be considered.

b) Selection for the coldest days of the year (use of the auxiliary electric heater)

The previous calculation shows that the RHUE-5AVHN-HM unit provides a heating capacity of 10.23 kW (-5 ºC WB), which is greater than the regular heating load necessary of 9.5 kW, but does not reach the peak heating load of 13.5 kW (-15 ºC WB) necessary on the coldest days of the year. The auxiliary electric heater is used in these cases.

The aim of this section is to check that the energy system chosen (combination of the YUTAKI M unit + auxiliary electric heater) covers the temporary heating requirements for the coldest days of the year.

- **Step 1: Initial pre-selection**

As the ambient temperature has fallen to -15 ºC, the capacities table has to be consulted again in section *"4.3 Maximum heating capacity table"* to decide the maximum heating capacity the RHUE-5AVHN-HM unit will provide for these new conditions.

The maximum heating capacity for an ambient temperature of -15 ºC WB and a water inlet/outlet temperature of 40/45 ºC is **9.2 kW.**

- **Step 2: Correction of the heating capacity for defrost and/or use of glycol**

The actual heating capacity for the unit selected for the coldest days of the year is calculated by applying correction factors for defrosting and glycol, following the method used above.

$$Q_h = Q_{Mh} \, x \, f_d \, x \, f_{gh}$$

Q_h: Actual heating capacity (kW)
Q_{Mh}: Maximum heating capacity (kW)
f_d: Defrosting correction factor
f_{gh}: Capacity correction factor owing to use of glycol

- Calculation of f_d:

  The tables in section *"4.4.1 Defrost correction factor"* show that the correction factor for an ambient temperature of -14.5 ºC DB does not appear on the table. However, for the temperature values immediately above and below there is the same defrosting correction factor of **0.95**. Therefore, this will be the defrosting correction factor obtained.

- Calculation of f_{gh}:

  The tables in section *"4.4.2 Correction factor owing to use of glycol"* show that the ambient temperature value of -14.5 ºC DB does not appear in the table. Therefore, the percentage of ethylene glycol to use will correspond to the ambient temperature immediately below in the table. In this case, it is -22 ºC.

  At this ambient temperature, the percentage of ethylene glycol necessary is 40%, for which there is a corresponding capacity correction factor, owing to the use of ethylene glycol, of ***0.99***.

- Calculation of Q_h:

  Once the correction factors to be applied have been determined the formula for actual heating capacity of the unit RHUE-5AVHN-HM can be applied:

  Q_h = *9.2 kW x 0.95 x 0.99* = **8.65 kW**

- **Step 3: Calculation for the heating capacity of the combination (YUTAKI M unit + electric heater)**

Once applied the applicable correction factors, the actual heating capacity provided by he RHUE-5AVHN-HM unit is 8.65 kW. This heating capacity does not cover the required heating load for the coldest days (13.5 kW).

In these cases, the water electric heater supplied by HITACHI as accessory (WEH-6E) will provide the auxiliary capacity required to cover temporary heating needs.

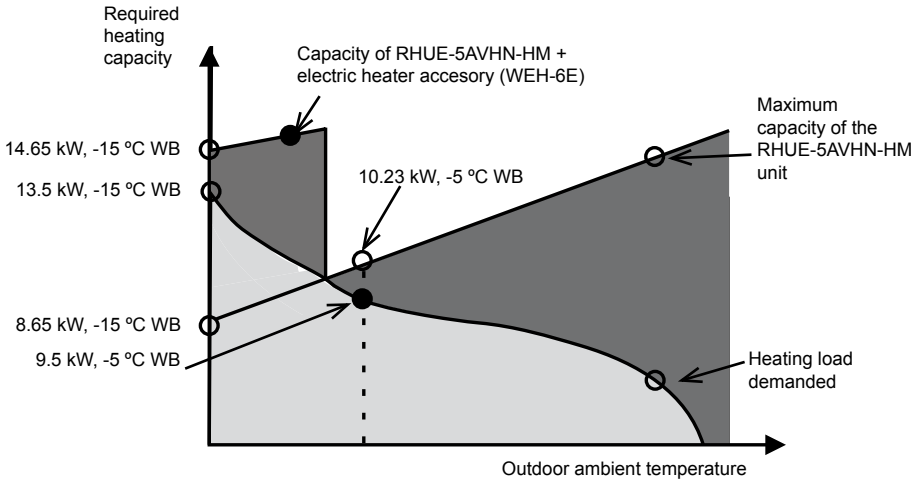
The electric heater offered by HITACHI as an accessory provides a power of 6kW which must be added to the heating capacity provided by the pre-selected unit. The result is:

Q_h = *8.65 kW + 6kW* = **14.65 kW**

NOTE

The heating capacity resulting from the combination (YUTAKI M unit + electric heater) is higher than the heating demand of 13.5 kW estimated in this example for the coldest days of the year, so that pre-selection of the RHUE-5AVHN-HM unit can be taken as valid.

This means that the energy system will be as follows:



c) Selecting the circulating water pump

To enable the designer to select the most suitable water circulating pump for each installation. YUTAKI M units do not have the water circulating pump as standard equipment. However, HITACHI offers the client three pump models to be selected as an accessory. The sizing method is equivalent in all cases.

NOTE

For this example, bear in mind the results from example a) Selection of YUTAKI M units for a regular heating load, as they are the results that demand a greater heating load and, therefore, a greater flow from the circulating pump.

Step 1: Calculation of the flow rate necessary for the circulation pump

First, calculate the flow needed on the pump to provide a heating capacity of 10.23 kW and obtain an increase in the water temperature of 40 to 45 ºC.

To do this, use the formula given below, where the flow required to increase the difference in temperature between the water inlet and outlet is calculated, depending on the heating capacity needed.

$$CFR = \frac{Q_h \times f_{gf} \times 860}{1000 \times (T_S - T_E)}$$

CFR: Calculated flow rate (m^3/h)

Q_h: Actual heating capacity (kW)

f_{gf}: Flow rate correction factor owing to use of glycol

$(T_S - T_E)$: Difference in temperature between water inlet/outlet (°C)

- Calculation of f_{gf}:

Once the actual heating capacity of the RHUE-5AVHN-HM and the difference between the water inlet and outlet temperatures are known, the value required to calculate the pump flow rate is the flow correction factor due to the use of glycol f_{gf}.

The use of glycol affects the actual heating capacity, since the density of glycol is higher than that of water. Therefore, a higher flow rate is necessary for the same conditions.

To calculate the flow rate correction factor due to the use of glycol, please see the table in section *"4.4.2 Correction factor owing to use of glycol"*, bearing in mind the type of glycol used.

Following the same method used to obtain the capacity correction factor due to the use of glycol, a flow rate correction factor is obtained due to the use of ethylene glycol of **1.01**.

- Calculation of *CFR*:

Once the flow correction factor due to the use of glycol has been obtained, the previous formula can be applied:

$$CFR = \frac{Q_h \times f_{gf} \times 860}{1000 \times (T_S - T_E)} = \frac{10.23\,kW \times 1.01 \times 860}{1000 \times (45-40)} = 1.78\ m^3/h$$

Finally, a flow rate value is obtained of **1.78 m³/h**.

- **Step 2: Checking the working limits of the flow on the water circulating pump**

Once the flow needed for the pump has been decided, check that it falls between the working limits for the heat exchanger on the unit.

To do this, refer to Chapter *"6. Working range"*, where the maximum and minimum flow for each YUTAKI M unit can be found.

As can be seen, the necessary flow-rate value calculated for the circulating pump falls within the operating limits of the selected unit RHUE-5AVHN-HM. Therefore, this value will be accepted.

$0.8 m^3/h < CFR = \mathbf{1.78 m^3/h} < 4.0 m^3/h$

- **Step 3: Calculation of the necessary pressure to be provided by the circulating pump**

The selected circulating pump must be able to provide the pressure required to overcome the pressure loss in the client's hydraulic unit installation, as well as those on the unit itself, working with the flow calculated previously.

The section *"4.6 YUTAKI M circulating pumps data"* shows the operating details of the various YUTAKI M units (operation of circulating pumps, including heat exchanger pressure losses). Once it is known that the operating data for the different models include pressure losses from the unit itself, the data needed are the pressure losses from the client's hydraulic unit installation.

For this example, pressure losses from the installation have been estimated as shown below, and are given by the following formula:

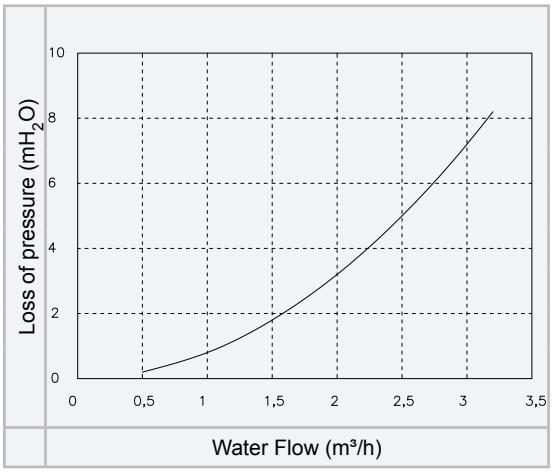
$$P = K \times Q^2$$

P = Loss of pressure on the client's hydraulic installation (mH_2O)

Q = Circulating water pump flow rate (m^3/h)

K = Coefficient depending on the characteristics of the hydraulic installation (diameter and length of pipes, roughness, etc.). This example assumes K = 0.8.

Water flow rate (m^3/h)	Loss of pressure on the client's hydraulic instal-lation (mH_2O)
0.5	0.2
1	0.8
1.5	1.8
2	3.2
2.5	5
3	7.2
3.2	8.2



- Necessary pressure for the circulating pump Q_h:

At a flow rate of 1.78 m^3/h the pressure loss form the client's hydraulic installation will be the following:

$$P = 0.8 \times 1.78^2 = \mathbf{2.53\ mH_2O}$$

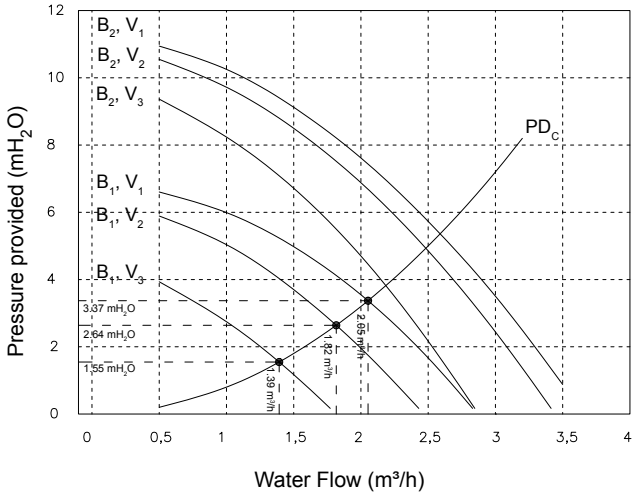
Therefore, the selected pump must provide a pressure higher than 2.53 mH_2O at a flow rate of 1.78 m^3/h.

- **Step 4: Selecting the circulating water pump**

The next step is to select a water pump from the YUTAKI M range that is capable of providing a pressure of 2.53 mH_2O for a flow rate of 1.78 m^3/h.

See section *"4.6 YUTAKI M circulating pumps data"* to select the pump which is most suitable for the RHUE-5AVHN-HM unit.

Below, the pressure loss curve on the client's hydraulic installation is situated on the same chart as the operating curves for the RHUE-5AVHN-HM unit (operating curves for the circulating pumps with pressure loss in the heat exchanger included, shown in section *"4.6 YUTAKI M circulating pumps data"*).

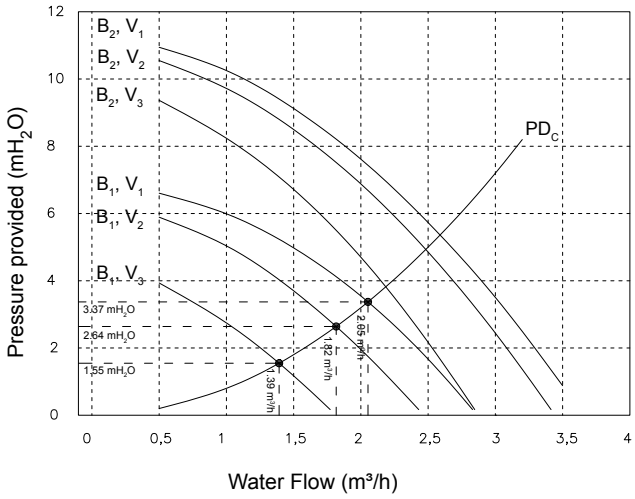


NOTE

- B: Circulating water pump
  - B_1: Pump kit A
  - B_2: Pump kit B
- V: Pump motor speed: V_1: High V_2: Medium V_3: Low
- PD_C: Pressure loss in the client's hydraulic installation

The chart shows that the calculated working point falls between 2 possible pump 1 configurations, so this will be the selected pump. Its working speed V_2 or V_3 must be choosen, assuming that the actual working flow rate will be higher or lower than the theoretical calculation.

The client must choose the working speed of the selected pump. Graphics for the 2 configurations possible for this selection example are shown below.



The approximate operating point for the 2 possible configurations is:

- Pump (B_1, V_2): Pressure of 2.64 mH_2O for a flow rate of 1.82 m^3/h
- Pump (B_1, V_3): Pressure of 1.55 mH_2O for a flow rate of 1.39 m^3/h

The pump motor speed (B_1,V_1) can also be selected resulting the following values:

- Presure of 3.37 mH_2O for a flow rate of 2.05 m^3/h

NOTE

The pump selection is done for the circulating water pump supplied by Hitachi. For other pumps, use their operating curves and take the pressure drop of the unit by refering to the section "9.2.1 Pressure drop".

4.2 Selection procedure of Domestic Hot Water Tank

Domestic Hot Water Tank is designed for combination with YUTAKI M units as follow:

YUTAKI M Unit	Domestic Hot Water Tank
RHUE-3AVHN1 and RHUE-3AVHN-HM	DHWT-200(E/S)-2.5H1E
	DHWT-300(E/S)-2.5H1E
RHUE-(4~6)A(V)HN-HM	DHWT-300(E/S)-2.5H1E

NOTE

The YUTAKI M unit system is designed for combination with HITACHI Domestic Hot Water Tank. In case of another tank is being used in combination with YUTAKI M system, HITACHI cannot guarantee neither good operation for reliability of the system.

4.3 Maximum heating capacity table

4.3.1 RHUE-3AVHN1

System	Water outlet temperature (°C)	Ambient temperature (°C WB)																	
		-20		-15		-10		-5		0		5		10		15		20	
		CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)
RHUE-3 AVHN1	60	-	-	-	-	-	-	7.3	3.47	8.1	3.55	8.8	3.62	9.5	3.69	10.3	3.77	11.0	3.84
	55	-	-	-	-	6.7	3.32	7.5	3.39	8.3	3.47	9.1	3.54	10.0	3.61	10.8	3.68	11.6	3.75
	50	5.1	3.10	6.0	3.17	6.8	3.24	7.6	3.31	8.5	3.38	9.5	3.45	10.4	3.52	11.3	3.59	12.2	3.66
	45	5.2	3.02	6.1	3.09	7.0	3.16	7.9	3.23	8.8	3.30	10.0	3.37	10.9	3.43	11.8	3.50	12.7	3.57
	40	5.3	2.82	6.2	2.88	7.1	2.95	8.0	3.02	9.1	3.08	10.3	3.14	11.3	3.21	12.3	3.27	13.2	3.33
	35	5.4	2.70	6.3	2.76	7.1	2.83	8.2	2.89	9.3	2.95	10.7	3.01	11.8	3.07	12.7	3.13	13.7	3.19
	30	-	-	-	-	-	-	-	-	-	-	-	-	12.3	2.94	13.4	2.99	14.4	3.05
	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.8	2.85	14.9	2.90
	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.4	2.73

NOTE

- *CAP: Capacity at maximum compressor frequency (kW). Capacity is valid for difference between water inlet and water outlet of 3-8°C.*
- *IPT: Total input power (kW)*

The table above shows the capacity data in peak values (without considering the defrost value). To calculate the integrated values it is necessary to apply the defrost correction factor referring to the section "4.4.1 Defrost correction factor".

The table above shows the input power (IPT) at maximum capacity (CAP). Most of the time, the unit runs at partial load, so that the actual input is lower.

4.3.2 RHUE(3-6)A(V)HN-HM

System	Water outlet temperature (ºC)	Ambient temperature (ºC WB)																	
		-20		-15		-10		-5		0		6		10		15		20	
		CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)	CAP (kW)	IPT (kW)
RHUE-3 AVHN-HM	55	-	-	-	-	5.7	3.29	6.3	3.28	6.8	3.36	7.5	3.13	8.0	3.16	8.7	3.25	9.4	3.33
	50	4.4	2.66	5.2	2.68	5.8	2.87	6.4	2.81	7.1	2.94	7.8	2.76	8.3	3.17	9.0	3.21	9.6	3.24
	45	4.5	2.67	5.2	2.68	5.9	2.87	6.6	2.73	7.3	2.85	8.0	2.66	8.6	3.14	9.3	3.18	9.9	3.22
	40	4.7	2.52	5.4	2.53	6.1	2.73	6.7	2.57	7.4	2.68	8.2	2.47	8.8	2.73	9.4	2.73	10.2	2.82
	35	4.9	2.49	5.5	2.49	6.2	2.50	6.8	2.49	7.5	2.56	8.4	2.35	8.9	2.54	9.6	2.59	10.3	2.62
	30	-	-	-	-	-	-	-	-	-	-	8.5	2.19	9.1	2.38	9.8	2.40	10.5	2.43
	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.3	2.30	11.1	1.82
	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.3	1.88
RHUE-4 AVHN-HM	55	-	-	-	-	7.1	4.60	7.9	4.38	8.6	4.20	9.5	4.10	10.1	4.12	10.9	4.07	11.6	3.99
	50	6.2	3.42	6.7	3.38	7.4	3.74	8.0	3.72	8.9	3.60	9.9	4.09	10.5	4.10	11.2	4.06	12.0	3.98
	45	6.1	3.53	6.7	3.38	7.6	3.25	8.2	3.25	9.1	3.39	10.2	4.07	10.8	4.09	11.6	4.05	12.5	3.98
	40	6.0	3.08	6.8	3.11	7.8	3.09	8.4	2.95	9.4	2.97	10.6	3.57	11.2	3.68	12.0	3.72	12.9	3.44
	35	5.9	2.74	6.8	2.88	7.9	2.95	8.6	2.70	9.6	2.65	10.9	3.21	11.6	3.36	12.4	3.40	13.3	2.90
	30	-	-	-	-	-	-	-	-	-	-	11.3	3.65	12.0	3.59	12.9	3.23	13.8	2.63
	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.3	3.02	14.2	2.33
	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.7	2.48
RHUE-5 A(V)HN-HM	55	-	-	-	-	9.8	6.35	10.8	6.02	11.8	5.76	13.1	5.57	13.8	5.94	14.8	5.05	15.8	4.51
	50	8.2	4.74	8.9	4.65	10.1	5.13	11.0	5.10	12.2	4.92	13.5	5.51	14.3	5.89	15.4	5.04	16.4	4.56
	45	8.3	4.36	9.2	4.36-	10.3	4.35	11.3	4.46	12.5	4.34	14.0	5.50	14.9	5.84	15.9	5.03	17.0	4.54
	40	8.4	4.17	9.5	4.16	10.6	4.16	11.5	4.15	13.0	4.14	14.5	5.14	15.4	5.29	16.5	4.93	17.6	4.58
	35	8.4	3.86	9.7	3.91	11.0	3.95	11.8	3.89	13.5	3.88	15.0	4.29	15.9	5.08	17.1	4.89	18.2	4.58
	30	-	-	-	-	-	-	-	-	-	-	15.3	4.86	16.2	4.86	17.4	4.85	18.5	4.58
	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.9	4.54	19.1	4.53
	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.7	4.50
RHUE-6 A(V)HN-HM	55	-	-	-	-	10.6	4.90	12.2	5.01	13.7	5.12	15.5	6.01	16.7	6.37	18.2	6.08	19.7	5.59
	50	9.2	4.98	10.6	4.98	11.4	4.99	12.8	5.00	14.3	5.00	16.0	5.04	17.2	6.15	18.8	5.87	20.3	5.40
	45	9.3	5.27	10.7	5.17	12.1	5.08	13.5	4.98	14.8	4.89	16.5	5.32	17.8	5.56	19.4	5.66	21.0	5.21
	40	9.2	4.92	10.7	4.82	12.2	4.72	13.7	4.63	15.2	4.53	17.0	4.58	18.3	5.54	20.0	5.29	21.6	4.86
	35	9.1	4.99	10.7	4.83	12.3	4.67	13.9	4.50	15.6	4.34	17.5	4.29	18.9	4.96	20.5	4.88	22.2	4.62
	30	-	-	-	-	-	-	-	-	-	-	18.0	4.35	19.4	4.64	21.1	4.76	22.9	4.38
	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21.7	4.49	23.5	4.12
	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24.1	3.85

NOTE

- *CAP: Capacity at maximum compressor frequency (kW). Capacity is valid for difference between water inlet and water outlet of 3-8ºC.*
- *IPT: Total input power (kW)*

The table above shows the capacity data in peak values (without considering the defrost value). To calculate the integrated values it is necessary to apply the defrost correction factor referring to the section "4.4.1 Defrost correction factor".

The table above shows the input power (IPT) at maximum capacity (CAP). Most of the time, the unit runs at partial load, so that the actual input is lower.

4.4 Correction factors

4.4.1 Defrost correction factor

The maximum heating capacity shown above does not include operation during frost or defrosting.

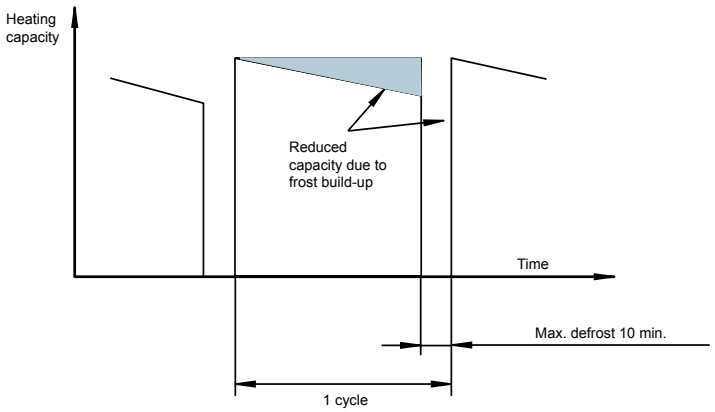
When this type of operation is taken into account, the heating capacity must be corrected according to the following equation:

Correction heating capacity = Correction factor x heating capacity

Outdoor inlet air temp. (ºC DB) (HR = 85%) / Defrost correction factor f_d	-20	-7	-5	-3	0	3	5	7
RHUE-3AVHN1	0.95	0.94	0.92	0.85	0.84	0.85	0.90	1.0
RHUE-(3-6)A(V)HN-HM	0.95	0.95	0.93	0.88	0.85	0.87	0.90	1.0

NOTE

- *Defrost correction factor corresponds to a relative humidity of 85%. If the condition changes, the correction factor will be different.*
- *Defrost correction factor is not valid for special conditions such as during snow or operation in a transitional period*



4.4.2 Correction factor owing to use of glycol

◆ Application at low ambient temperature

When the ambient temperature is low in winter, the water in the pipes and circulating pump may freeze and damage the pipes and water pumps in shutdown periods.

To prevent this, it is useful to drain the water from the installation or not to interrupt installation power supply, as an electrical cable can prevent the water from freezing in the circuit.

In addition, in cases where it is difficult to drain the water, it is a good idea to use a mixture with glycol anti-freeze (ethylene or propylene between 10% and 40%).

Unit performance when operating with glycol may be reduced, depending on the percentage of glycol used, because glycol is denser than water.

Two tables are given below (one for ethylene glycol and the other for propylene glycol) showing the percentage of ethylene glycol recommended for the various values for the outdoor air inlet temperature, with their respective correction factors.

Corrected heating capacity = capacity correction factor owing to use of glycol x heating capacity

- Ethylene glycol

Ambient Temperature	DB (°C)	-3	-7	-13	-22
Percentage of glycol required	%	10	20	30	40
Capacity correction factor	f_{gh}	1.00	1.00	0.99	0.99
Consumed power correction factor	f_{gi}	1.01	1.02	1.03	1.04
Flow rate correction factor	f_{gc}	1.01	1.01	1.02	1.04
Pressure loss correction factor	f_{gp}	1.03	1.09	1.16	1.26

- Propylene glycol

Ambient Temperature	DB (°C)	-3	-7	-13	-22
Percentage of glycol required	%	10	20	30	40
Capacity correction factor	f_{gh}	1.00	1.00	0.99	0.99
Consumed power correction factor	f_{gi}	1.01	1.02	1.03	1.04
Flow rate correction factor	f_{gc}	1.02	1.02	1.04	1.07
Pressure loss correction factor	f_{gp}	1.24	1.31	1.39	1.51

4.5 Partial load performance

NOTE

- *WOT: Water outlet temperature (ºC)*
- *CLD: Compressor load*
- *HCAP: Heating capacity (kW)*
- *IPT: Compressor input power (kW)*

◆ **RHUE-3AVHN1**

Ambient temperature ºC (WB)																							
WOT	CLD	-20			-10			-5			0			5			10			20		
		HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP
55	Max	-			6.3	3.11	2.03	6.9	3.18	2.17	7.0	3.24	2.15	8.2	3.31	2.47	10.0	3.61	2.77	11.6	3.75	3.10
	↓				5.7	3.02	1.88	6.2	3.09	2.01	6.6	3.15	2.09	7.8	3.22	2.44	9.7	3.49	2.78	11.2	3.62	3.10
	↓				5.5	2.45	2.24	5.9	2.50	2.36	6.0	2.56	2.36	7.2	2.61	2.76	9.0	3.13	2.87	10.4	3.25	3.21
	↓				4.4	2.34	1.86	4.7	2.39	1.94	4.7	2.45	1.91	6.1	2.50	2.44	8.0	2.81	2.83	9.2	2.92	3.16
	↓				3.7	2.20	1.69	4.0	2.25	1.76	4.0	2.30	1.74	5.2	2.34	2.24	6.9	2.39	2.88	8.0	2.48	3.22
	Min				3.1	2.10	1.50	3.3	2.15	1.55	3.3	2.20	1.49	4.3	2.24	1.92	5.7	2.11	2.71	6.6	2.19	3.02
45	Max	4.9	2.83	1.75	6.6	2.96	2.22	7.3	3.02	2.40	7.4	3.09	2.39	9.0	3.15	2.86	10.9	3.43	3.17	12.7	3.57	3.56
	↓	4.5	2.74	1.63	5.9	2.86	2.08	6.6	2.93	2.24	7.1	2.99	2.37	8.6	3.05	2.81	10.6	3.31	3.20	12.3	3.44	3.58
	↓	4.3	2.30	1.87	5.7	2.40	2.38	6.3	2.45	2.55	6.7	2.51	2.66	8.0	2.56	3.12	9.8	3.07	3.20	11.5	3.19	3.59
	↓	3.4	2.12	1.60	4.5	2.22	2.04	4.9	2.27	2.15	5.0	2.32	2.17	6.7	2.37	2.82	8.7	2.68	3.26	10.2	2.78	3.66
	↓	2.9	1.89	1.53	3.8	1.98	1.94	4.2	2.02	2.06	4.3	2.07	2.10	5.8	2.11	2.74	7.6	2.15	3.53	8.8	2.23	3.96
	Min	2.4	1.74	1.40	3.2	1.82	1.78	3.5	1.86	1.87	3.5	1.90	1.87	4.8	1.94	2.46	6.3	1.80	3.50	7.3	1.87	3.93
35	Max	5.1	2.53	2.03	6.7	2.65	2.52	7.5	2.71	2.79	7.8	2.76	2.83	9.6	2.82	3.41	11.8	3.07	3.84	13.7	3.19	4.29
	↓	4.8	2.43	1.97	6.2	2.54	2.45	7.0	2.60	2.67	7.5	2.66	2.83	9.2	2.71	3.39	11.4	2.94	3.89	13.3	3.05	4.35
	↓	4.5	1.86	2.40	5.8	1.95	2.98	6.5	1.99	3.25	7.0	2.03	3.43	8.5	2.08	4.09	10.6	2.49	4.25	12.3	2.59	4.75
	↓	3.5	1.71	2.07	4.6	1.79	2.57	5.1	1.83	2.76	5.3	1.87	2.83	7.1	1.91	3.72	9.4	2.16	4.34	10.9	2.24	4.85
	↓	3.0	1.51	2.01	3.9	1.58	2.50	4.3	1.61	2.69	4.5	1.65	2.76	6.1	1.68	3.63	8.0	1.71	4.70	9.3	1.78	5.25
	Min	2.5	1.37	1.85	3.3	1.43	2.29	3.6	1.47	2.45	3.7	1.50	2.47	5.0	1.53	3.27	6.7	1.42	4.69	7.7	1.47	5.25

◆ RHUE-3AVHN-HM

Ambient temperature ºC (WB)																							
WOT	CLD	-20			-10			-5			0			5			10			20			
		HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	
55	Max				5.3	3.29	1.60	5.7	3.28	1.73	6.1	3.36	1.80	6.6	3.13	2.10	8.0	3.16	2.53	9.4	3.33	2.82	
					5.1	3.15	1.61	5.5	3.12	1.75	5.8	3.18	1.82	6.4	3.01	2.13	7.9	3.11	2.55	9.3	3.27	2.85	
					4.8	2.93	1.63	5.1	2.86	1.79	5.4	2.90	1.85	6.2	2.82	2.18	7.8	3.02	2.59	9.2	3.17	2.89	
					4.7	2.84	1.64	5.0	2.76	1.81	5.2	2.78	1.87	6.0	2.74	2.20	7.8	2.99	2.60	9.1	3.13	2.91	
					4.2	2.53	1.67	4.5	2.43	1.86	4.6	2.40	1.92	5.7	2.49	2.28	7.6	2.87	2.66	8.9	2.99	2.97	
		-			4.1	2.45	1.68	4.4	2.34	1.88	4.4	2.30	1.93	5.6	2.43	2.30	7.6	2.84	2.67	8.8	2.96	2.98	
					3.9	2.32	1.69	4.2	2.20	1.90	4.2	2.14	1.95	5.4	2.33	2.33	7.5	2.79	2.69	8.7	2.90	3.01	
					3.7	2.19	1.70	3.9	2.05	1.91	3.9	1.99	1.96	5.0	2.14	2.33	6.5	2.40	2.73	7.6	2.43	3.12	
					3.5	2.07	1.70	3.7	1.93	1.93	3.7	1.87	1.98	4.6	1.99	2.33	5.8	2.10	2.75	6.7	2.08	3.22	
					3.3	1.96	1.70	3.5	1.82	1.94	3.5	1.75	1.99	4.3	1.83	2.33	5.0	1.80	2.78	5.8	1.75	3.31	
	Min				3.1	1.85	1.70	3.3	1.70	1.95	3.3	1.63	2.00	3.9	1.68	2.33	4.2	1.50	2.80	4.9	1.44	3.40	
45	Max	4.4	2.67	1.64	5.6	2.87	1.95	6.1	2.73	2.25	6.4	2.85	2.25	6.9	2.60	2.67	8.6	3.14	2.74	9.9	3.22	3.08	
		4.2	2.55	1.65	5.4	2.75	1.96	5.9	2.59	2.28	6.1	2.69	2.28	6.8	2.51	2.70	8.6	3.05	2.80	9.9	3.11	3.18	
		3.9	2.35	1.66	5.0	2.56	1.97	5.5	2.37	2.32	5.7	2.44	2.34	6.5	2.37	2.75	8.5	2.92	2.91	9.8	2.93	3.34	
		3.8	2.27	1.67	4.9	2.49	1.97	5.3	2.28	2.34	5.5	2.34	2.36	6.4	2.32	2.77	8.4	2.86	2.95	9.8	2.87	3.41	
		3.4	1.99	1.69	4.4	2.22	1.99	4.8	1.99	2.40	4.9	2.02	2.44	6.1	2.14	2.85	8.3	2.69	3.10	9.7	2.67	3.64	
		3.2	1.92	1.69	4.3	2.15	1.99	4.6	1.91	2.42	4.8	1.93	2.47	6.0	2.09	2.87	8.3	2.65	3.14	9.7	2.61	3.70	
		3.1	1.80	1.70	4.1	2.04	2.00	4.4	1.79	2.45	4.5	1.80	2.50	5.9	2.02	2.90	8.3	2.58	3.20	9.6	2.53	3.80	
		2.9	1.66	1.73	3.8	1.89	2.03	4.1	1.67	2.46	4.2	1.67	2.53	5.4	1.88	2.87	7.2	2.24	3.20	8.4	2.20	3.80	
		2.7	1.56	1.75	3.6	1.77	2.05	3.9	1.58	2.48	4.0	1.57	2.55	5.0	1.76	2.85	6.3	1.96	3.20	7.3	1.93	3.80	
		2.6	1.45	1.78	3.4	1.66	2.08	3.7	1.48	2.49	3.8	1.46	2.58	4.7	1.65	2.82	5.4	1.68	3.20	6.3	1.66	3.80	
	Min	2.4	1.35	1.80	3.2	1.55	2.10	3.5	1.39	2.50	3.5	1.36	2.60	4.3	1.53	2.80	4.5	1.41	3.20	5.3	1.39	3.80	
35	Max	4.7	2.49	1.87	5.8	2.50	2.33	6.4	2.49	2.58	6.7	2.56	2.61	7.3	2.31	3.15	8.9	2.54	3.51	10.3	2.62	3.92	
		4.4	2.36	1.88	5.6	2.36	2.36	6.1	2.35	2.61	6.4	2.41	2.64	7.1	2.18	3.25	8.9	2.44	3.65	10.3	2.50	4.11	
		4.0	2.15	1.88	5.1	2.13	2.40	5.6	2.12	2.65	5.9	2.18	2.69	6.7	1.97	3.42	8.9	2.28	3.88	10.3	2.33	4.42	
		3.9	2.06	1.88	4.9	2.04	2.42	5.4	2.03	2.67	5.6	2.08	2.71	6.6	1.89	3.49	8.9	2.23	3.98	10.3	2.26	4.54	
		3.3	1.77	1.89	4.3	1.74	2.48	4.7	1.73	2.73	4.9	1.77	2.78	6.1	1.63	3.73	8.8	2.05	4.31	10.3	2.06	4.98	
		3.2	1.68	1.89	4.1	1.66	2.50	4.5	1.65	2.75	4.7	1.69	2.80	6.0	1.57	3.80	8.8	2.01	4.40	10.3	2.01	5.10	
		3.1	1.61	1.92	4.0	1.60	2.50	4.4	1.59	2.76	4.6	1.62	2.82	5.7	1.50	3.81	8.3	1.88	4.40	9.6	1.89	5.10	
		2.9	1.48	1.97	3.8	1.52	2.50	4.2	1.50	2.77	4.3	1.52	2.84	5.3	1.39	3.82	7.3	1.66	4.40	8.6	1.68	5.10	
		2.8	1.38	2.02	3.6	1.45	2.50	4.0	1.43	2.78	4.1	1.44	2.86	5.0	1.30	3.83	6.5	1.48	4.40	7.7	1.51	5.10	
		2.7	1.29	2.06	3.5	1.38	2.50	3.8	1.35	2.79	3.9	1.35	2.88	4.7	1.22	3.84	5.8	1.31	4.40	6.9	1.34	5.10	
	Min	2.5	1.21	2.10	3.3	1.32	2.50	3.6	1.28	2.80	3.7	1.27	2.90	4.4	1.13	3.85	5.0	1.14	4.40	6.0	1.18	5.10	

◆ RHUE-4AVHN-HM

Ambient temperature ºC (WB)																							
WOT	CLD	-20			-10			-5			0			5			10			20			
		HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	
55	Max	-			6.7	4.60	1.45	7.2	4.38	1.65	7.2	4.20	1.72	8.4	4.09	2.06	10.1	4.12	2.45	11.6	3.99	2.91	
	↓				6.4	4.15	1.54	6.9	4.02	1.71	7.1	3.89	1.81	8.1	3.84	2.10	9.8	3.89	2.51	11.2	3.76	2.97	
					6.1	3.74	1.63	6.6	3.68	1.78	6.9	3.61	1.91	7.7	3.60	2.15	9.4	3.67	2.57	10.7	3.54	3.03	
					5.8	3.33	1.73	6.2	3.34	1.85	6.7	3.32	2.02	7.3	3.35	2.19	9.1	3.44	2.64	10.2	3.30	3.10	
					5.4	2.97	1.83	5.8	3.02	1.93	6.5	3.06	2.12	7.0	3.10	2.24	8.7	3.22	2.71	9.7	3.07	3.17	
					5.1	2.78	1.84	5.5	2.83	1.95	6.1	2.88	2.13	6.6	2.90	2.29	8.3	3.00	2.77	9.3	2.88	3.23	
					4.8	2.60	1.86	5.2	2.64	1.97	5.8	2.69	2.14	6.3	2.71	2.33	7.9	2.79	2.83	8.9	2.69	3.29	
					4.4	2.34	1.88	4.7	2.36	2.00	5.2	2.42	2.16	5.8	2.44	2.39	7.3	2.57	2.83	8.2	2.49	3.29	
					3.9	2.08	1.90	4.3	2.10	2.03	4.7	2.15	2.17	5.3	2.18	2.45	6.7	2.35	2.83	7.5	2.29	3.29	
					3.5	1.82	1.93	3.8	1.84	2.07	4.1	1.89	2.19	4.9	1.93	2.52	6.0	2.14	2.83	6.9	2.09	3.29	
	Min				3.1	1.57	1.95	3.4	1.60	2.10	3.6	1.62	2.20	4.4	1.70	2.58	5.4	1.92	2.83	6.2	1.89	3.29	
45	Max	5.8	3.53	1.65	7.3	3.25	2.25	7.9	3.25	2.42	7.8	3.39	2.30	9.2	3.68	2.49	10.8	4.09	2.65	12.5	3.98	3.13	
	↓	5.6	3.31	1.69	7.1	3.20	2.23	7.6	3.17	2.40	7.7	3.28	2.36	8.9	3.43	2.60	10.5	3.87	2.70	12.0	3.59	3.35	
		5.4	3.09	1.74	6.9	3.14	2.20	7.4	3.09	2.39	7.7	3.17	2.42	8.7	3.20	2.71	10.1	3.67	2.75	11.6	3.24	3.57	
		5.1	2.87	1.79	6.7	3.08	2.18	7.1	3.00	2.37	7.6	3.06	2.48	8.4	2.97	2.84	9.7	3.44	2.80	11.1	2.90	3.82	
		4.9	2.65	1.84	6.5	3.02	2.15	6.8	2.90	2.35	7.5	2.95	2.55	8.1	2.75	2.96	9.2	3.23	2.85	10.6	2.61	4.06	
		4.6	2.45	1.89	6.1	2.80	2.19	6.5	2.72	2.37	7.1	2.78	2.56	7.7	2.62	2.96	8.8	3.05	2.90	10.2	2.37	4.28	
		4.4	2.25	1.93	5.8	2.59	2.22	6.1	2.54	2.40	6.7	2.61	2.56	7.4	2.49	2.96	8.5	2.87	2.95	9.7	2.16	4.50	
		4.0	1.98	2.01	5.2	2.28	2.28	5.5	2.27	2.43	6.1	2.36	2.57	6.8	2.29	2.96	7.9	2.67	2.95	9.1	2.01	4.50	
		3.6	1.72	2.08	4.6	1.98	2.34	5.0	2.02	2.47	5.4	2.11	2.58	6.2	2.09	2.96	7.3	2.48	2.95	8.4	1.87	4.50	
		3.2	1.49	2.15	4.1	1.70	2.39	4.4	1.77	2.51	4.8	1.86	2.59	5.6	1.90	2.97	6.7	2.28	2.95	7.7	1.72	4.50	
	Min	2.8	1.26	2.22	3.5	1.44	2.45	3.9	1.52	2.54	4.2	1.61	2.60	5.0	1.70	2.97	6.2	2.09	2.95	7.1	1.57	4.50	
35	Max	6.0	2.74	2.18	7.5	2.95	2.54	8.1	2.70	3.01	8.2	2.65	3.10	9.6	2.92	3.30	11.6	3.36	3.45	13.3	2.90	4.59	
	↓	5.8	2.58	2.23	7.2	2.72	2.65	7.9	2.59	3.05	8.0	2.57	3.12	9.4	2.77	3.39	11.2	3.06	3.65	12.8	2.74	4.68	
		5.6	2.43	2.28	6.9	2.51	2.75	7.6	2.48	3.08	7.8	2.48	3.14	9.2	2.63	3.49	10.8	2.80	3.85	12.4	2.59	4.76	
		5.3	2.28	2.34	6.6	2.29	2.88	7.3	2.35	3.12	7.5	2.39	3.16	8.9	2.48	3.59	10.3	2.53	4.07	11.8	2.43	4.86	
		5.1	2.13	2.40	6.3	2.09	3.00	7.1	2.23	3.16	7.3	2.30	3.18	8.7	2.34	3.70	9.8	2.29	4.29	11.3	2.27	4.96	
		4.9	2.05	2.37	6.0	2.02	2.96	6.7	2.16	3.12	7.0	2.21	3.15	8.3	2.26	3.66	9.4	2.09	4.49	10.8	2.14	5.05	
		4.6	1.97	2.34	5.7	1.96	2.91	6.4	2.07	3.08	6.6	2.12	3.12	7.8	2.17	3.61	9.0	1.91	4.69	10.3	2.01	5.14	
		4.3	1.85	2.30	5.3	1.85	2.84	5.9	1.95	3.01	6.1	1.98	3.08	7.2	2.04	3.54	8.4	1.70	4.90	9.6	1.79	5.37	
		3.9	1.72	2.26	4.8	1.74	2.78	5.3	1.81	2.95	5.6	1.84	3.04	6.6	1.90	3.48	7.7	1.51	5.11	8.9	1.59	5.60	
		3.5	1.59	2.21	4.4	1.62	2.71	4.8	1.67	2.88	5.1	1.69	2.99	6.0	1.75	3.41	7.1	1.34	5.33	8.2	1.40	5.83	
	Min	3.2	1.46	2.17	4.0	1.50	2.64	4.3	1.53	2.82	4.5	1.54	2.95	5.3	1.60	3.34	6.5	1.17	5.54	7.4	1.23	6.06	

◆ RHUE-5A(V)HN-HM

Ambient temperature ºC (WB)																							
WOT	CLD	-20			-10			-5			0			5			10			20			
		HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	
55	Max	-			9.2	6.35	1.45	9.9	6.02	1.65	9.9	5.76	1.72	11.5	5.36	2.15	13.8	5.94	2.32	15.8	4.51	3.50	
	↓				8.8	5.98	1.47	9.4	5.65	1.67	9.7	5.52	1.76	11.1	5.11	2.17	13.1	5.37	2.44	15.0	4.21	3.57	
					8.3	5.61	1.48	8.8	5.25	1.68	8.9	4.95	1.80	10.3	4.73	2.18	12.4	4.85	2.55	14.2	3.91	3.63	
					8.2	5.52	1.48	8.8	5.22	1.68	9.1	5.01	1.81	10.3	4.73	2.18	12.2	4.73	2.58	14.0	3.84	3.65	
					7.7	5.16	1.50	8.2	4.84	1.70	8.3	4.49	1.85	9.6	4.36	2.20	11.5	4.27	2.70	13.2	3.55	3.71	
					7.3	4.66	1.56	7.7	4.40	1.76	7.8	4.11	1.90	9.0	4.00	2.26	10.8	3.84	2.81	12.4	3.28	3.78	
					6.7	4.09	1.64	7.1	3.89	1.84	7.2	3.66	1.97	8.3	3.56	2.33	9.9	3.36	2.96	11.4	2.95	3.86	
					6.1	3.57	1.72	6.5	3.42	1.92	6.6	3.25	2.04	7.6	3.15	2.41	9.1	3.06	2.96	10.4	2.69	3.86	
					5.7	3.19	1.78	6.1	3.07	1.98	6.1	2.93	2.09	7.0	2.84	2.47	8.4	2.83	2.96	9.6	2.48	3.86	
					5.2	2.84	1.85	5.6	2.74	2.04	5.7	2.63	2.15	6.4	2.55	2.53	7.7	2.59	2.96	8.8	2.27	3.86	
	Min				4.8	2.51	1.91	5.1	2.43	2.10	5.2	2.35	2.20	5.9	2.27	2.58	7.0	2.35	2.96	8.0	2.06	3.86	
45	Max	8.0	4.36	1.83	9.9	4.35	2.28	10.7	4.46	2.40	10.7	4.34	2.46	12.4	4.77	2.60	14.9	5.84	2.55	17.0	4.54	3.75	
	↓	7.6	4.12	1.84	9.4	4.20	2.25	10.1	4.28	2.37	10.2	4.09	2.48	11.8	4.39	2.68	14.1	5.09	2.78	16.2	4.10	3.95	
		7.2	3.88	1.85	8.9	4.04	2.21	9.6	4.09	2.34	9.6	3.85	2.50	11.2	4.03	2.77	13.4	4.46	3.01	15.4	3.70	4.15	
		7.1	3.82	1.85	8.8	4.00	2.20	9.4	4.04	2.33	9.5	3.79	2.51	11.0	3.95	2.79	13.2	4.32	3.07	15.2	3.61	4.20	
		6.7	3.58	1.86	8.3	3.83	2.16	8.8	3.84	2.30	9.0	3.55	2.53	10.4	3.61	2.87	12.5	3.80	3.30	14.3	3.25	4.41	
		6.2	3.29	1.90	7.8	3.59	2.16	8.3	3.60	2.31	8.5	3.36	2.52	9.8	3.41	2.87	11.8	3.35	3.53	13.5	2.93	4.61	
		5.7	2.95	1.94	7.1	3.29	2.16	7.6	3.29	2.32	7.8	3.12	2.51	9.1	3.16	2.87	10.9	3.09	3.53	12.5	2.71	4.61	
		5.2	2.63	1.99	6.5	3.00	2.17	7.0	3.00	2.33	7.2	2.88	2.50	8.3	2.90	2.86	10.0	2.84	3.53	11.5	2.49	4.61	
		4.8	2.38	2.03	6.0	2.76	2.17	6.4	2.76	2.34	6.7	2.68	2.49	7.7	2.70	2.86	9.3	2.63	3.53	10.6	2.31	4.61	
		4.4	2.13	2.06	5.5	2.52	2.17	5.9	2.52	2.34	6.2	2.49	2.48	7.1	2.50	2.86	8.6	2.43	3.53	9.8	2.13	4.61	
	Min	4.0	1.90	2.10	5.0	2.29	2.17	5.4	2.29	2.35	5.7	2.29	2.47	6.6	2.29	2.86	7.9	2.23	3.53	9.0	1.95	4.61	
35	Max	8.4	3.86	2.16	10.4	3.95	2.63	11.3	3.89	2.90	11.3	3.88	2.92	13.3	4.15	3.20	15.9	5.08	3.14	18.2	4.58	3.98	
	↓	7.9	3.55	2.23	9.9	3.78	2.61	10.7	3.58	2.98	10.8	3.58	3.02	12.6	3.78	3.33	15.2	4.36	3.48	17.3	3.96	4.38	
		7.5	3.27	2.30	9.3	3.61	2.59	10.1	3.29	3.06	10.2	3.29	3.11	11.9	3.45	3.46	14.4	3.76	3.82	16.5	3.44	4.79	
		7.4	3.20	2.32	9.2	3.57	2.58	9.9	3.22	3.08	10.1	3.22	3.13	11.8	3.37	3.50	14.2	3.63	3.91	16.2	3.32	4.89	
		7.0	2.93	2.39	8.7	3.40	2.56	9.3	2.95	3.16	9.6	2.96	3.23	11.1	3.06	3.63	13.4	3.16	4.25	15.4	2.90	5.29	
		6.6	2.79	2.36	8.2	3.18	2.57	8.8	2.83	3.10	9.0	2.83	3.18	10.5	2.92	3.58	13.0	2.82	4.59	14.8	2.60	5.70	
		6.1	2.61	2.32	7.5	2.91	2.59	8.1	2.66	3.04	8.3	2.67	3.13	9.7	2.74	3.53	11.9	2.49	4.78	13.6	2.30	5.93	
		5.5	2.43	2.28	6.9	2.65	2.60	7.4	2.49	2.98	7.7	2.50	3.07	8.9	2.56	3.47	10.9	2.19	4.97	12.5	2.02	6.17	
		5.1	2.28	2.24	6.4	2.43	2.61	6.9	2.35	2.93	7.1	2.36	3.02	8.3	2.41	3.43	10.0	1.96	5.12	11.5	1.81	6.35	
		4.7	2.13	2.21	5.8	2.23	2.63	6.3	2.20	2.87	6.6	2.22	2.97	7.6	2.26	3.38	9.2	1.75	5.27	10.6	1.61	6.54	
	Min	4.3	1.97	2.18	5.3	2.02	2.64	5.8	2.05	2.82	6.1	2.07	2.93	7.0	2.10	3.34	8.4	1.55	5.42	9.6	1.43	6.73	

◆ RHUE-6A(V)HN-HM

WOT	CLD	Ambient temperature ºC (WB)																				
		-20			-10			-5			0			5			10			20		
		HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP	HCAP	IPT	COP
55	Max	-			10.1	4.90	2.05	11.2	5.01	2.24	11.5	5.12	2.25	13.7	5.47	2.50	16.7	6.37	2.62	19.7	5.59	3.53
	↓				9.9	4.85	2.05	11.1	4.96	2.24	11.4	5.06	2.25	13.5	5.40	2.50	16.5	6.25	2.64	19.5	5.39	3.61
					9.5	4.64	2.04	10.5	4.75	2.21	10.8	4.85	2.24	12.8	5.12	2.51	15.7	5.76	2.72	18.5	4.70	3.94
					9.0	4.44	2.02	10.0	4.54	2.19	10.3	4.63	2.22	12.2	4.84	2.52	14.9	5.30	2.81	17.6	4.11	4.27
					8.2	4.12	2.00	9.1	4.21	2.16	9.5	4.30	2.21	11.2	4.42	2.53	13.7	4.67	2.93	16.1	3.38	4.77
					7.8	3.90	1.99	8.5	3.99	2.14	9.0	4.08	2.20	10.5	4.14	2.53	12.9	4.27	3.01	15.2	2.98	5.10
					7.3	3.69	1.97	8.0	3.77	2.13	8.4	3.84	2.19	9.9	3.91	2.52	12.1	4.01	3.01	14.2	2.79	5.10
					6.8	3.47	1.96	7.5	3.54	2.12	7.9	3.61	2.19	9.2	3.68	2.51	11.3	3.74	3.01	13.3	2.61	5.10
					6.3	3.25	1.94	7.0	3.32	2.10	7.4	3.38	2.19	8.6	3.44	2.49	10.5	3.47	3.01	12.3	2.42	5.10
					5.8	3.02	1.93	6.5	3.09	2.09	6.9	3.14	2.18	7.9	3.20	2.48	9.7	3.21	3.01	11.4	2.23	5.10
					5.2	2.74	1.91	5.8	2.80	2.08	6.2	2.85	2.18	7.2	2.90	2.46	8.7	2.87	3.01	10.2	2.00	5.10
	Min				4.6	2.45	1.89	5.2	2.50	2.06	5.5	2.55	2.17	6.4	2.60	2.45	7.6	2.54	3.01	9.0	1.77	5.10
45	Max	8.2	5.27	1.55	11.2	5.08	2.21	12.4	4.98	2.48	12.5	4.89	2.55	14.6	4.84	3.02	17.8	5.56	3.20	21.0	5.21	4.03
	↓	8.0	5.14	1.56	11.1	4.98	2.22	12.2	4.90	2.49	12.3	4.82	2.55	14.4	4.78	3.02	17.6	5.46	3.22	20.7	5.05	4.10
		7.6	4.66	1.63	10.5	4.60	2.28	11.5	4.55	2.52	11.7	4.55	2.58	13.7	4.54	3.02	16.7	5.08	3.29	19.7	4.47	4.41
		7.1	4.22	1.69	9.9	4.24	2.33	10.8	4.22	2.55	11.2	4.29	2.60	13.0	4.29	3.03	15.9	4.72	3.36	18.7	3.96	4.72
		6.5	3.61	1.79	9.0	3.73	2.41	9.7	3.73	2.60	10.3	3.90	2.63	11.9	3.93	3.03	14.6	4.21	3.47	17.2	3.31	5.19
		6.0	3.24	1.85	8.4	3.41	2.46	9.0	3.42	2.63	9.7	3.65	2.66	11.2	3.69	3.04	13.7	3.88	3.54	16.2	2.94	5.50
		5.7	3.13	1.81	7.9	3.27	2.42	8.5	3.25	2.61	9.1	3.43	2.66	10.5	3.45	3.06	12.9	3.64	3.54	15.2	2.76	5.50
		5.3	3.02	1.77	7.4	3.12	2.38	8.0	3.08	2.59	8.6	3.20	2.67	9.9	3.21	3.08	12.0	3.40	3.54	14.2	2.58	5.50
		5.0	2.90	1.72	6.9	2.96	2.35	7.5	2.91	2.58	8.0	2.98	2.68	9.2	2.97	3.09	11.2	3.16	3.54	13.2	2.40	5.50
		4.7	2.77	1.68	6.5	2.80	2.31	7.0	2.74	2.56	7.4	2.76	2.69	8.5	2.73	3.11	10.3	2.92	3.54	12.2	2.21	5.50
		4.2	2.60	1.63	5.9	2.59	2.26	6.4	2.52	2.53	6.7	2.49	2.70	7.7	2.44	3.14	9.3	2.62	3.54	10.9	1.98	5.50
	Min	3.8	2.42	1.58	5.3	2.38	2.21	5.8	2.29	2.51	6.0	2.22	2.71	6.8	2.15	3.16	8.2	2.32	3.54	9.7	1.76	5.50
35	Max	8.4	4.99	1.69	11.6	4.67	2.48	12.8	4.50	2.85	13.1	4.34	3.01	15.5	4.31	3.59	18.9	4.96	3.80	22.2	4.62	4.81
	↓	8.3	4.79	1.73	11.4	4.52	2.53	12.7	4.39	2.89	12.9	4.25	3.04	15.3	4.22	3.61	18.6	4.83	3.85	21.9	4.49	4.89
		7.9	4.10	1.93	10.9	4.01	2.72	12.0	3.96	3.04	12.3	3.89	3.16	14.4	3.90	3.70	17.6	4.35	4.05	20.8	3.99	5.21
		7.5	3.53	2.13	10.3	3.56	2.91	11.4	3.57	3.19	11.7	3.56	3.28	13.6	3.60	3.79	16.6	3.90	4.25	19.6	3.54	5.53
		6.9	2.85	2.43	9.5	2.98	3.19	10.4	3.05	3.41	10.8	3.11	3.45	12.4	3.16	3.91	15.1	3.32	4.55	17.8	2.97	6.00
		6.5	2.78	2.35	9.0	2.88	3.12	9.8	2.93	3.35	10.2	2.97	3.42	11.7	3.00	3.90	14.2	3.05	4.66	16.8	2.73	6.14
		6.1	2.70	2.28	8.5	2.78	3.04	9.2	2.80	3.29	9.6	2.82	3.39	11.0	2.83	3.89	13.4	2.80	4.77	15.8	2.51	6.29
		5.8	2.62	2.20	7.9	2.67	2.96	8.7	2.67	3.24	9.0	2.67	3.36	10.3	2.66	3.87	12.5	2.56	4.88	14.7	2.29	6.43
		5.4	2.53	2.12	7.4	2.56	2.89	8.1	2.54	3.18	8.4	2.51	3.32	9.6	2.48	3.86	11.6	2.33	4.99	13.7	2.09	6.58
		5.0	2.44	2.05	6.9	2.44	2.81	7.5	2.40	3.12	7.8	2.36	3.29	8.9	2.31	3.85	10.8	2.11	5.10	12.7	1.89	6.72
		4.5	2.31	1.95	6.2	2.28	2.72	6.8	2.22	3.05	7.0	2.16	3.25	8.0	2.09	3.83	9.7	1.85	5.23	11.4	1.66	6.90
	Min	4.0	2.16	1.86	5.5	2.10	2.62	6.0	2.03	2.98	6.3	1.95	3.21	7.1	1.87	3.81	8.6	1.61	5.37	10.2	1.44	7.08

4.6 YUTAKI M circulating pumps data

As described in the *"4.1 Selection procedure for YUTAKI M units"* section, HITACHI makes three circulating pump models available for AVHN1 or two circulating pumps for AVHN for clients to select as accessories.

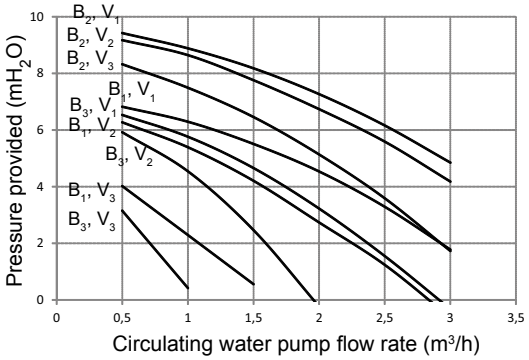
The characteristics of YUTAKI M units are given in tables below, with their respective operating curves:

NOTE

The charts presented below show the characteristic curve of the pump and include the pressure drop produced in the heat exchanger.

◆ RHUE-3AVHN1

	ATW-PK1-01 (B_1): Pressure provided (mH_2O)			ATW-PK2-01 (B_2): Pressure provided (mH_2O)			ATW-PK3-01 (B_3): Pressure provided (mH_2O)		
Pump motor speed / Flow rate (m^3/h)	V_1	V_2	V_3	V_1	V_2	V_3	V_1	V_2	V_3
0.5	6.8	6.3	4.0	9.4	9.2	8.3	6.5	5.9	3.2
1	6.3	5.4	2.3	8.9	8.6	7.5	5.8	4.5	0.4
1.5	5.5	4.2	0.6	8.2	7.8	6.5	4.7	2.5	-
2	4.5	2.7	-	7.3	6.7	5.1	3.2	-	-
2.5	3.3	1.2	-	6.2	5.6	3.6	1.6	-	-
3	1.8	-	-	4.8	4.2	1.7	-	-	-



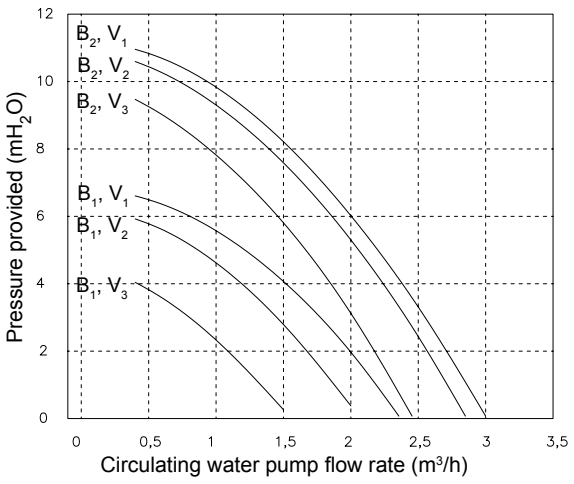
NOTE

$B_{(1,2,3)}$: Circulating water pump

V: Pump motor speed (V_1: High, V_2: Medium, V_3: Low)

◆ RHUE-(3/4)AVHN-HM

	Pump kit A (B_1): Pressure provided (mH_2O)			Pump kit B (B_2): Pressure provided (mH_2O)		
Pump motor speed / Flow rate (m^3/h)	V_1	V_2	V_3	V_1	V_2	V_3
0,4	6,6	5,9	4,0	11,0	10,6	9,5
0,5	6,5	5,8	3,8	10,8	10,4	9,3
1	5,6	4,6	2,3	9,8	9,3	7,8
1,5	4,1	2,8	0,3	8,2	7,6	5,8
2	2,0	0,4	-	6,0	5,3	3,1
2,5	-	-	-	3,3	2,4	-



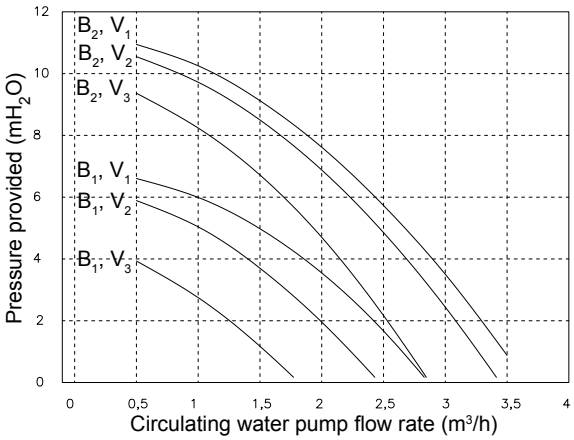
NOTE

$B_{(1,2)}$: Circulating water pump

V: Pump motor speed (V_1: High, V_2: Medium, V_3: Low)

◆ RHUE-5A(V)HN-HM

Flow rate (m^3/h) \ Pump motor speed	Pump kit A (B_1): Pressure provided (mH_2O)			Pump kit B (B_2) Pressure provided (mH_2O)		
	V_1	V_2	V_3	V_1	V_2	V_3
0,5	6,6	5,9	3,9	10,9	10,5	9,4
1	6,0	5,0	2,7	10,3	9,7	8,2
1,5	5,0	3,7	1,2	9,1	8,5	6,7
2	3,5	2,0	-	7,6	6,9	4,7
2,5	1,7	-	-	5,7	4,9	2,2
3	-	-	-	3,5	2,4	'-
3,5	-	-	-	0,9	'-	'-



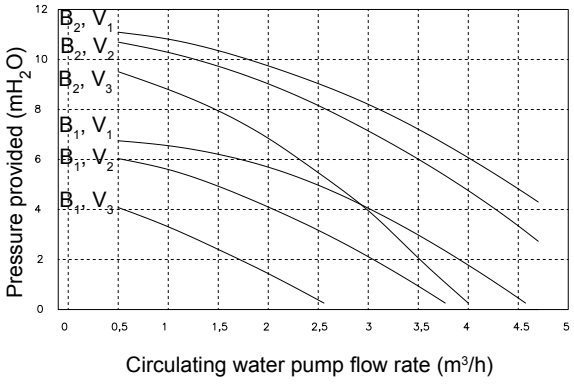
NOTE

$B_{(1.2)}$: Circulating water pump

V: Pump motor speed (V_1: High, V_2: Medium, V_3: Low)

◆ RHUE-6A(V)HN-HM

Flow rate (m^3/h) \ Pump motor speed	Pump kit A (B_1): Pressure provided (mH_2O)			Pump kit B (B_2) Pressure provided (mH_2O)		
	V_1	V_2	V_3	V_1	V_2	V_3
0,5	6,8	6,0	4,1	11,1	10,7	9,5
1	6,6	5,6	3,3	10,8	10,3	8,8
1,5	6,2	4,9	2,4	10,4	9,7	7,9
2	5,7	4,1	1,4	9,7	9,0	6,8
2,5	5,0	3,2	-	9,0	8,2	5,5
3	4,1	2,1	-	8,2	7,1	4,0
3,5	3,0	0,9	-	7,2	6,0	2,1
4	1,8	-	-	6,1	4,8	0,3
4,5	0,5	-	-	4,8	3,3	'-
4,7	-	-	-	4,3	2,7	'-



NOTE

$B_{(1.2)}$: Circulating water pump

V: Pump motor speed (V_1: High, V_2: Medium, V_3: Low)

5. Acoustic characteristic curves

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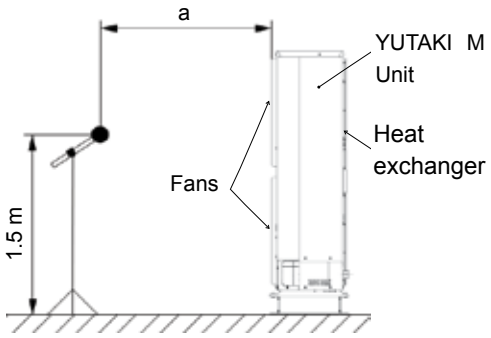
5.1 Considerations

This section shows details of noise on the various Yutaki M units for 2 different noise conditions, with the corresponding graphics:



◆ Condition 1: (a = 1 m)

	Sound pressure level (dB)								Global (dB(A))
	Frequency band (Hz)								
	63	125	250	500	1000	2000	4000	8000	
RHUE-3AVHN1	55.6	48.5	47.4	46.4	43.9	41.8	32.6	34.7	49
RHUE-3AVHN-HM	54.5	47.5	46.5	45.5	43	41	32	34	48
RHUE-4AVHN-HM	55.5	48.5	47.5	46.5	44	42	33	35	49
RHUE-5AVHN-HM	57.5	50.5	49.5	48.5	46	44	35	37	51
RHUE-6AVHN-HM	58.5	51.5	50.5	49.5	47	45	36	38	52
RHUE-5AHN-HM	57.5	50.5	49.5	48.5	46	44	35	37	51
RHUE-6AHN-HM	58.5	51.5	50.5	49.5	47	45	36	38	52

◆ Condition 2: (a = 10 m)

	Sound pressure level (dB)								Global (dB(A))
	Frequency band (Hz)								
	63	125	250	500	1000	2000	4000	8000	
RHUE-3AVHN1	40.3	35.2	34.4	33.7	31.8	30.3	23.7	25.2	37
RHUE-3AVHN-HM	42.5	35.5	34.5	33.5	31	29	20	22	36
RHUE-4AVHN-HM	43.5	36.5	35.5	34.5	32	30	21	23	37
RHUE-5AVHN-HM	45.5	38.5	37.5	36.5	34	32	23	25	39
RHUE-6AVHN-HM	46.5	39.5	38.5	37.5	35	33	24	26	40
RHUE-5AHN-HM	45.5	38.5	37.5	36.5	34	32	23	25	39
RHUE-6AHN-HM	46.5	39.5	38.5	37.5	35	33	24	26	40

NOTE

1. dB(A) = Weighting "A" of acoustic power (scale A in accordance with IEC).

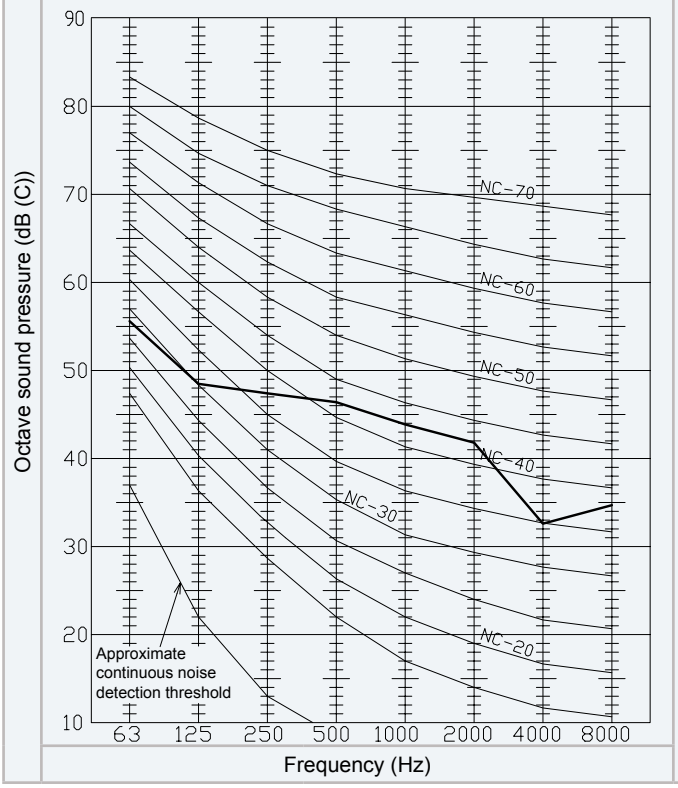
2. If the noise is measured under actual conditions of the installation, the values measured will be higher because of background noise and reflected sound.

5.2 Sound pressure level

Model: RHUE-3AVHN1 | **Power supply: 230 V 50 Hz**

Measurement point: 1.5 metres from floor level
1 meter from the unit's front surface.
Sound criteria curve

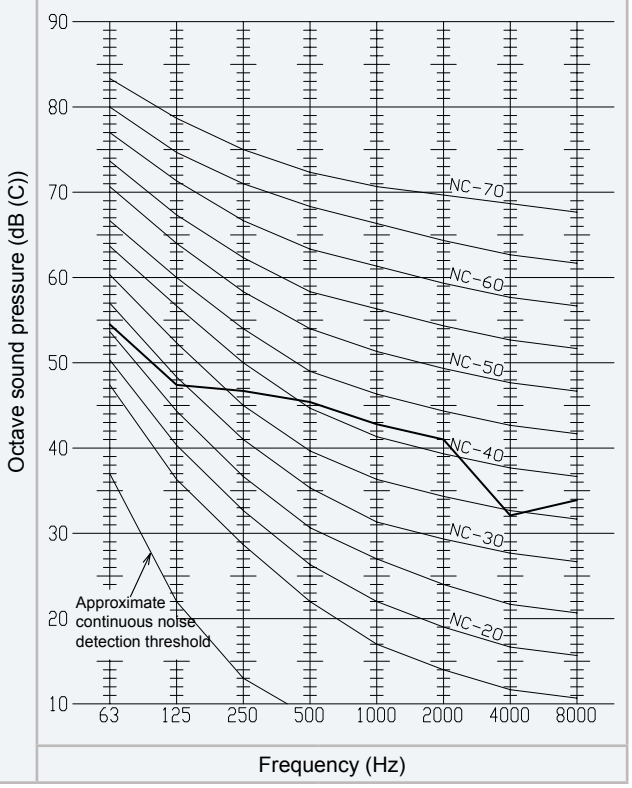
Nominal: 49 dB(A)



Model: RHUE-3AVHN-HM | **Power supply: 230 V 50 Hz**

Measurement point: 1.5 metres from floor level
1 meter from the unit's front surface.
Sound criteria curve

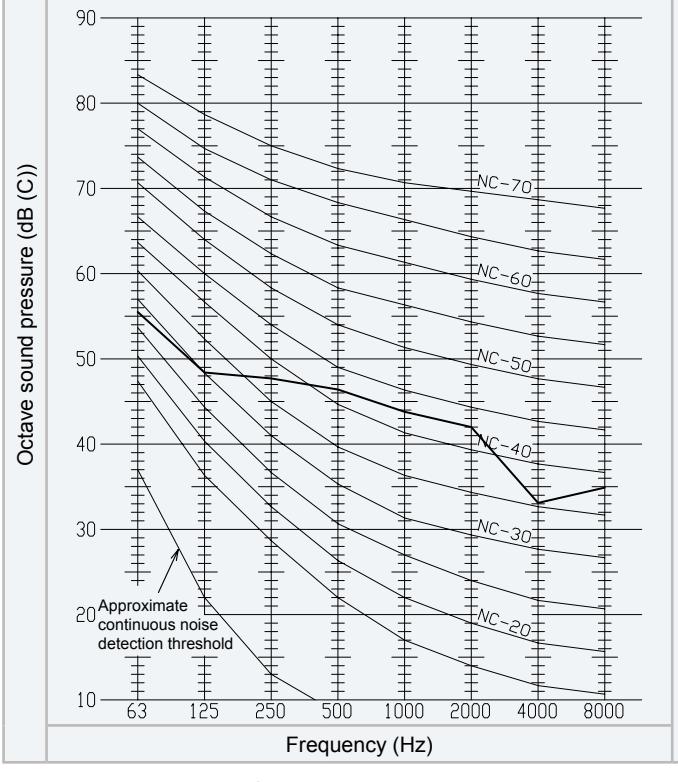
Nominal: 48 dB(A)



Model: RHUE-4AVHN-HM | **Power supply: 230 V 50 Hz**

Measurement point: 1.5 metres from floor level
1 meter from the unit's front surface.
Sound criteria curve

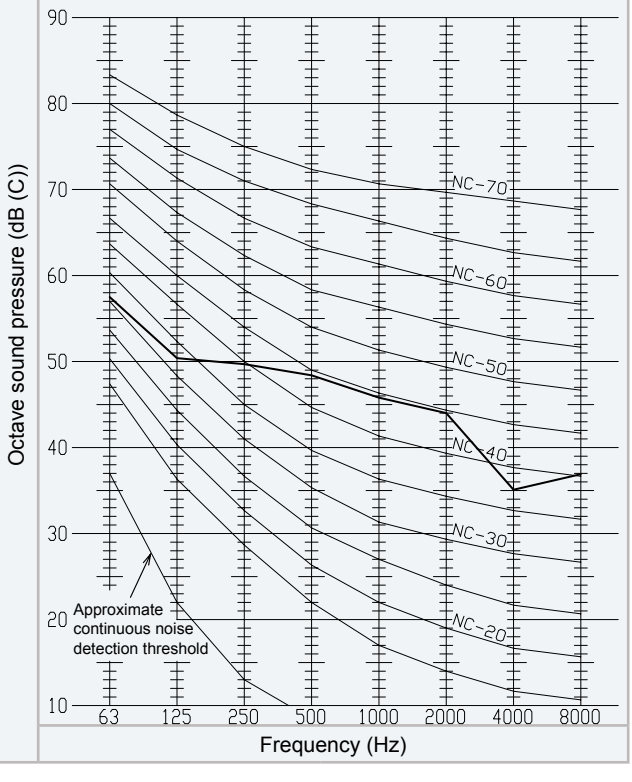
Nominal: 49 dB(A)



Model: RHUE-5AVHN-HM | **Power supply: 230 V 50 Hz**

Measurement point: 1.5metres from floor level
1 m from the front surface of the unit.
Sound criteria curve

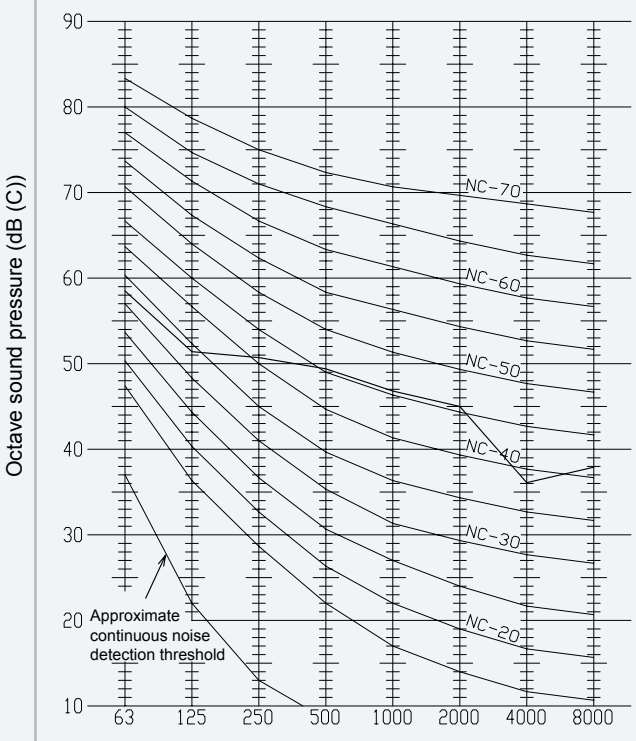
Nominal: 51 dB(A)



Model: RHUE-6AVHN-HM **Power supply: 230 V 50 Hz**

Measurement point: 1.5metres from floor level
1 m from the front surface of the unit.
Sound criteria curve

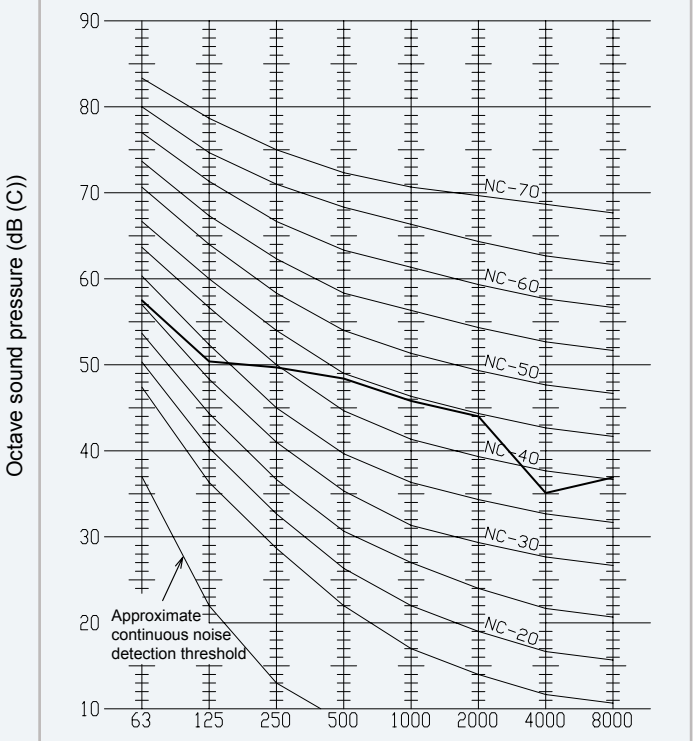
Nominal: 52 dB(A)



Model: RHUE-5AHN-HM **Power supply: 400 V 50 Hz**

Measurement point: 1.5 metres from floor level
1 meter from the front surface of the unit.
Sound criteria curve

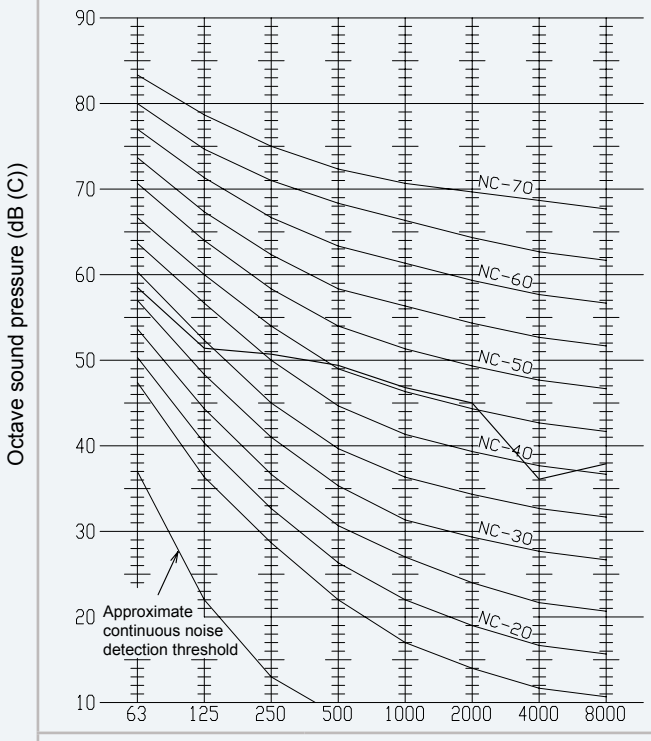
Nominal: 51 dB(A)



Model: RHUE-6AHN-HM **Power supply: 400 V 50 Hz**

Measurement point: 1.5 metres from floor level
1 meter from the front surface of the unit.
Sound criteria curve

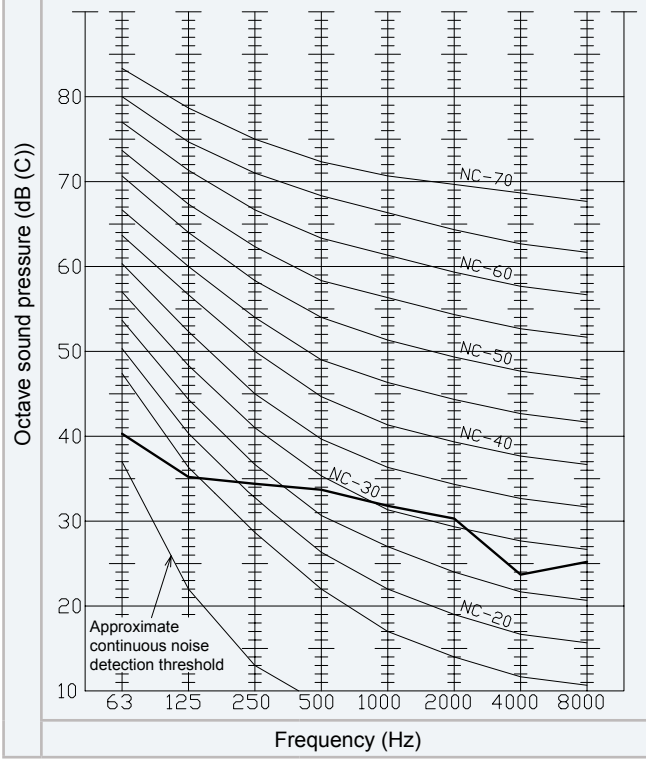
Nominal: 52 dB(A)



Model: RHUE-3AVHN1 | **Power supply: 230 V 50 Hz**

Measurement point: 1.5 metres from floor level
10 meters from the front surface of the unit.
Sound criteria curve

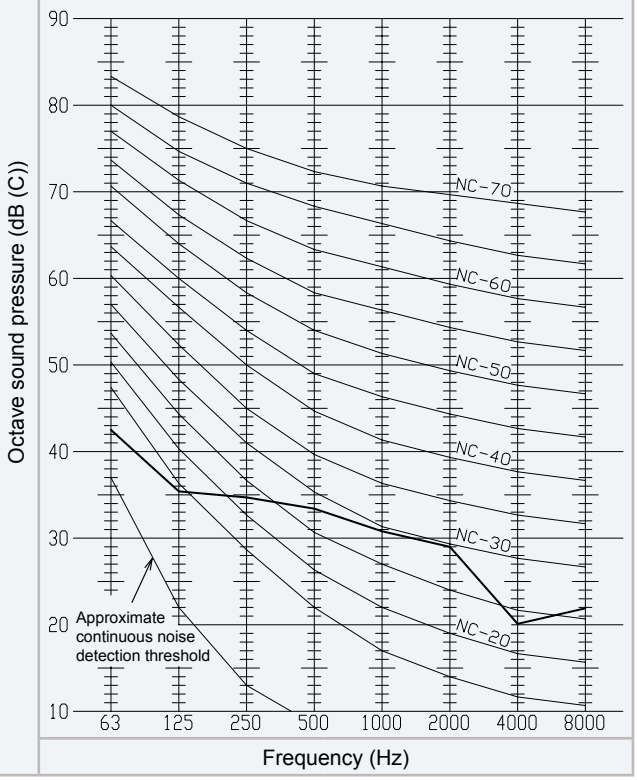
Nominal: 37 dB(A)



Model: RHUE-3AVHN-HM | **Power supply: 230 V 50 Hz**

Measurement point: 1.5 metres from floor level
10 meters from the front surface of the unit.
Sound criteria curve

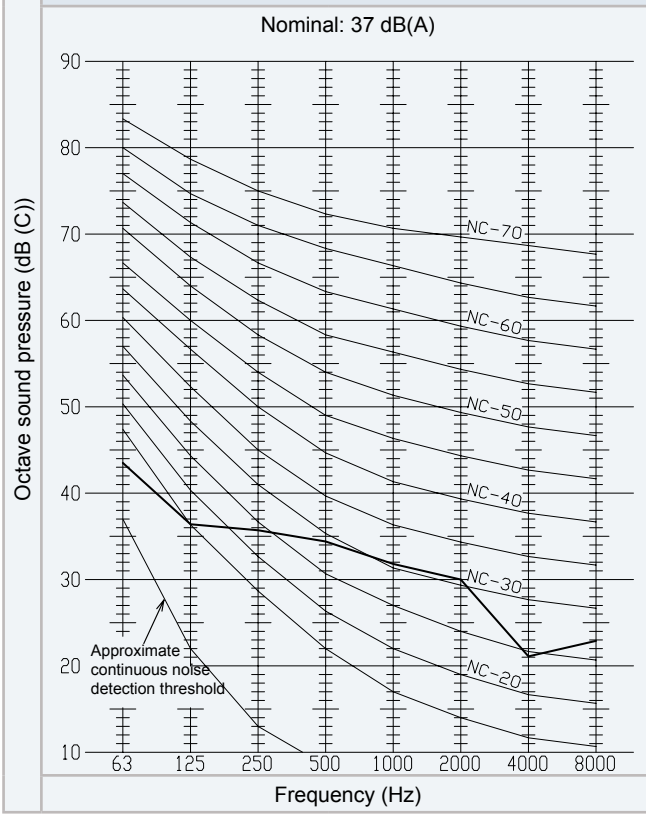
Nominal: 36 dB(A)



Model: RHUE-4AVHN-HM | **Power supply: 230 V 50 Hz**

Measurement point: 1.5 metres from floor level
10 meters from the front surface of the unit.
Sound criteria curve

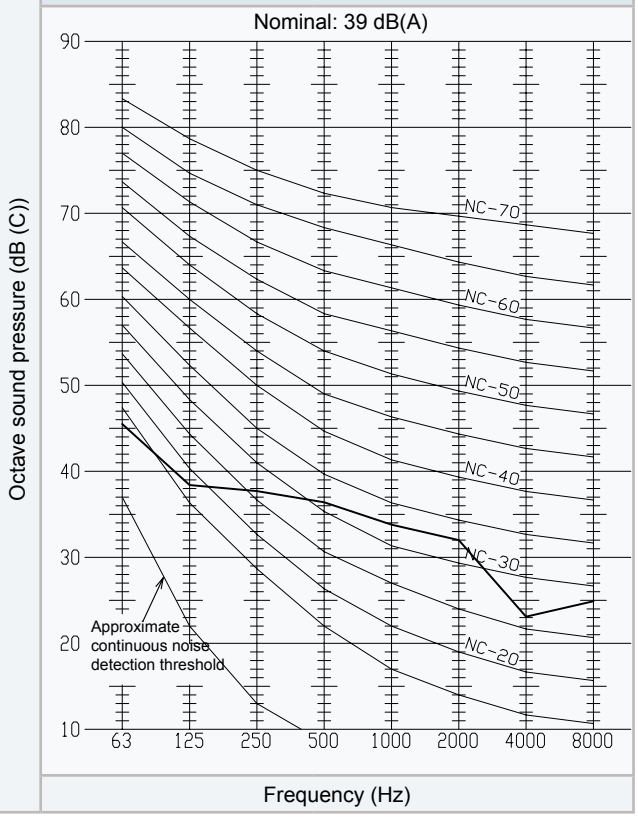
Nominal: 37 dB(A)



Model: RHUE-5AVHN-HM | **Power supply: 230 V 50 Hz**

Measurement point: 1.5 metres from floor level
10 meters from the front surface of the unit
Sound criteria curve

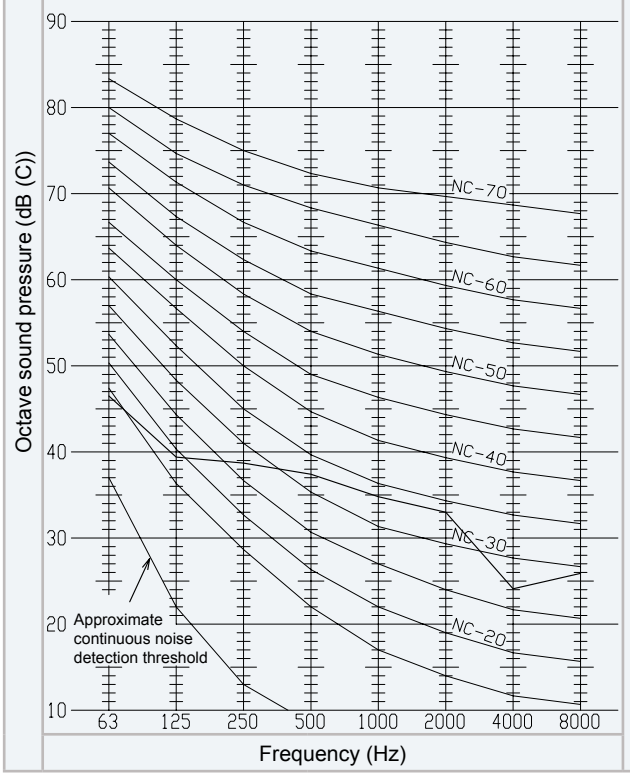
Nominal: 39 dB(A)



Model: RHUE-6AVHN-HM	Power supply: 230 V 50 Hz

Measurement point: 1.5 metres from floor level
10 meters from the front surface of the unit
Sound criteria curve

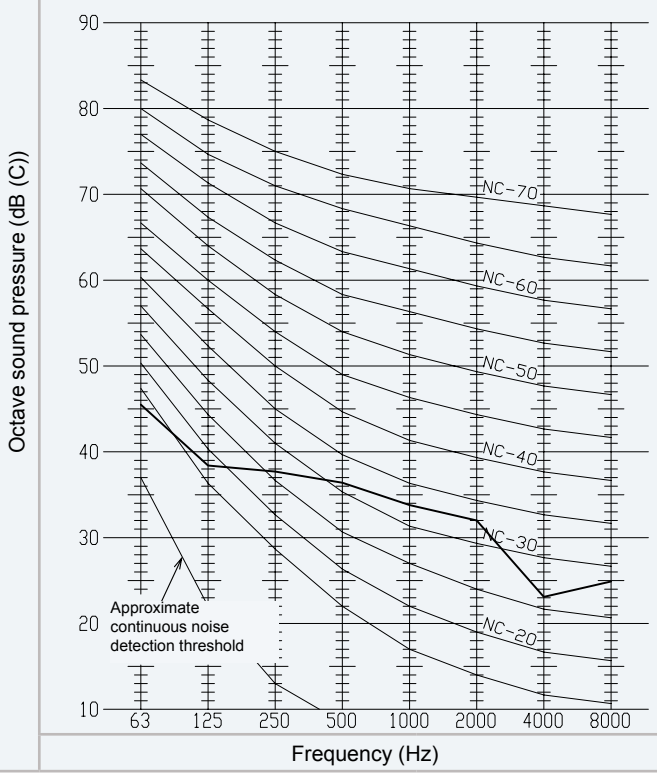
Nominal: 40 dB(A)



Model: RHUE-5AHN-HM	Power supply: 400 V 50 Hz

Measurement point: 1.5 metres from floor level
10 meters from the front surface of the unit.
Sound criteria curve

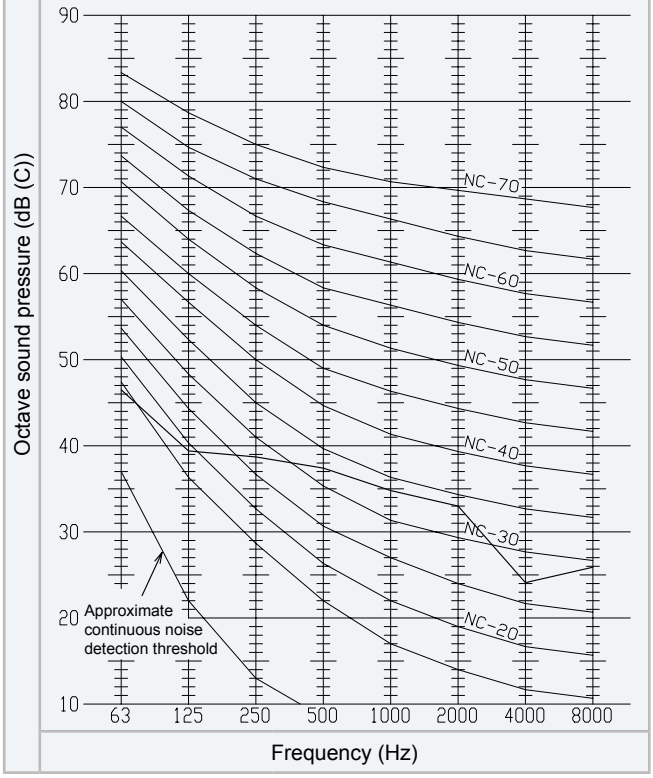
Nominal: 39 dB(A)



Model: RHUE-6AHN	Power supply: 400 V 50 Hz

Measurement point: 1.5 metres from floor level
10 meters from the front surface of the unit.
Sound criteria curve

Nominal: 40 dB(A)



6. Working range

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6.1 Power supply range

◆ Nominal power supply

- Single phase: 1~ 230V 50Hz
- Three phase: 3N~ 400V 50Hz

◆ Operating voltage

Between 90 and 110% of the nominal voltage.

◆ Voltage imbalance for nominal power supply 3N~ 400V 50Hz

Up to 3% of each phase, measured at the main terminal of the outdoor unit.

◆ Starting voltage

Always higher than 85% of the nominal voltage.

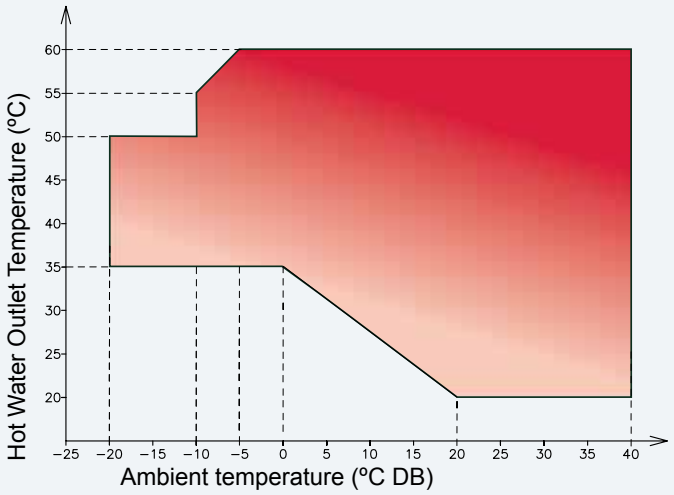
6.2 Working range of YUTAKI M unit

Model		RHUE-3 AVHN1	RHUE-3 AVHN-HM	RHUE-4 AVHN-HM	RHUE-5 AVHN-HM	RHUE-6 AVHN-HM	RHUE-5 AHN-HM	RHUE-6 AHN-HM
Ambient Temperature	ºC	-20 (WB) ~ 37.5 (WB), -19.8 (DB) ~ 40 (DB)						
Hot Water Outlet Temperature	ºC	20 ~ 60	20 ~ 55					
Minimum Flow Rate	m^3/h	0.9	0.4	0.6	0.8	0.8	0.8	0.8
Maximum Flow Rate	m^3/h	2.6	2.5	3.3	4.0	4.7	4.0	4.7
Minimum system water volume	L	28	28	38	46	56	46	56
Maximum Permissible Water Pressure	MPa	1.0						
Internal Volume in Water Side Heat Exchanger	L	1.67	0.89	0.89	1.11	2.22	1.11	2.22

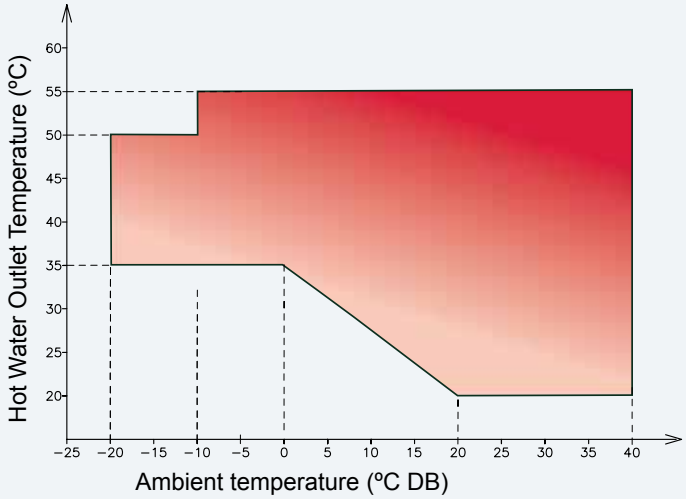
NOTE

The system water volume is calculated at 4ºC ON/OFF. Differential and water temperature drop of 15ºC. In case of different conditions, refer to chapter 6 "Refrigerant cycle and hydraulic circuit" for the calculation.

RHUE-AVHN1



RHUE-(3-6)AVHN-HM



NOTE

Tested at -15°C in the Building Research Establishment Laboratory for MCS Certification.

6.3 Working range of accessories

◆ Advanced system controller

System controller	
Power supply	230Vac +10%, -15%, 50Hz
Power Consumption	Max. 12VA
Ambient Operating Temperature	0 to 50°C (0 to 40°C with terminal covers)
Storage Temperature	-20 to 55°C
Humidity	0 to 90% RH non-condensing

Water temperature sensor	
Water temperature sensor element	Type NTC20k @ 25°C
Range, precision	+5 to +90 °C, +/-1 K

◆ Hydraulic Module

Hydraulic Module has been designed for being combined with the YUTAKI M units series for working in the following temperature range.

		Temperature	
		Maximum	Minimum
Heating Mode	AT	40 °C DB	-19.8 °C DB
	HT	60 °C (RHUE-3AVHN1) 55ºC (RHUE-(3-6)AVHN-HM	20 °C
AT: Ambient temperature HT: Hot water temperature DB: Dry bulb temperature			

◆ Water pump

Pump kit		ATW-PK1-01	ATW-PK2-01	ATW-PK3-01	Pump kit A	Pump kit B
		For RHUE-3AVHN1			For RHUE-(3-6)AVHN-HM	
Maximum working temperature	°C	110	110	95	130ºC (short term (2h) +140ºC)	
Minimum working temperature	°C	-25	-25	2	-20	-20
Maximum delivery head	m	8	10	8	7	12
Maximum operating pressure	bar	10	10	10	10	10
Maximum operating flow	m^3/h	8.0	11.5	4.5	7.5	10.5

◆ WEH - Water Electric Heater

Concept	Min.	Max.
Water flow	0.4 m^3/h	4 m^3/h
Water temperature	Out of freeze	+65ºC
Water pressure	1 bar	5 bar

◆ DHWT - Domestic Hot Water Tank

		DHWT(200/300)(E/S)-2.5H1E
Maximum operating temperature of heating circuit	ºC	200
Maximum operating pressure of heating circuit	bar	25
Maximum operating temperature of DHW tank	ºC	90
Maximum pressure of DHW tank	bar	8

◆ Water check valve

Maximum Working Pressure	16 bar
Maximum Working Temperature	70 ºC

7. General dimensions

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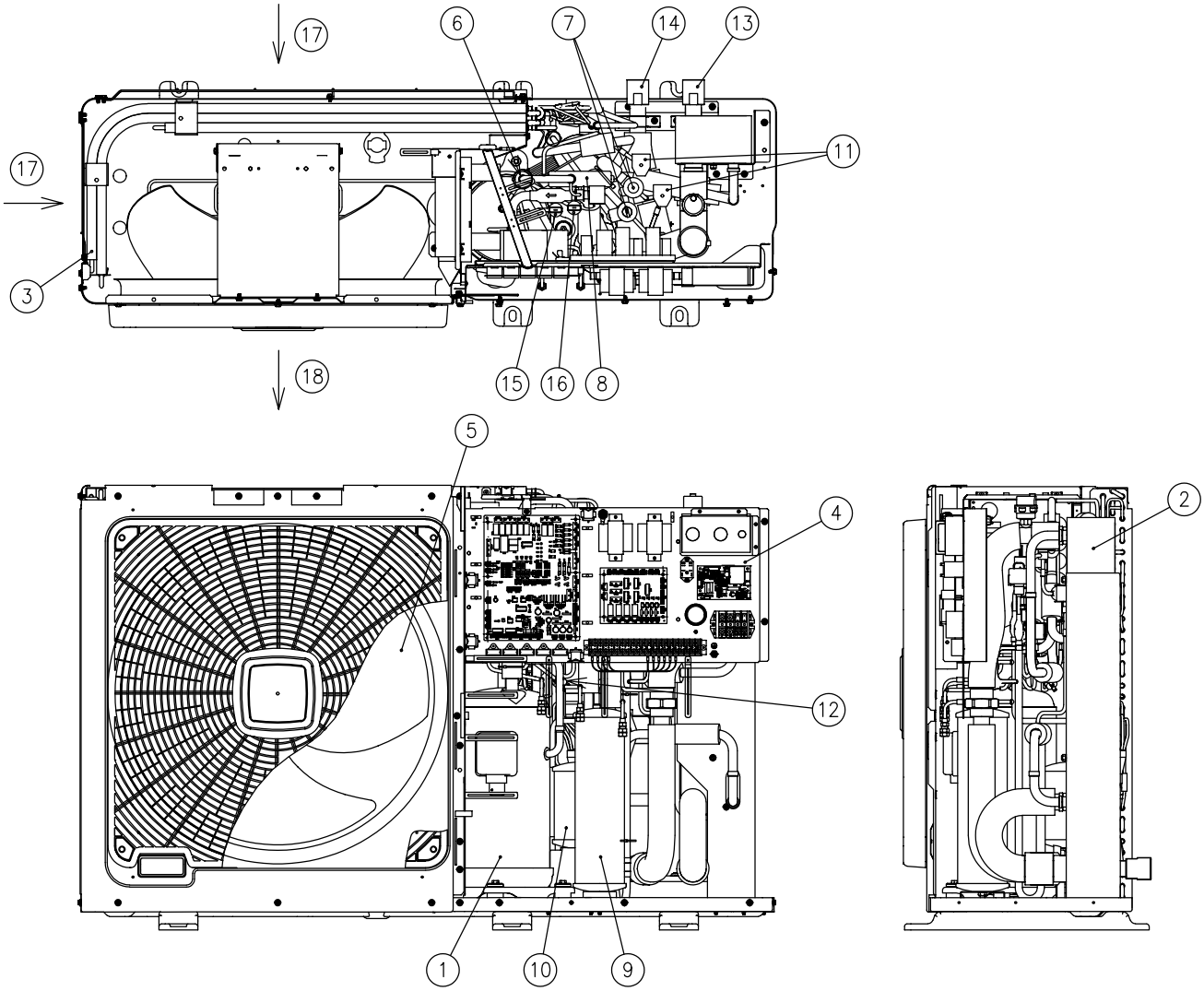
7.1 YUTAKI M unit

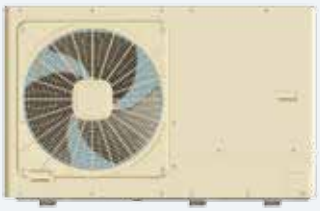
7.1.1 Name of parts

◆ **RHUE-3AVHN1**

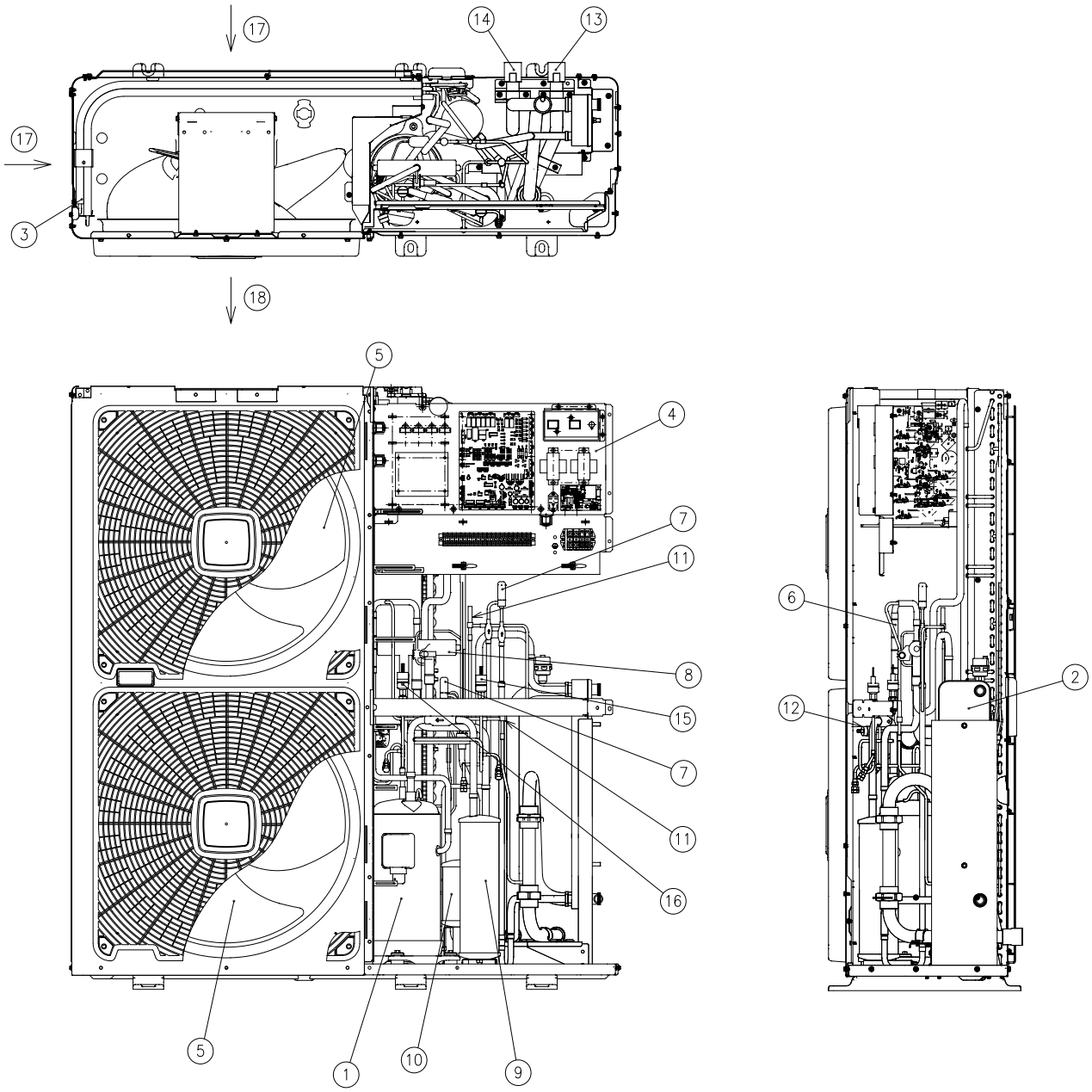


No.	Description	Remarks
1	Compressor	-
2	Water Side Heat Exchanger	-
3	Air Side Heat Exchanger	-
4	Electrical Box	-
5	Fan	x1
6	Check Valve	-
7	Electronic Expansion Valve	x2
8	4-way Valve	-
9	Accumulator	-

No.	Description	Remarks
10	Liquid Tank	-
11	Solenoid Valve	x2
12	High Pressure Switch	-
13	Water Inlet	Rp1”
14	Water Outlet	Rp1”
15	Low Pressure Sensor	-
16	High Pressure Sensor	-
17	Air Inlet	-
18	Air Outlet	-

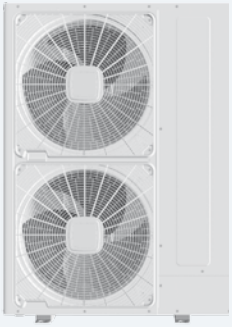


◆ RHUE-(3-6)A(V)HN-HM



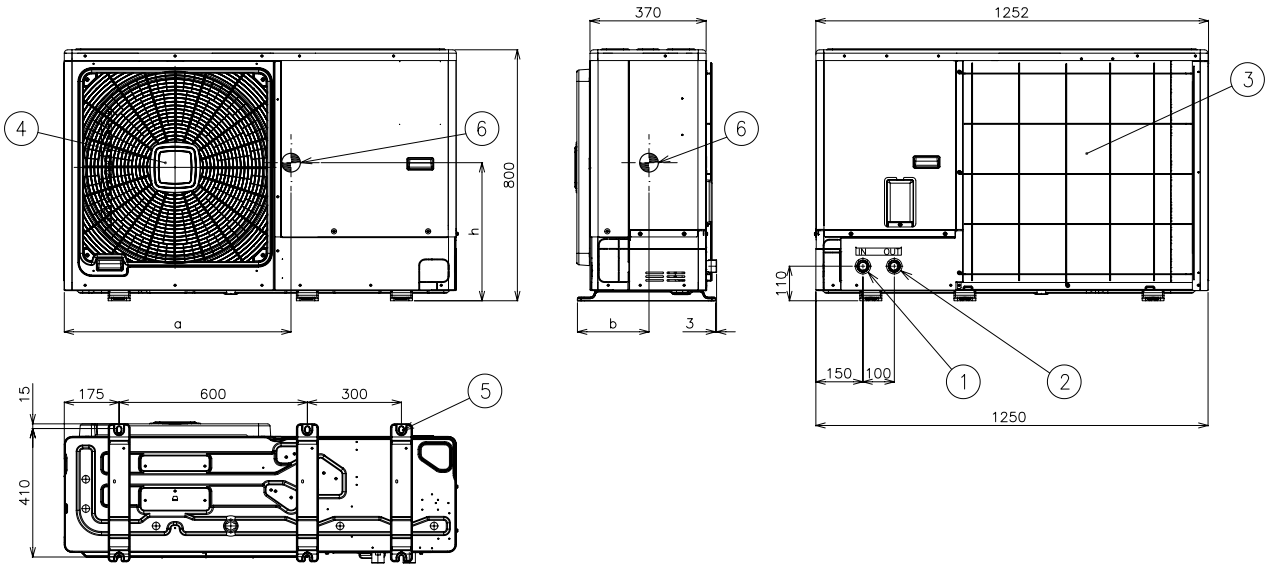
No.	Description	Remarks
1	Compressor	-
2	Water Side Heat Exchanger	-
3	Air Side Heat Exchanger	-
4	Electrical Box	-
5	Fan	x2
6	Check Valve	-
7	Electronic Expansion Valve	x2
8	4-Way Valve	-
9	Accumulator	-

No.	Description	Remarks
10	Liquid Tank	-
11	Solenoid Valve	x2
12	High Pressure Switch	-
13	Water Inlet	Rp1”
14	Water Outlet	Rp1”
15	Low Pressure Sensor	-
16	High Pressure Sensor	-
17	Air Inlet	-
18	Air Outlet	-



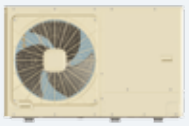
7.1.2 Dimensional data

◆ **RHUE-3AVHN1**



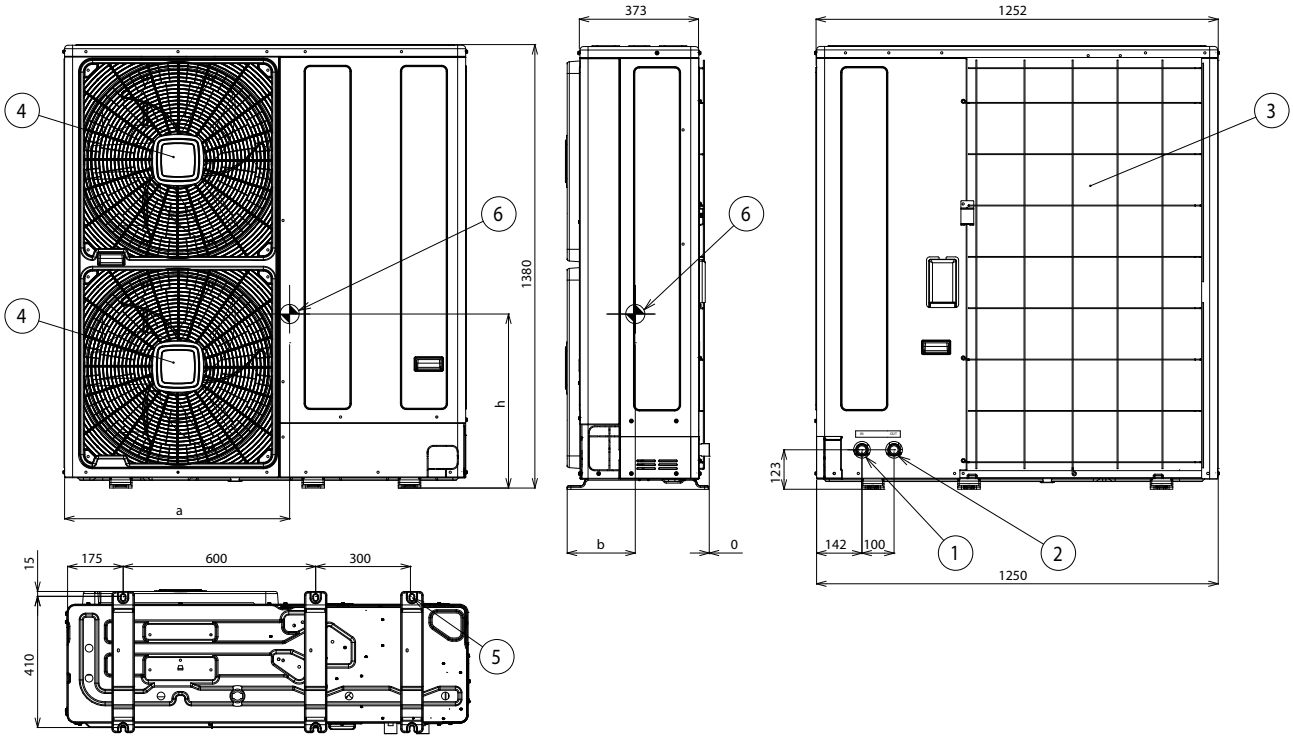
Model	Operation weight (kg)	Gravity center position (mm)		
		a	b	h
RHUE3AVHN1	110	723	228	440

No.	Description
1	Water inlet (Rp1”)
2	Water outlet (Rp1”)
3	Air inlet
4	Air outlet
5	6-Mounting Holes (for M10 Bolt)
6	Gravity center



Units: in mm

◆ RHUE-(3-6)A(V)HN-HM

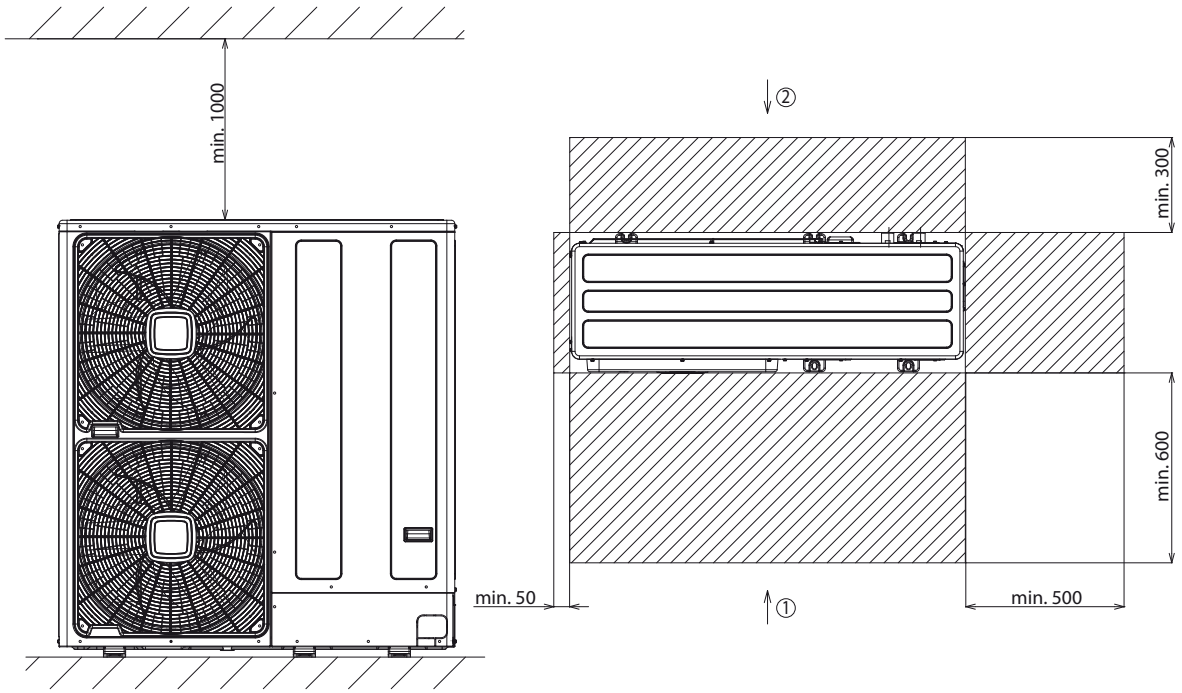


Model	Operation weight (kg)	Gravity center position (mm)		
		a	b	h
RHUE-3AVHN-HM	130	705	223	545
RHUE-4AVHN-HM	130	705	223	545
RHUE-5AVHN-HM	135	695	228	560
RHUE-6AVHN-HM	139	695	228	560
RHUE-5AHN-HM	140	695	228	560
RHUE-6AHN-HM	144	695	228	560

No.	Description
1	Water inlet (Rp1”)
2	Water outlet (Rp1”)
3	Air inlet
4	Air outlet
5	6-Mounting Holes (for M10 Bolt)
6	Gravity center

Units: in mm

7.1.3 Service space

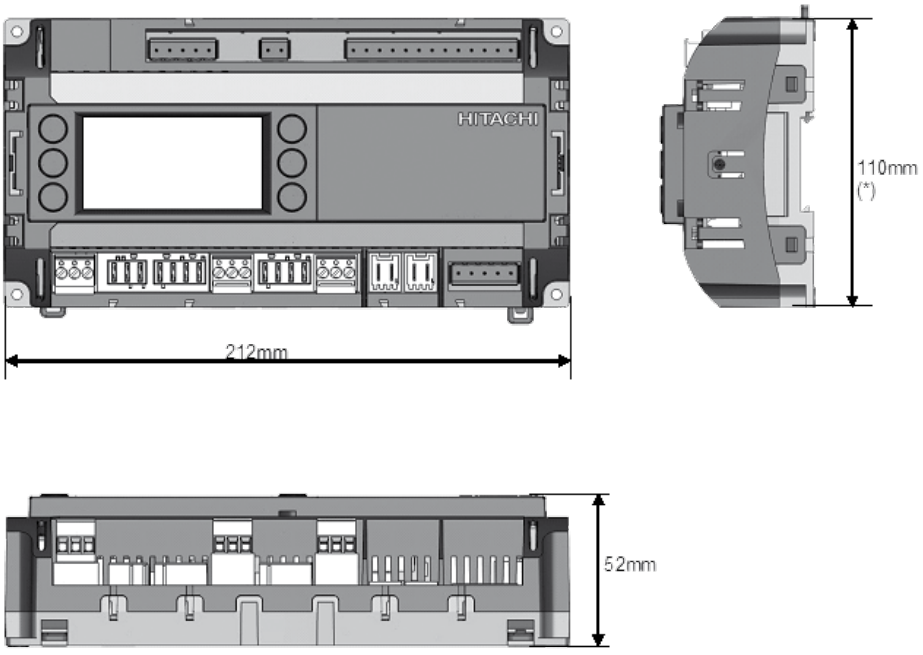


Units in: mm

No.	Description
1	Frontal Side
2	Waterpipe Side

7.2 Accessories

7.2.1 Advanced system controller

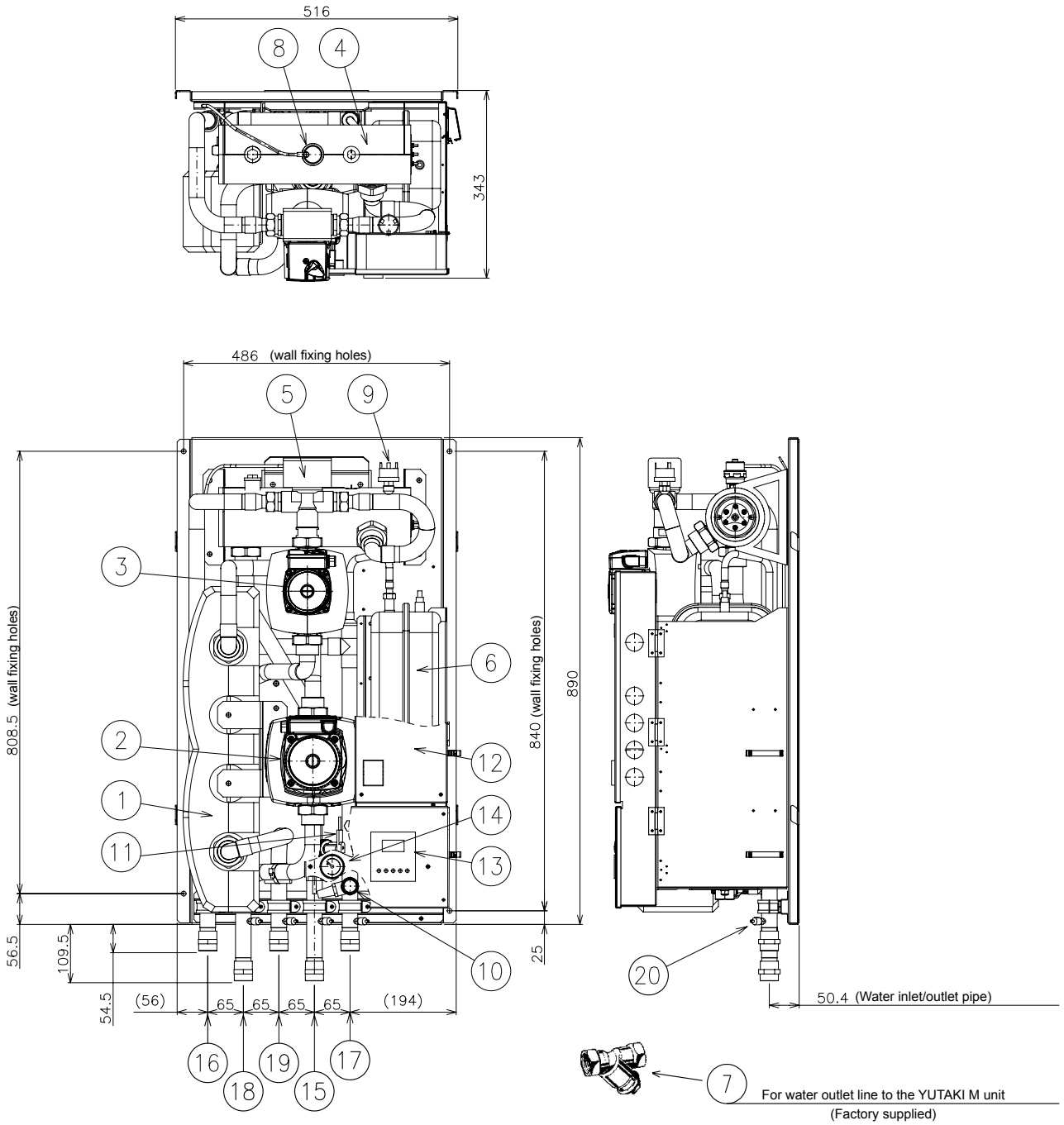


NOTE

(*): 150mm if terminal cover is applied.

7.2.2 Hydraulic module

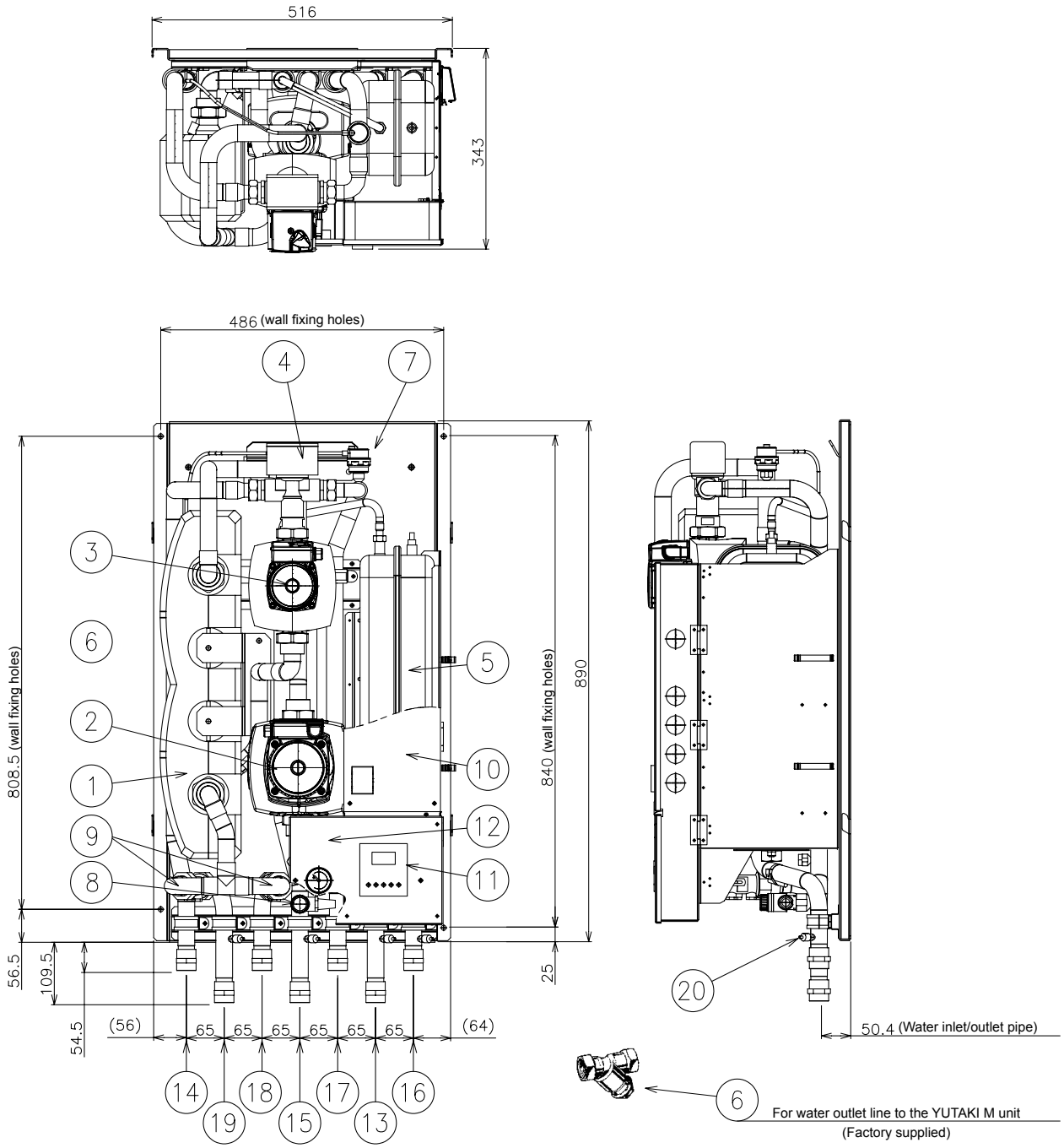
◆ **RHM-EH01E**



No.	Description
1	Hydraulic separator
2	Pump 1 (Primary circuit)
3	Pump 2 (Secondary circuit)
4	Electric heater
5	3-way valve
6	Expansion vessel
7	Water strainer
8	Air purger
9	Low pressure switch
10	Safety valve

No.	Description
11	Flow switch
12	Electrical box
13	System controller 1
14	Manometer
15	Water outlet (To space heating)
16	Water outlet (To DHWT)
17	Water inlet (From space heating and DHWT)
18	Water outlet (To YUTAKI M unit)
19	Water inlet (From YUTAKI M unit)
20	Pressure port

◆ RHM-BC01E



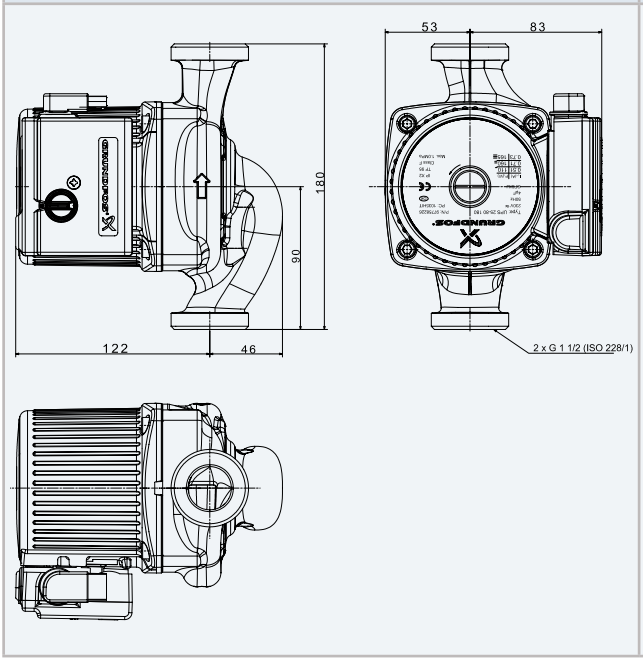
No.	Description
1	Hydraulic separator
2	Pump 1 (Primary circuit)
3	Pump 2 (Secondary circuit)
4	Diverting valve
5	Expansion vessel
6	Water strainer
7	Air purger
8	Safety valve
9	Check valves
10	Electrical box

No.	Description
11	System controller 1
12	Manometer
13	Water outlet (To space heating)
14	Water outlet (To DHWT)
15	Water inlet (From space heating and DHWT)
16	Water outlet (To YUTAKI M unit)
17	Water outlet (To Boiler)
18	Water inlet (From Boiler)
19	Water inlet (From YUTAKI M unit)
20	Pressure port

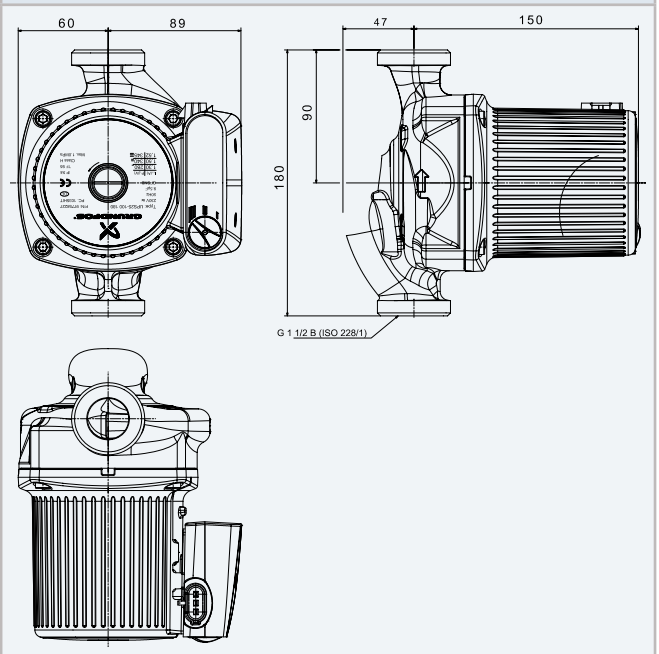
7.2.3 Water pump

◆ **ATW-PK(1/2/3)-01 (For RHUE-3AVHN1)**

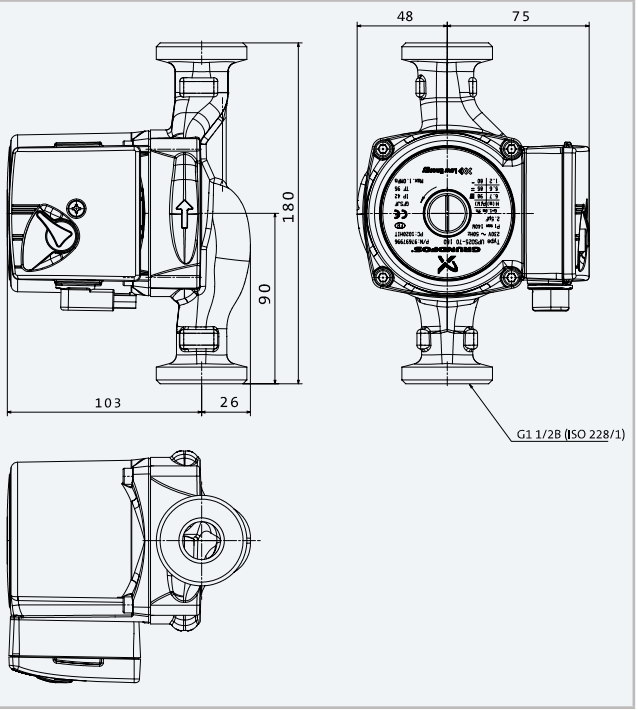
ATW-PK1-01



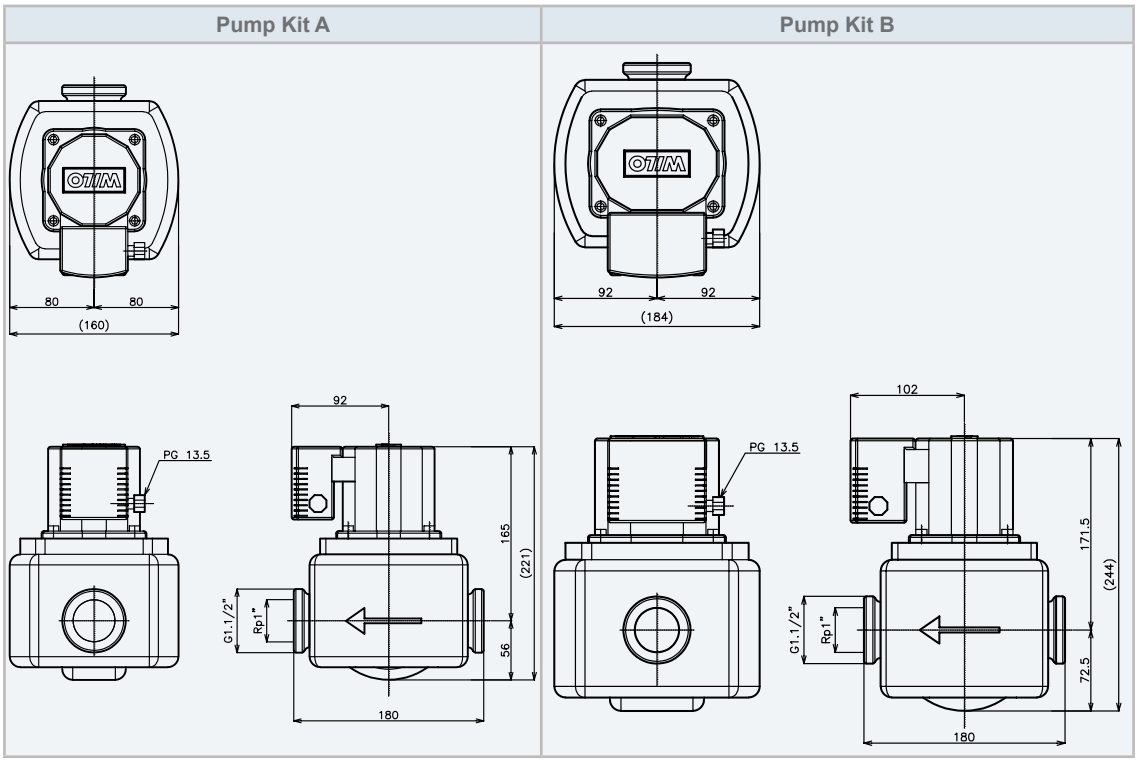
ATW-PK2-01



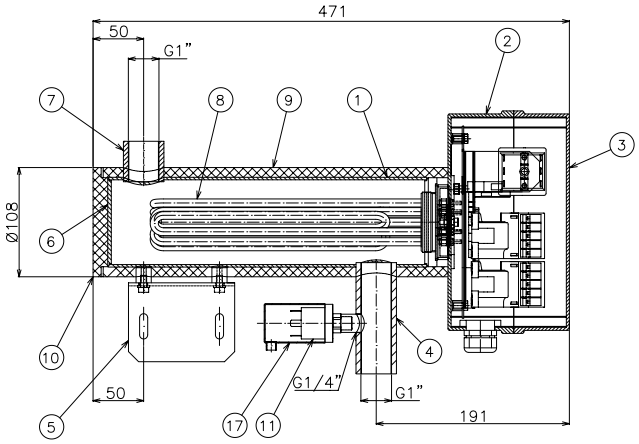
ATW-PK3-01

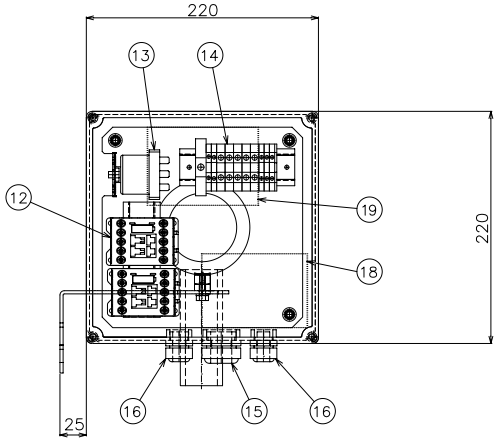


◆ Pump kit (A/B) (For RHUE-(3-6)A(V)HN-HM)



7.2.4 WEH - Water Electric Heater





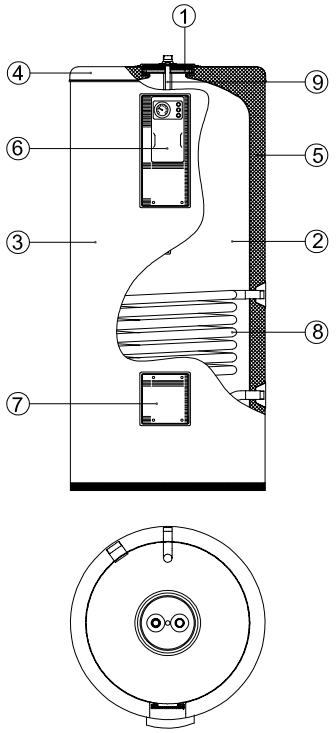
Ref.	Name	Qty.
①	Tank body	1
②	Front E-casing	1
③	Back E-casing	1
④	Tank in-connection	1
⑤	Wall support	1
⑥	Tank front cover	1
⑦	Tank out-connection	1
⑧	Resistance	1
⑨	Tank body insulation	1

Ref.	Name	Qty.
⑪	PSW	1
⑫	3-pole contactor	2
⑬	Thermostat	1
⑭	Terminal board	1
⑮	Packing gland	1
⑯	Packing gland	2
⑰	PSW protector	1
⑱	Caution label	1
⑲	Wiring label	1

7.2.5 DHWT - Domestic Hot Water Tank

◆ Name of parts

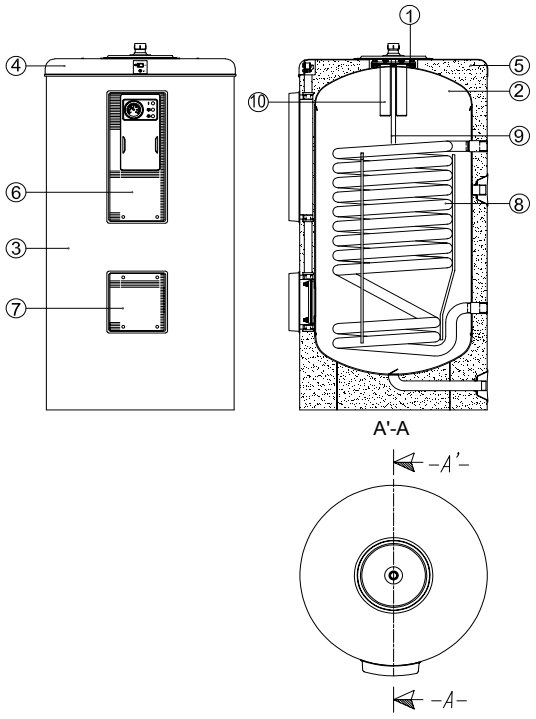
DHWT(200/300)S-2.5H1E



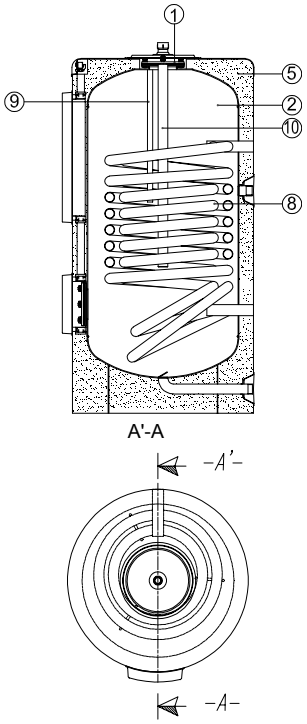
Ref.	Name	Qty.
①	Inspection aperture	1
②	HSW storage tank	1
③	External covering	1
④	Top cover	1
⑤	Thermal insulation	1
⑥	Control panel	1
⑦	Electrical Heater	1
⑧	Heating coil	1
⑨	Sensor probe	1

DHWT(200/300)E-2.5H1E

DHWT200E-2.5H1E



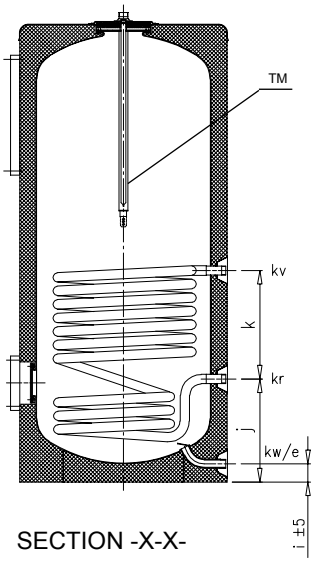
DHWT300E-2.5H1E



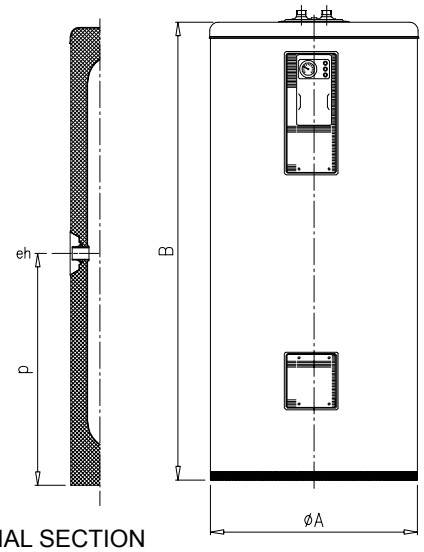
Ref.	Name	Qty.
①	Inspection aperture	1
②	HSW storage tank	1
③	External covering	1
④	Top cover	1
⑤	Thermal insulation	1
⑥	Control panel	1
⑦	Electrical Heater	1
⑧	Heating coil	1
⑨	Sensor probe	1
⑩	Cathodic protection (anode)	1

◆ Dimensional data

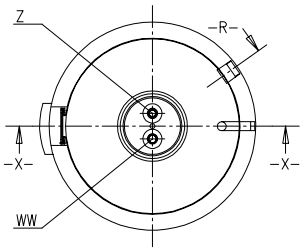
DHWT(200/300)S-2.5H1E



SECTION -X-X-



PARTIAL SECTION FOR -R-



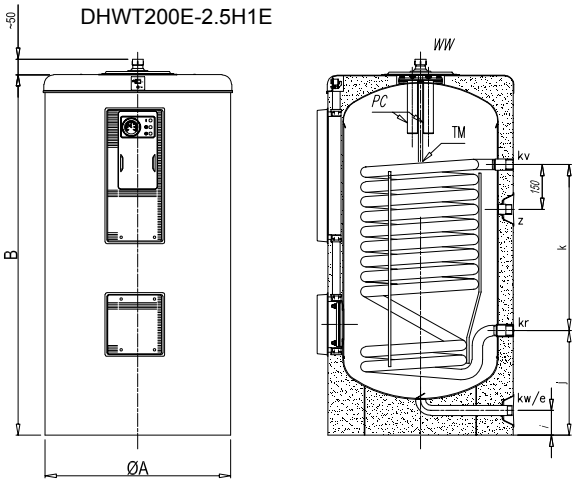
PLAN VIEW

kw/e- Cold water input/drain
ww- Hot water output
z- Recirculation
kv- Heat Pump feed
kr- Heat Pump
eh- Side connection
TM- Sensor Tube

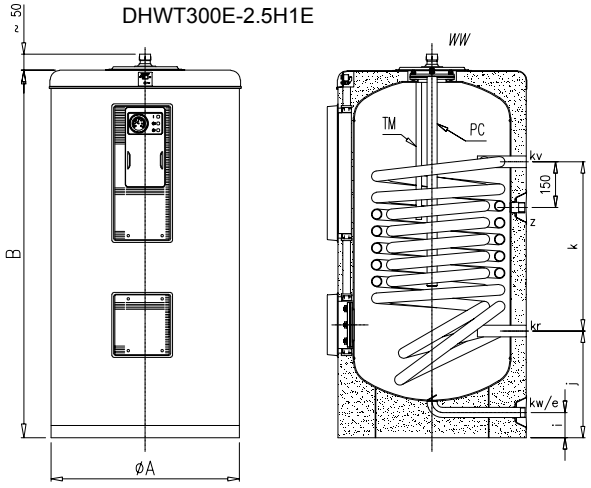
ITEM		DHWT200S-2.5H1E	DHWT300S-2.5H1E
A: External diameter	mm	620	620
B: Total length (without pipes)	mm	1205	1685
Kw: Cold water input/drain (external thread)	in.	1”	1”
ww: Hot water output (external thread)	in.	1”	1”
z: Recirculation (external thread)	in.	1”	1”
kv: Heat Pump feed (external thread)	in.	1”	1”
kr: Heat Pump return (external thread)	in.	1”	1”
eh: Side screwed connection (external thread)	in.	1-1/2”	1-1/2”
Dimension i	mm	70	70
Dimension j	mm	308	380
Dimension k	mm	400	500
Dimension p	mm	758	868

DHWT(200/300)E-2.5H1E

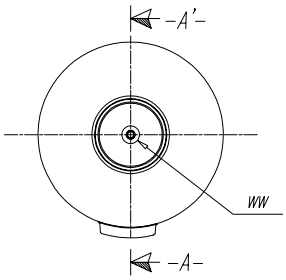
DHWT200E-2.5H1E



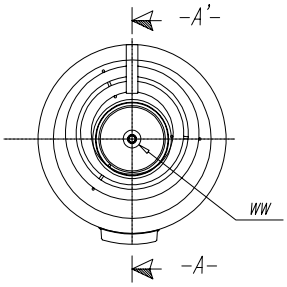
DHWT300E-2.5H1E



SECTION -A-A-



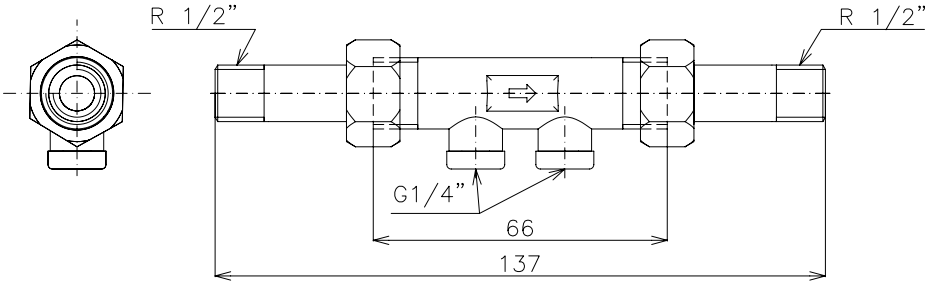
SECTION -A-A-



kw/e- Cold water input/drain
ww- Hot water output
z- Recirculation
kv- Heat Pump feed
kr- Heat Pump return
PC- Cathodic protection
TM- Sensor Tube

ITEM		DHWT200E-2.5H1E	DHWT300E-2.5H1E
A: External diameter	mm	620	620
B: Total length (without pipes)	mm	1205	1685
Kw: Cold water input/drain (external thread)	in.	1”	1”
ww: Hot water output (external thread)	in.	1”	1”
z: Recirculation (external thread)	in.	1”	1”
kv: Heat Pump feed (external thread)	in.	1”	1”
kr: Heat Pump return (external thread)	in.	1”	1”
eh: Side screwed connection (external thread)	in.	1-1/2”	1-1/2”
Dimension i	mm	70	70
Dimension j	mm	308	380
Dimension k	mm	400	500

7.2.6 Water check valve



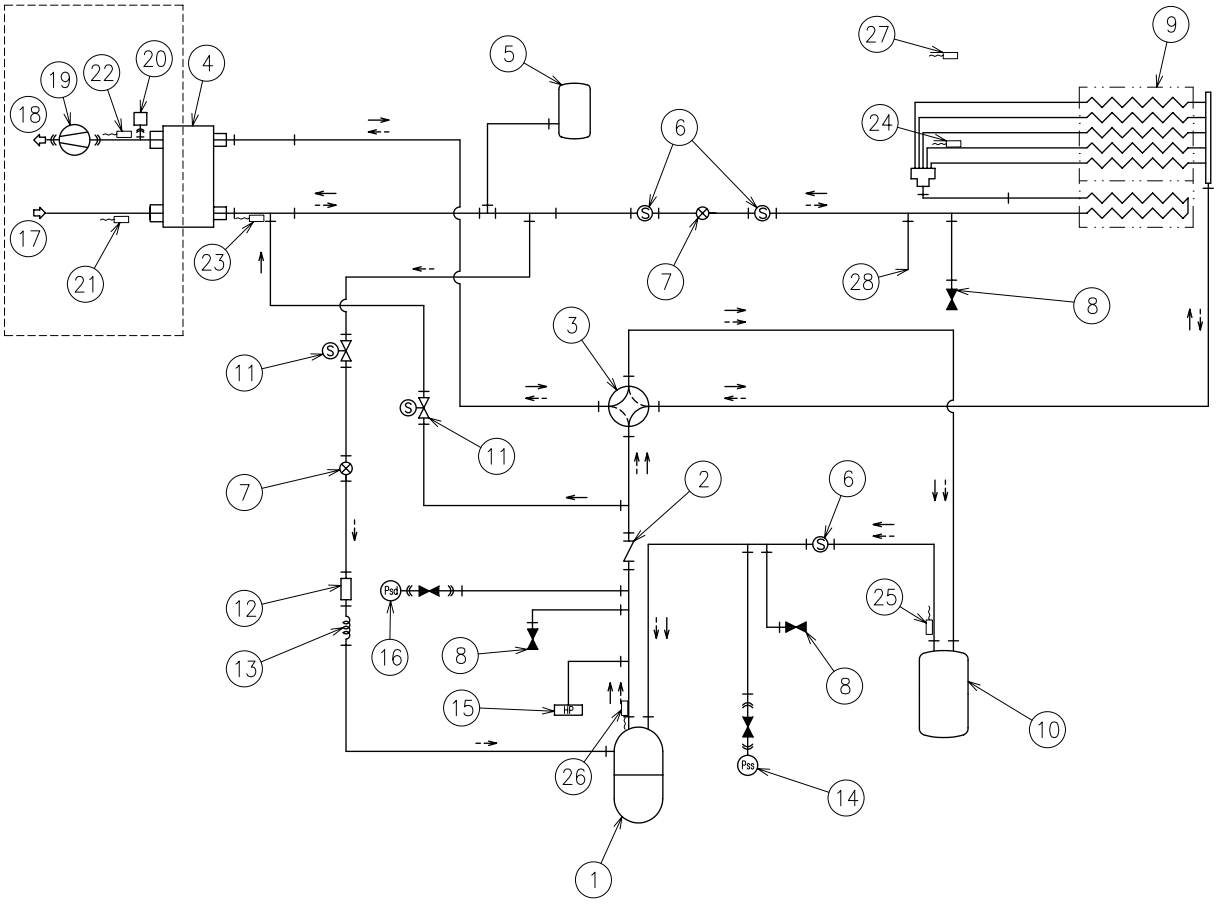
8. Refrigerant cycle and hydraulic circuit

Index

8.1 YUTAKI M unit

8.1.1 RHUE-3AVHN1

Hydraulic circuit



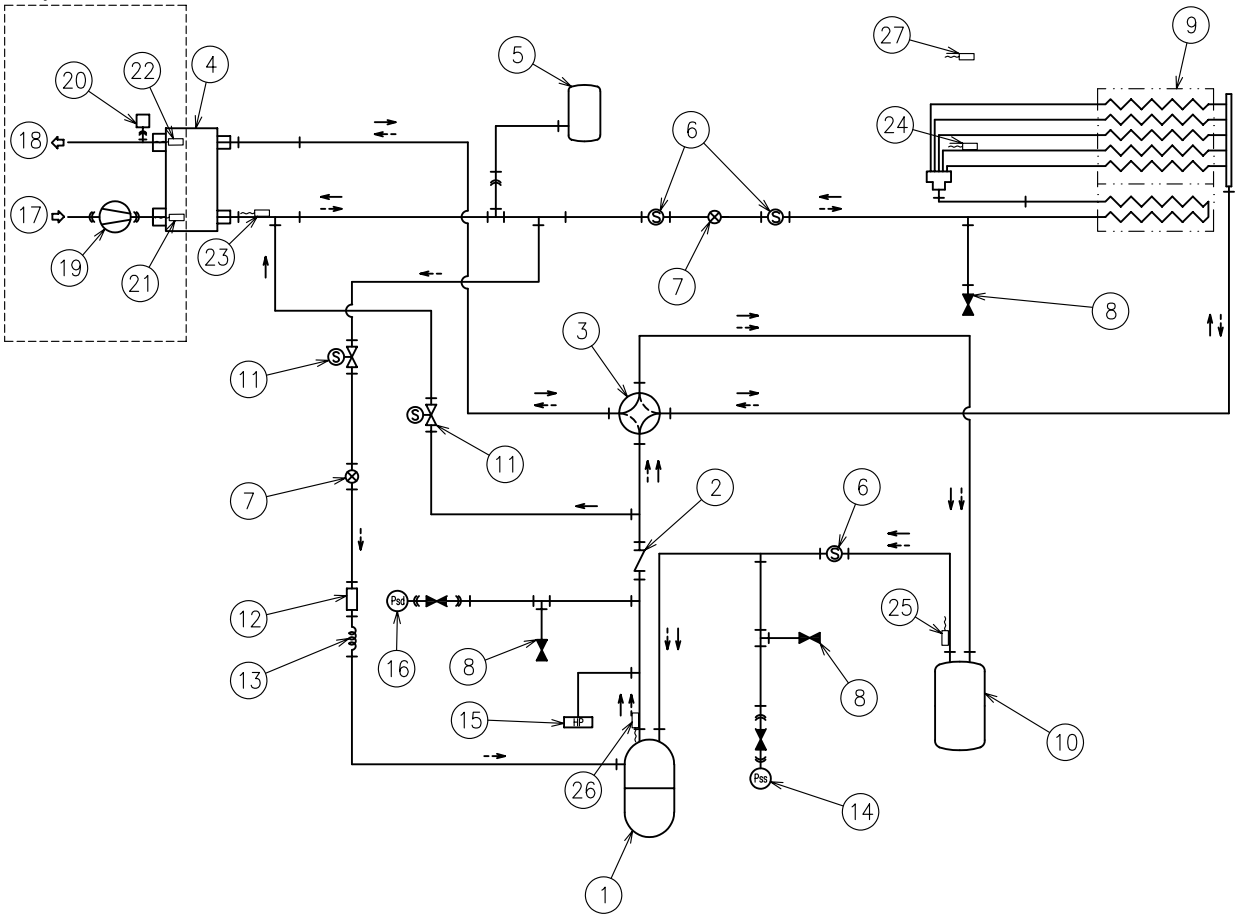
						Refrigerant:	Airtight test pressure 4.15 MPa
Defrost and Unit Starting	Heating Refrigerant Flow	Installation Refrigerant Piping Line	Flare Nut Connection	Flange Connection	Brazing Connection	R410A	

No.	Name of item
1	Compressor
2	Check Valve
3	4-way Valve
4	Water Side Heat Exchanger
5	Liquid Tank
6	Strainer
7	Electronic Expansion Valve
8	Stop Valve (Check Joint)
9	Air Side Heat Exchanger
10	Accumulator
11	Solenoid Valve
12	Silencer
13	Capillary Tube
14	Pressure Sensor (Low)

No.	Name of item
15	High Pressure Switch
16	Pressure Sensor (High)
17	Water Inlet
18	Water Outlet
19	Pump (accessory)
20	Air purge
21	Thermistor for water inlet
22	Thermistor for water outlet
23	Thermistor for evaporation in cooling
24	Thermistor for evaporation in heating
25	Suction gas thermistor
26	Discharge gas thermistor
27	Thermistor for outdoor temperature
28	Testing pipe

8.1.2 RHUE-(3-6)A(V)HN-HM

Hydraulic circuit



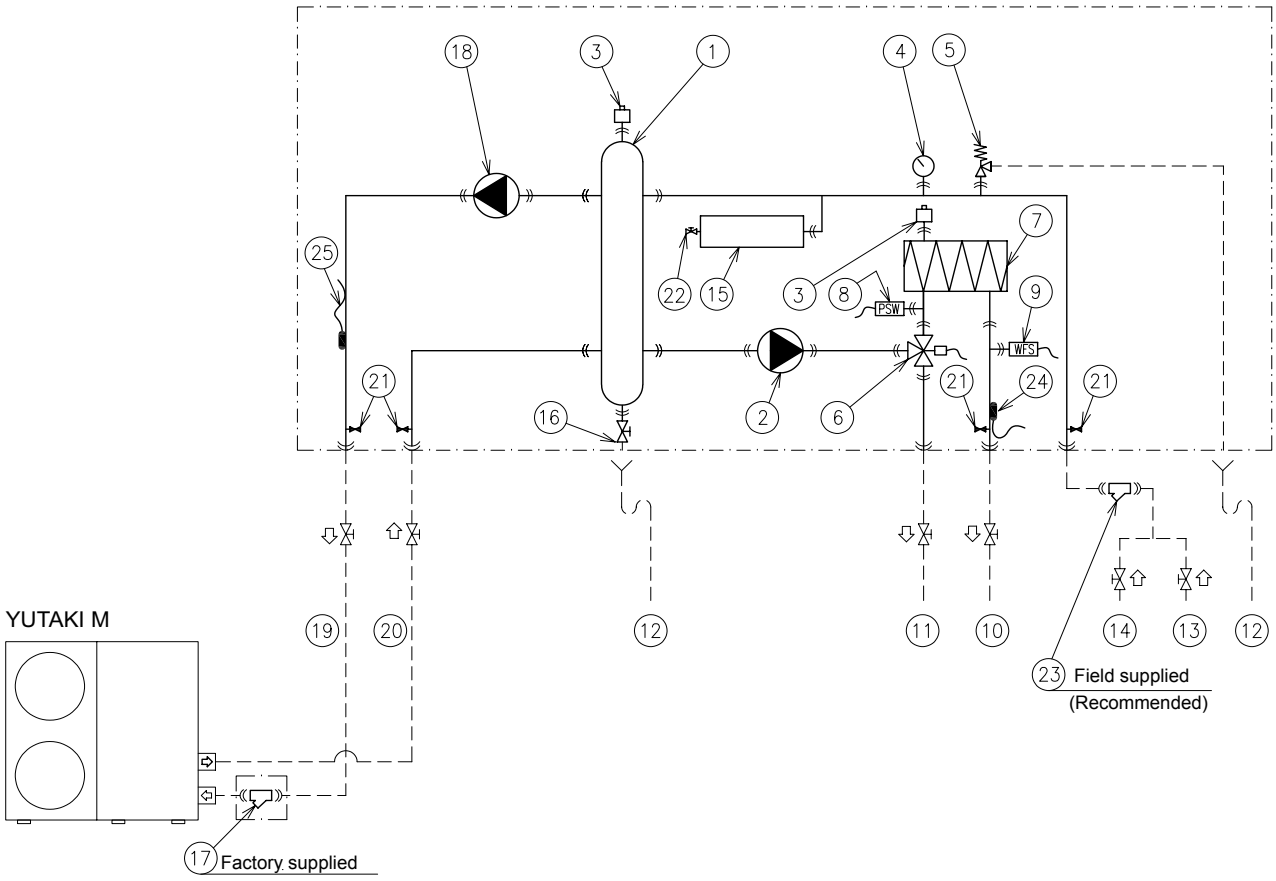
						Refrigerant:	Airtight test pressure 4.15 MPa
Defrost and Unit Starting	Heating Refrigerant Flow	Installation Refrigerant Piping Line	Flare Nut Connectiion	Flange Connection	Brazing Connection	R410A	

No.	Name of item
1	Compressor
2	Check Valve
3	4-Way Valve
4	Water Side Het Exchanger
5	Liquid Tank
6	Strainer
7	Electronic Expansion Valve
8	Stop Valve (Check Joint)
9	Air Side Heat Exchanger
10	Accumulator
11	Solenoid Valve
12	Silencer
13	Capilary Tube
14	Pressure Sensor (Low)

No.	Name of item
15	High Pressure Switch
16	Pressure Sensor (High)
17	Water Inlet
18	Water Outlet
19	Pump (accesory)
20	Air purge
21	Thermistor for water inlet
22	Thermistor for water outlet
23	Thermistor for evaporation in cooling
24	Thermistor for evaporation in heating
25	Suction gas thermistor
26	Discharge gas thermistor
27	Thermistor for outdoor temperature

8.2 Hydraulic Module accessory

8.2.1 RHM-EH01E

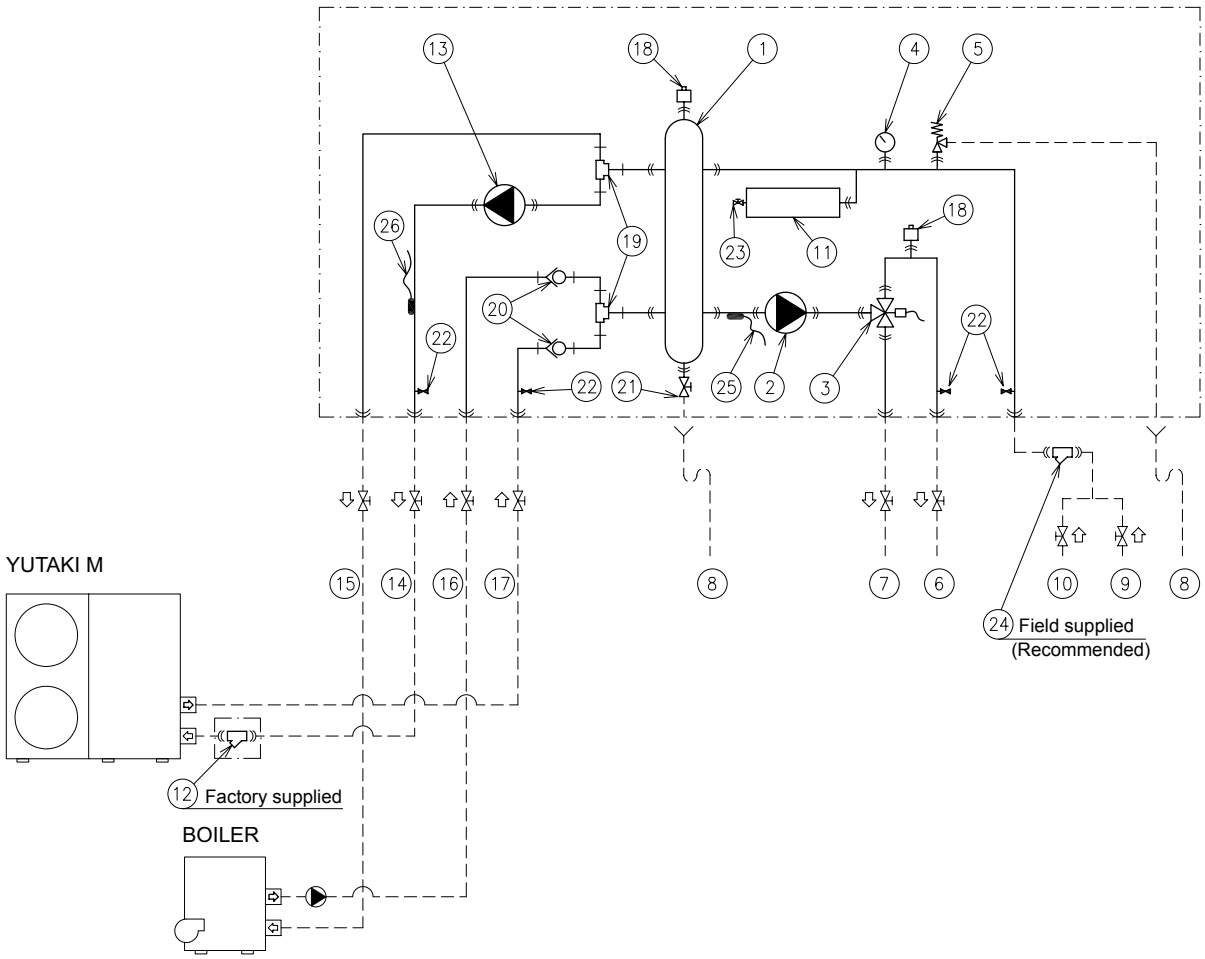


⇨	---	—)—	—|—
Water flow (Heating/Cooling)	Field supplied piping line	Flare nut connection	Brazed connection

No.	Name of item
1	Hydraulic separator
2	Pump 2 (Secondary circuit)
3	Air purger
4	Manometer
5	Safety valve
6	3-way valve
7	Electric heater
8	Water pressure switch
9	Flow switch
10	Water outlet (To space heating circuit)
11	Water outlet (To DHWT)
12	Draining
13	Water inlet (From space heating circuit)

No.	Name of item
14	Water inlet (From DHWT)
15	Expansion vessel
16	Drain valve
17	Water strainer
18	Pump 1 (Primary circuit)
19	Water outlet (To YUTAKI unit)
20	Water inlet (From YUTAKI unit)
21	Pressure port
22	Drain port
23	Water strainer
24	Water thermistor (TSUP)
25	Water thermistor (TRET)

8.2.2 RHM-BC01E



Water flow (Heating/Cooling)	Field supplied piping line	Flare nut connection	Brazed connection

No.	Name of item
1	Hydraulic separator
2	Pump 2 (Secondary circuit)
3	3-way valve
4	Manometer
5	Safety valve
6	Water outlet (To space heating circuit)
7	Water outlet (To DHWT)
8	Draining
9	Water inlet (From space heating circuit)
10	Water inlet (From DHWT)
11	Expansion vessel
12	Water strainer
13	Pump 1 (Primary circuit)

No.	Name of item
14	Water outlet (To YUTAKI unit)
15	Water outlet (To boiler)
16	Water inlet (From boiler)
17	Water inlet (From YUTAKI unit)
18	Air purger
19	T-joint
20	Check valves
21	Drain valve
22	Pressure port
23	Drain port
24	Water strainer
25	Water thermistor (TSUP)
26	Water thermistor (TRET)

9. Refrigerant and water piping

Index

9.1 Refrigerant charging quantity

YUTAKI M has been charged from factory.

⚠CAUTION

If charging refrigerant accurately measure refrigerant to be charged.

Overcharging or undercharging of refrigerant might cause compressor trouble.

O/U MODEL	Wo (Kg)
RHUE-3AVHN1 and RHUE-(3/4)AVHN-HM	2.6
RHUE-5A(V)HN-HM	3.4
RHUE-6A(V)HN-HM	4.2

NOTE

YUTAKI M is an appliance designed to be installed outdoor. Should it be covered by an enclosure, this shall be done according to the EN378 (KHK standard can also be considered as a reference), so that the refrigerant concentration be below 0.44 kg/m³ (i.e., provide a shutterless opening that will allow fresh air to flow into the enclosure).

9.2 Hydraulic circuit of YUTAKI M

9.2.1 Pressure drop

The following diagrams show the curves for the YUTAKI M unit (without pump).

This pressure drop it's calculated by the following formula:

$$PD = \alpha \, x \, Q^{\beta}$$

Where:

- *PD*: Pressure Drop (mca)
- *Q*: Water flow (m3/h)
- *α, β*: Parameters (see table)

Model	α	β
RHUE-3AVHN1	0.6075	1.7645
RHUE-(3/4)AVHN-HM	1.2006	1.9271
RHUE-5A(V)HN-HM	0.782	1.9334
RHUE-6A(V)HN-HM	0.2197	1.9339

Diagram for RHUE-3AVHN1

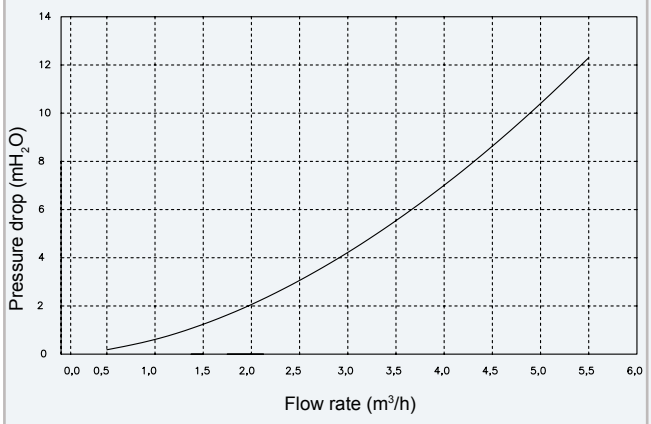


Diagram for RHUE-(3/4)AVHN-HM

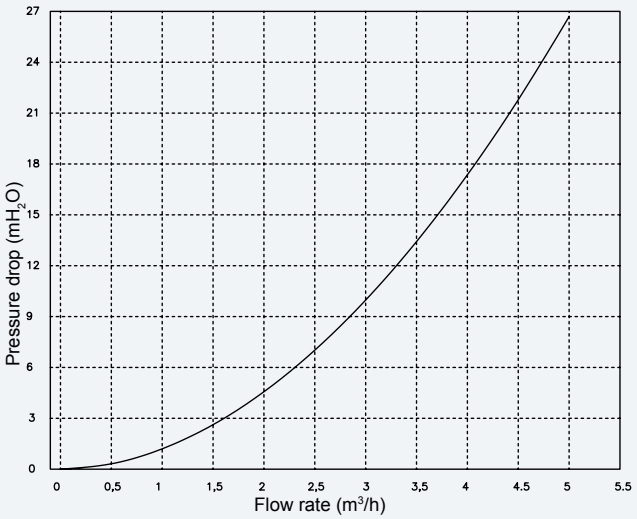


Diagram for RHUE-5A(V)HN-HM

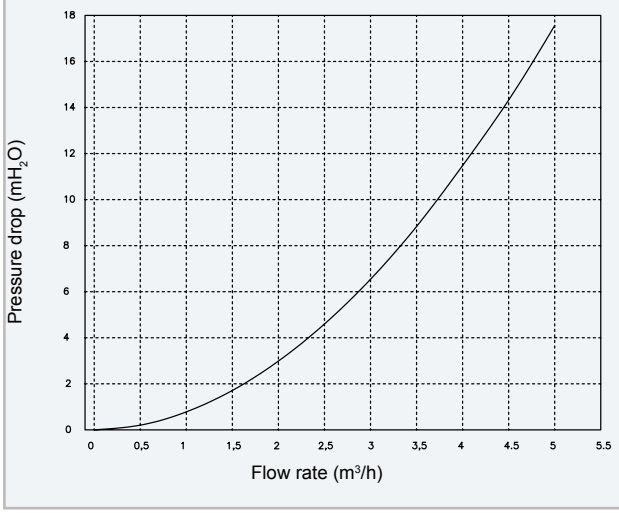
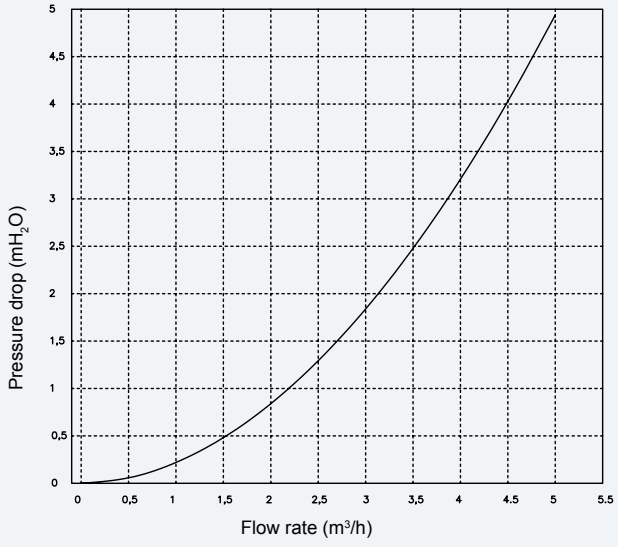


Diagram for RHUE-6A(V)HN-HM



9.2.2 Minimum water volume description

◆ Necessity of Water in System and Summary of Calculation

The following problems should occur when the quantity of water in the forced circulation system(1) on water side is insufficient.

- Compressor in operation repeats rough stops when light-loaded, which should result in shorter life or an accident.
- Low temperature in water circulation system at defrosting, which should cause an alarm (freeze protection).

NOTE

(1) The shaded part of the pipe system below.

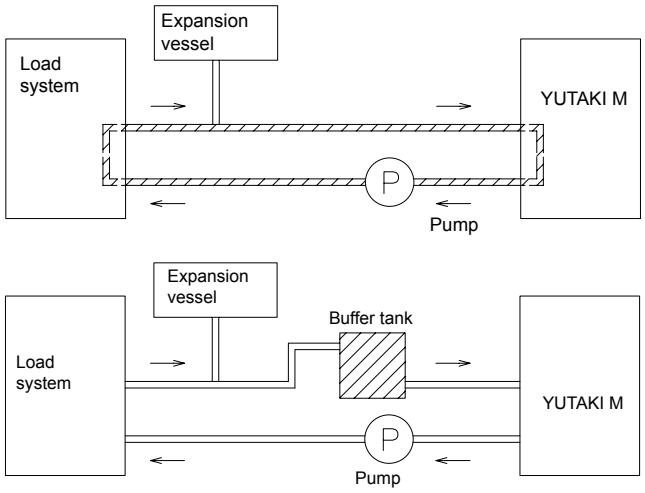
** Excluding the expansion tank (cistern)*

Calculate and ensure that the water volume in the system is equal or greater than the larger value obtained from:

1. “Protective Water Volume for Product“ and
2. “Minimum Water volume for Temperature Drop at Defrosting“, as shown to the right. Use a “buffer tank “ to supply water shortage as shown below(2), when the minimum water volume cannot be ensured.

NOTE

(2) Shortage = Minimum Water Volume – Water Volume in Circulation System



The following part shows how to calculate the minimum water volume in the system for product protection (anti-hunting) and temperature drop at defrosting.

1 Protective Water Volume for Product

Ensure that the water volume is equal or greater than those shown below, in order to lower ON/OFF frequency of YUTAKI M unit at no load or extreme light load. When water volume is less than the volume indicated (minimum water volume), compressor operation frequently stops at light load, which should result in shorter life or failure.

CAUTION

The factory default ON/OFF temperature differential is “4 °C”. Note that the minimum water volume varies for different setting for each purpose as shown in the next table:

(Unit: ltrs.)

	Model				
ON/OFF Temp. Differential	RHUE-3AVHN1	RHUE-3AVHN-HM	RHUE-4AVHN-HM	RHUE-5A(V)HN-HM	RHUE-6A(V)HN-HM
4ºC	28	28	38	46	56
3ºC	36	36	48	58	70
2ºC	50	50	65	80	96
1ºC	80	80	107	130	156

2 Minimum required water volume during defrosting

- The following formula is used to make the calculation:

Where:

$$V = \frac{360 \times Q_{DEF}}{\Delta T \times 4168.8} \; ; \; Q_{DEF} = Q_I + Q_Y$$

V = Required water volume (m^3):

The minimum volume of water needed in the installation to cover the heat loss caused by a reduction in the delivery water temperature during defrosting.

ΔT = Permissible water temperature drop (ºC):

Drop in the delivery water temperature that the client is willing to allow in the installation.

Q_{DEF} = Heat loss during defrosting (kW):

Heat loss caused in the system by reducing the delivery water temperature, which may affect the user's comfort level of warmth. This value is the sum of the two following items:

Q_I = Heat demand from the installation (kW):

While defrosting is taking place, the unit is not providing the heat required to cover the heat demand from the installation. This value can be obtained in 2 ways:

1. By using the value of the energy demand from the installation, if known.

2. If this value is not known, it can be estimated by using the heating capacity of the unit at an air temperature of 0ºC WB and a delivery water temperature at, for example, 45ºC.

Q_Y = Cooling load on the YUTAKI M unit (kW):

In addition to not providing the heat required to cover the heat demanded by the installation during defrosting, the unit is also producing cold. It can be estimated that this value is approximately 85% of the heating capacity on the unit under standard conditions (air temperature: 6/7ºC (WB/DB) and input/output temperature of the water: 40 / 45 ºC).

NOTE

- *The maximum time for defrosting considered is 10 minutes per hour.*
- *To obtain the capacity data, it's necessary refer to chapter 4.*

The following table shows the minimum water volume needed in each YUTAKI M unit in case of a permitted drop in temperature of 10ºC.

(Unit: l)

	Model				
Water temperature drop	RHUE-3AVHN1	RHUE-3AVHN-HM	RHUE-4AVHN-HM	RHUE-5A(V)HN-HM	RHUE-6A(V)HN-HM
5ºC	232	212	276	342	410
10ºC	116	106	138	171	205
15ºC	77	71	92	114	137
20ºC	58	53	69	86	103
25ºC	46	42	55	68	82

CAUTION

The values shown on the table are based on theoretical installation conditions. In addition, Yutaki M unit admits several hydraulic circuits configurations, and the value can be different depending on each specific installation.

Therefore, it rests with the client to recalculate these values depending on the real conditions of the installation.

9.2.3 Water control

⚠CAUTION

- *When industrial water is applied for chilled water and condenser water, industrial water it rarely causes deposits of scales or other foreign substances on the equipment. However, well water or river water should in most cases contain suspended solid matter, organic matter, and scales in great quantities. Therefore, such water should be subjected to filtration or to a softening treatment with chemicals before application as chilled water.*
- *It is also necessary to analyse the quality of water by checking pH, electrical conductivity, ammonia ion content, sulphur content, and others. Should the results of the analysis be not good, the use of industrial water would be recommended.*

The following is the recommended standard water quality.

Item	Chilled Water System		Tendency (1)	
	Circulating Water (20 C Less than)	Supply Water	Corrosion	Deposits of Scales
Standard Quality pH (25 °C)	6.8 ~ 8.0	6.8 ~ 8.0	●	●
Electrical Conductivity (mS/m) (25°C) {μS/cm} (25 °C) (2)	Less than 40 Less than 400	Less than 30 Less than 300	●	●
Chlorine Ion (mg Cl^-/l)	Less than 50	Less than 50	●	
Sulphur Acid Ion (mg SO_4^{2-}/l)	Less than 50	Less than 50	●	
The Amount of Acid Consumption (pH 4.8) (mg $CaCO_3$/l)	Less than 50	Less than 50		●
Total Hardness (mg $CaCO_3$/l)	Less than 70	Less than 70		●
Calcium Hardness (mg $CaCO_3$/l)	Less than 50	Less than 50		●
Silica L (mg SIO_2/l)	Less than 30	Less than 30		●
Reference Quality Total Iron (mg Fe/l)	Less than 1.0	Less than 0.3	●	●
Total Copper (mg Cu/l)	Less than 1.0	Less than 0.1	●	
Sulphur Ion (mg S^{2-}/l)	It shall not be detected.		●	
Ammonium Ion (mg NH_4^+/l)	Less than 1.0	Less than 0.1	●	
Remaining Chlorine (mg Cl/l)	Less than 0.3	Less than 0.3	●	
Floating Carbonic Acid (mg CO_2/l)	Less than 4.0	Less than 4.0	●	
Index of Stability	6.8 ~ 8.0	-	●	●

NOTE

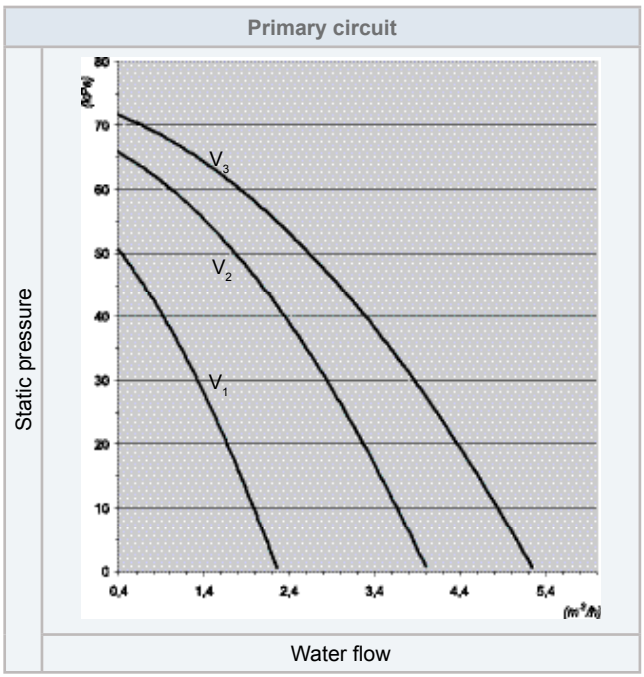
- *(1) The mark "●" in the table means the factor concerned with the tendency of corrosion or deposits of scales.*
- *(2) The value showed in "{}" are for reference only according to the former unit.*

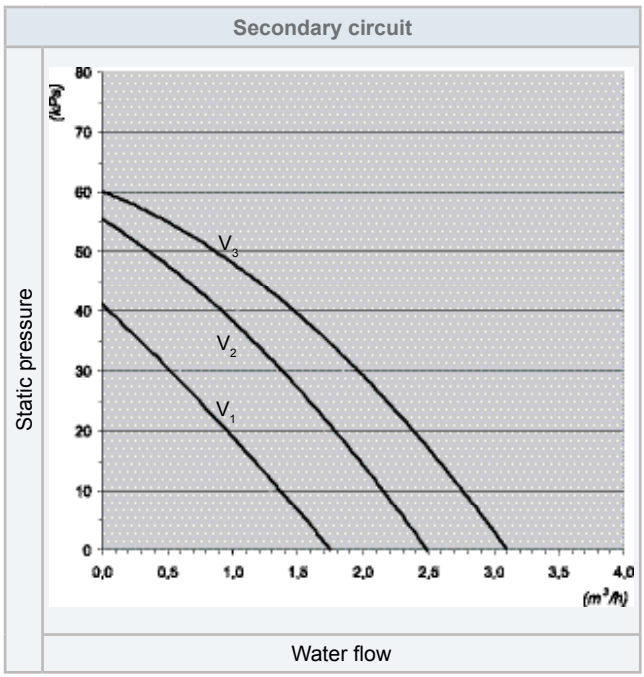
9.3 Hydraulic circuit of accessories

9.3.1 Hydraulic module

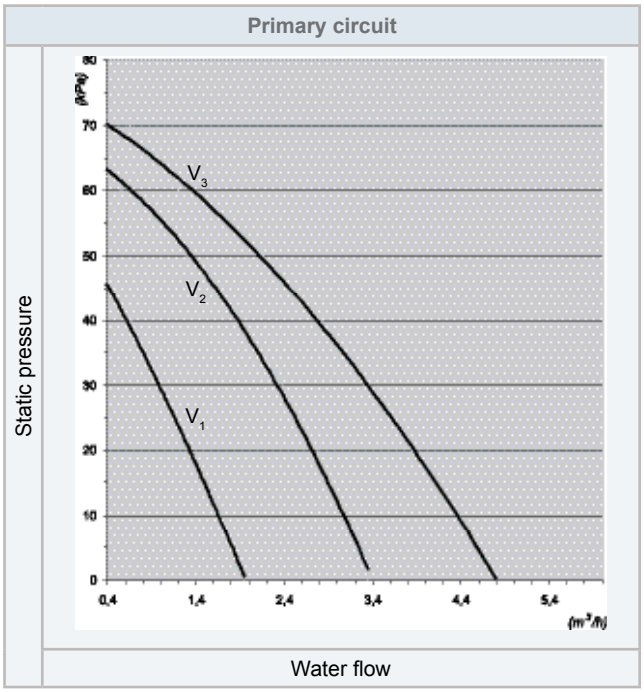
◆ **Pump performance curves (Only Hydraulic Module accessory)**

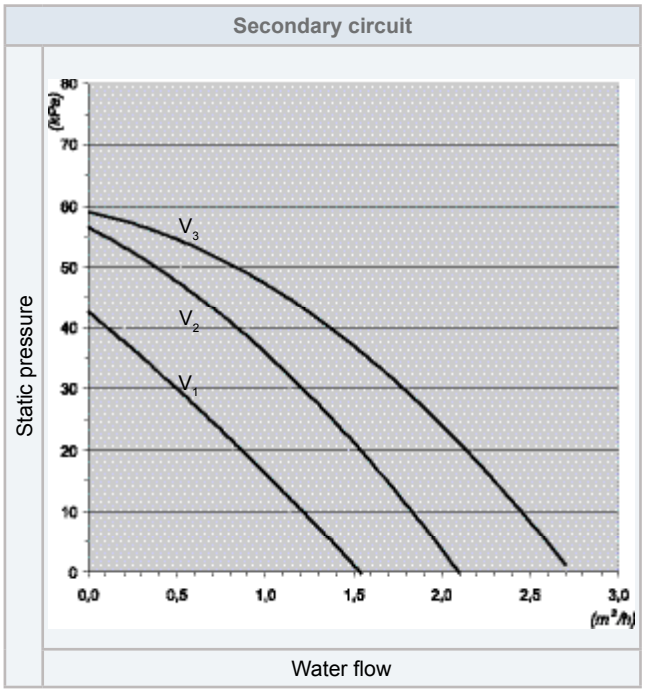
RHM-EH01E





RHM-BC01E





NOTE

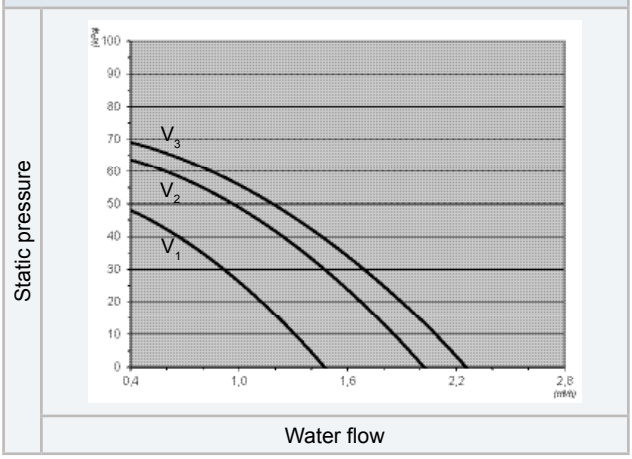
V: Pump motor speed (V_1: Low, V_2: Medium, V_3: High)

◆ Pump performance curves (YUTAKI M + Hydraulic Module accessory)

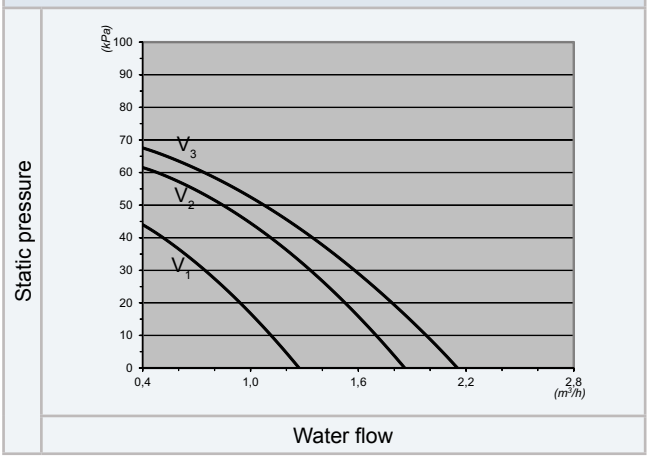
NOTE

- The following graphics show the available pump performance curves (primary circuit) when the Hydraulic Module is combined with the YUTAKI unit (internal plate heat exchanger pressure drop has been taken into account).
- V: Pump motor speed (V_1: Low, V_2: Medium, V_3: High)

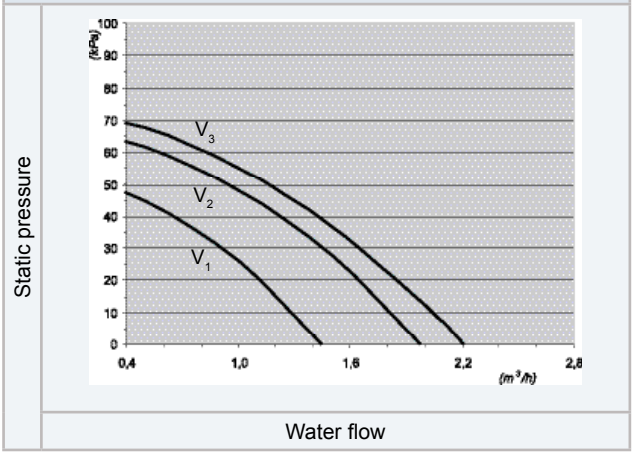
RHM-EH01E combined with RHUE-3AVHN1



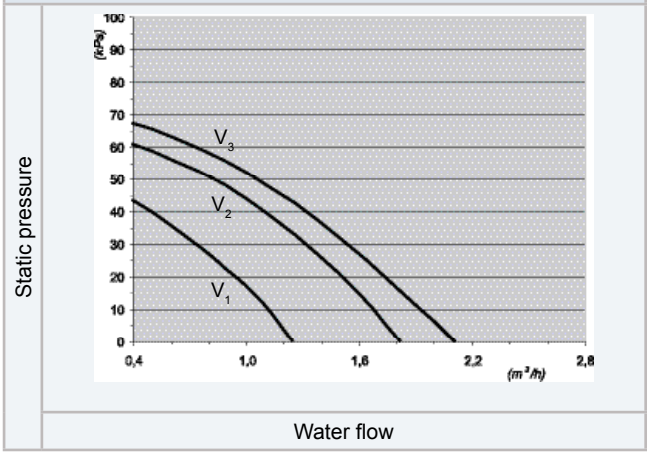
RHM-BC01E combined with RHUE-3AVHN1



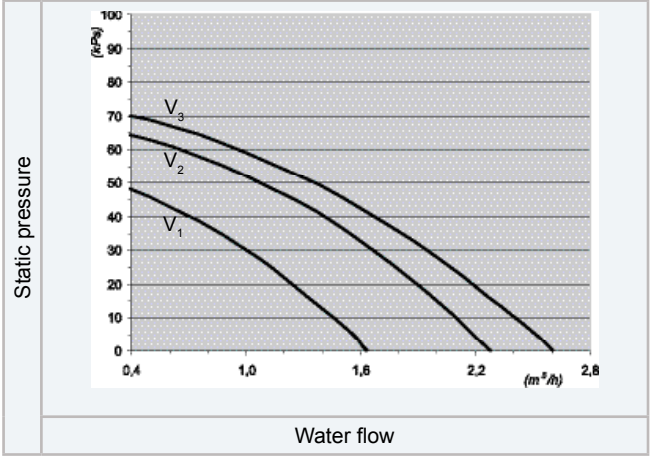
RHM-EH01E combined with RHUE-3AVHN-HM



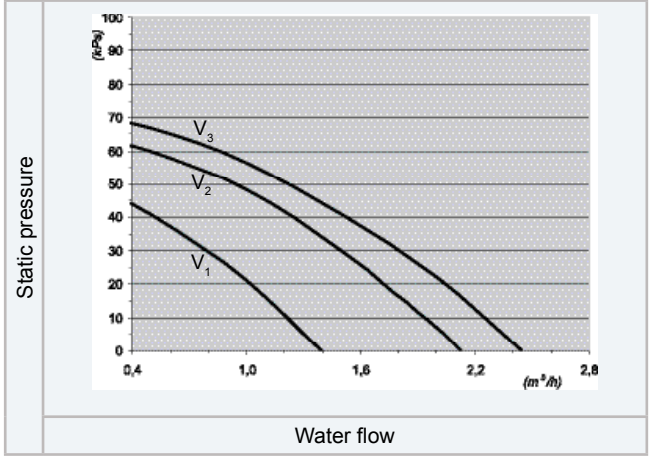
RHM-BC01E combined with RHUE-3AVHN-HM



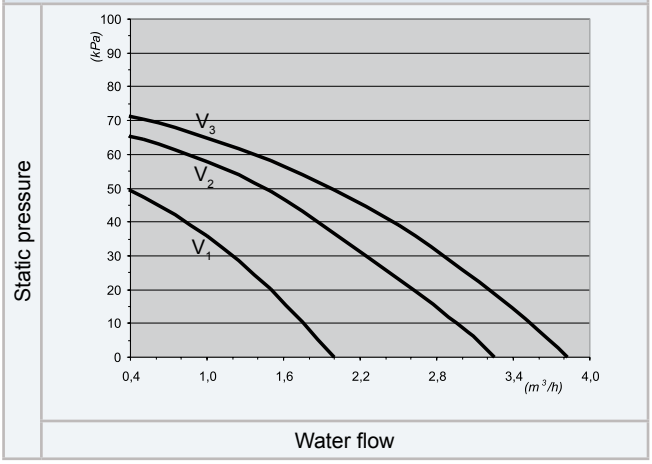
RHM-EH01E combined with RHUE-(4/5)A(V)HN-HM



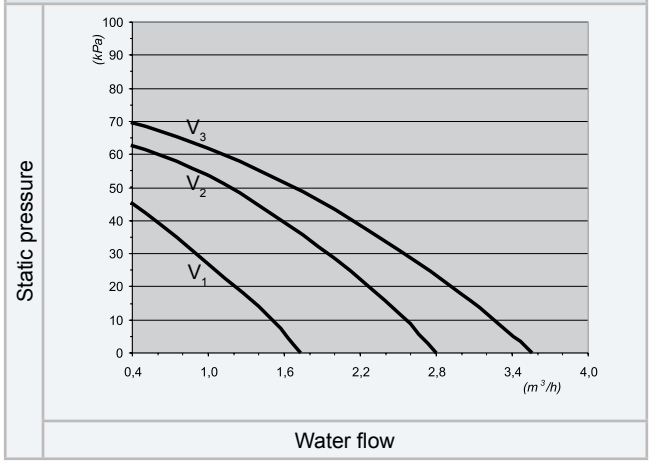
RHM-BC01E combined with RHUE-(4/5)A(V)HN-HM



RHM-EH01E combined with RHUE-6A(V)HN-HM



RHM-BC01E combined with RHUE-6A(V)HN-HM

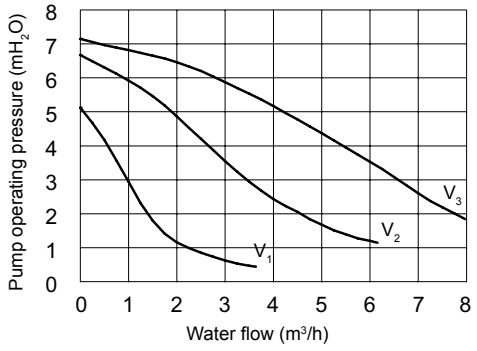


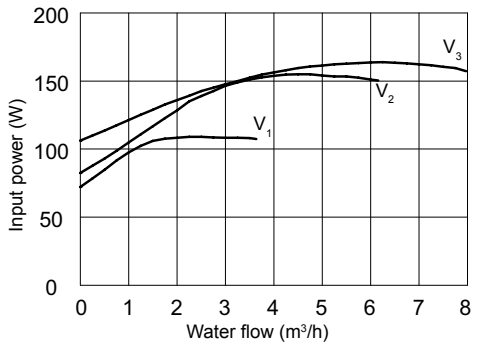
9.3.2 Pump kit

◆ ATW-PK(1/2/3)-01 (For RHUE-3AVHN1)

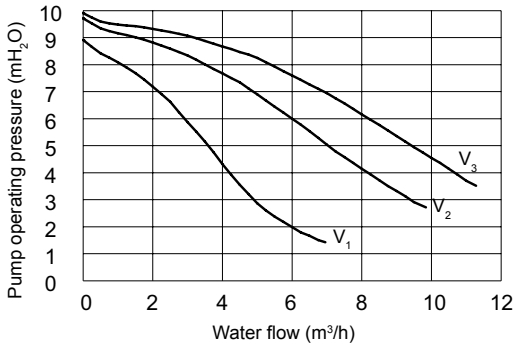
The followings diagrams show the operating curves for the circulating pumps:

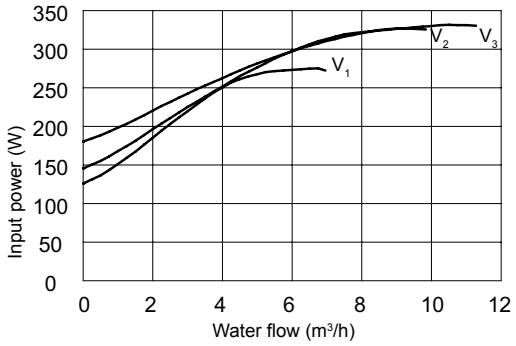
ATW-PK1-01



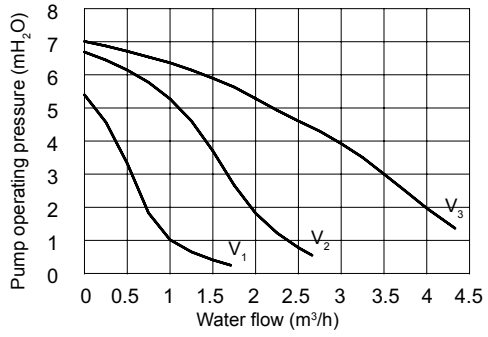


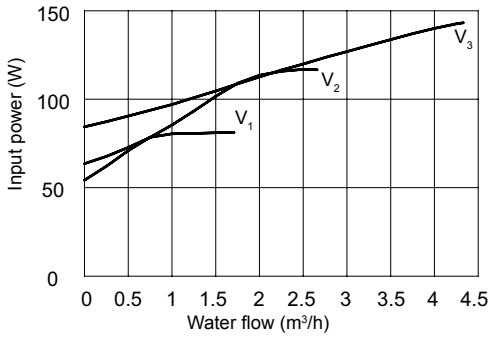
ATW-PK2-01





ATW-PK3-01



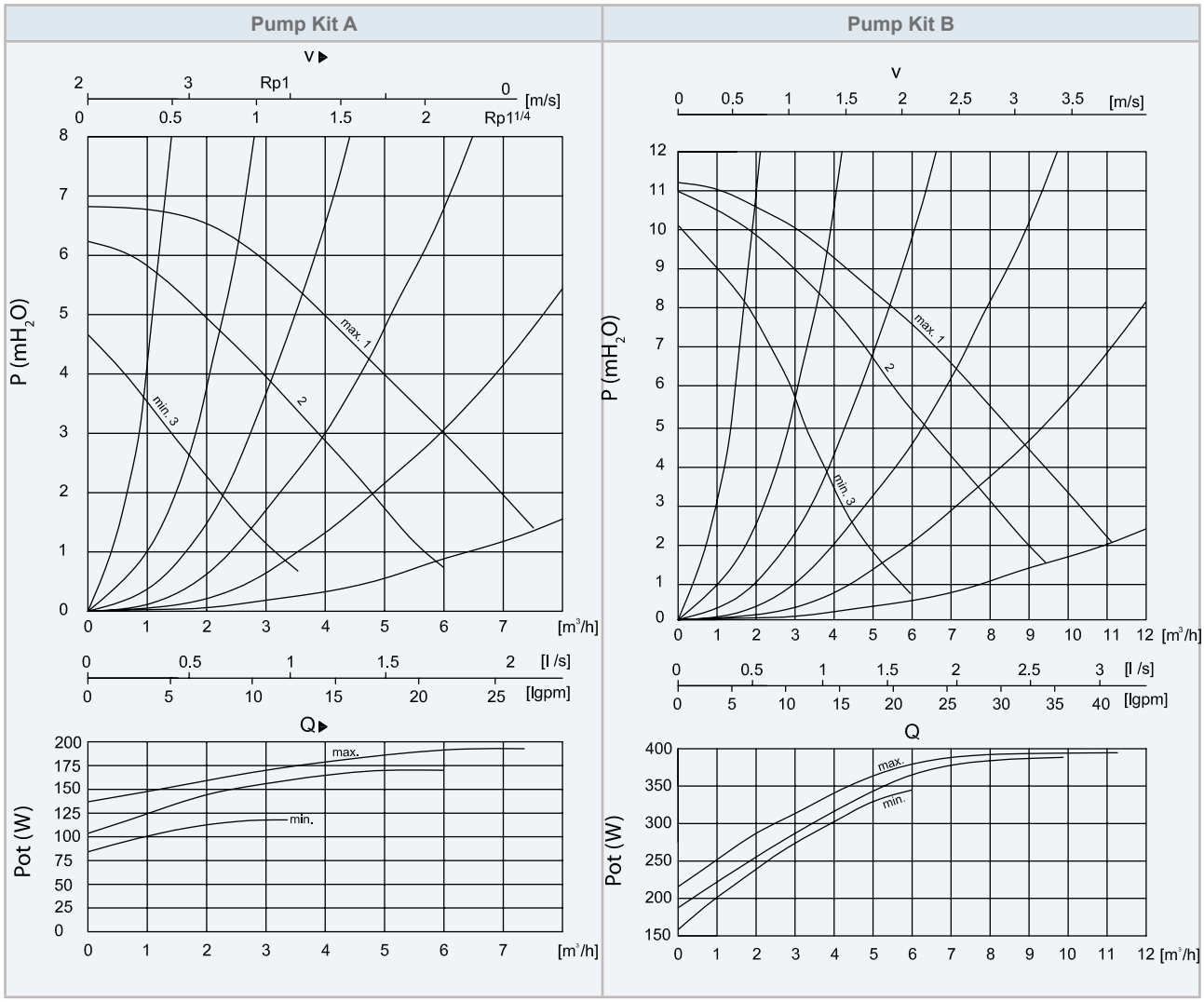


NOTE

V: Pump motor speed (V_1: Low, V_2: Medium, V_3: High)

Pump kit (A/B) (For RHUE-(3-6)A(V)HN-HM)

The followings diagrams show the operating curves for the circulating pumps:

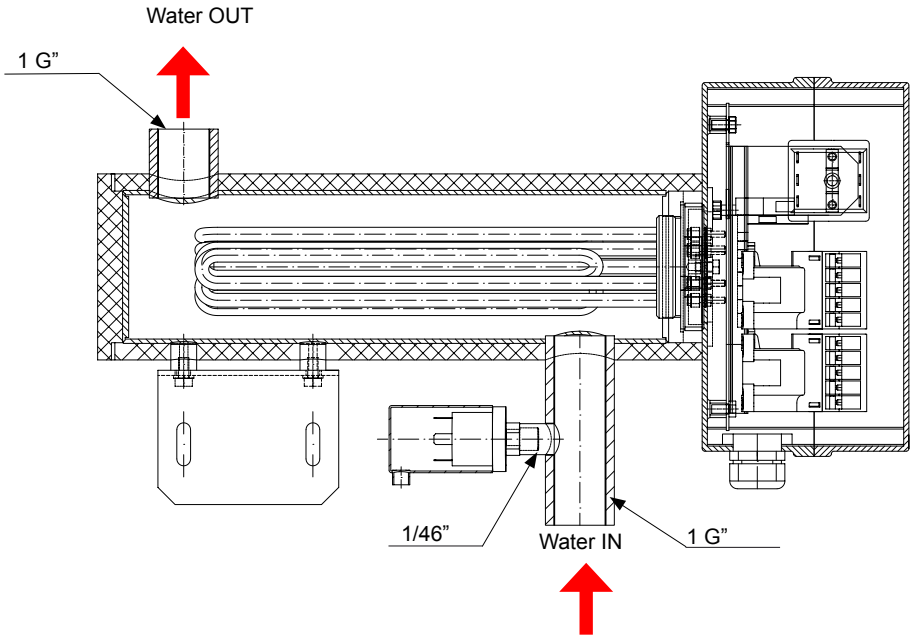


9.3.3 WEH - Water Electric Heater

◆ General notes

In a mono-energetic system (CONF 2), the electric heater is used if required to increase the supply water temperature:

- It must be kept the water flow direction indicated in the following drawing:



- A low water pressure switch (LPSW) needs to be connected in inlet pipe: 1/8’’ G
- Inlet and outlet connection pipes must be 1 G”

◆ Minim water volume description

The following problems should occur when the quantity of water in the forced circulation system (1) on water side is insufficient.

1 WEH frequently ON/OFF cycles affecting Yutaki performance.
2 Low temperature in water circulation system at defrosting, which should cause an alarm (freeze protection).
3 LWPS or Cut-Out thermostat activation due to low water pressure (< 1 bar) or due to excessive high water temperature inside WEH.

NOTE

Calculate and ensure that the water volume in the system is enough (see “9.2.2 Minimum water volume description”)

9.3.4 Domestic Hot Water Tank

◆ General Data

Technical specification			DHWT200E-2.5H1E	DHWT300E-2.5H1E	DHWT200S-2.5H1E	DHWT300S-2.5H1E
Tank Water Volume		l	200	300	200	300
Piping connections	Water Inlet domestic connection	inch	1” (male)		1” (male)	
	Water Outlet domestic connection	inch	1” (male)		1” (male)	
	Recirculation	inch	1” (male)		1” (male)	
	In Coil connection	inch	1” (female)		1” (female)	
	Out Coil connection	inch	1” (female)		1” (female)	

◆ General notes

When Piping connections are performed:

1. Connect all pipes as close as possible to the unit, so that disconnection can be easily performed when required.
2. It is recommended to use flexible joints for the piping of water inlet and outlet, so vibration will not be transmitted.
3. Whenever possible, sluice valves should be installed for water piping, in order to minimise flow resistance and to maintain sufficient water flow.
4. It is recommended to apply ball valves in both water pipe connections to make easier any maintenance work.
5. Proper inspection should be performed to check for leaking parts inside and outside the system, by completely opening the hot water inlet and outlet valves to the water condenser.
6. This DHWT must be fully air purged to avoid heating elements radiating the tank case without water.
7. Apply thermal insulation on the hydraulic system pipes in order to avoid accidental injure due to excessive heat on piping surfaces and also to avoid heat losses.
8. When the unit is stopped during shutdown periods and the ambient temperature is very low, it is possible that the water in the pipes and in the circulating pump freeze, thus damaging the pipes and the water pump. In order to prevent this, during shutdown periods it is useful to empty the water from the installation.

NOTE

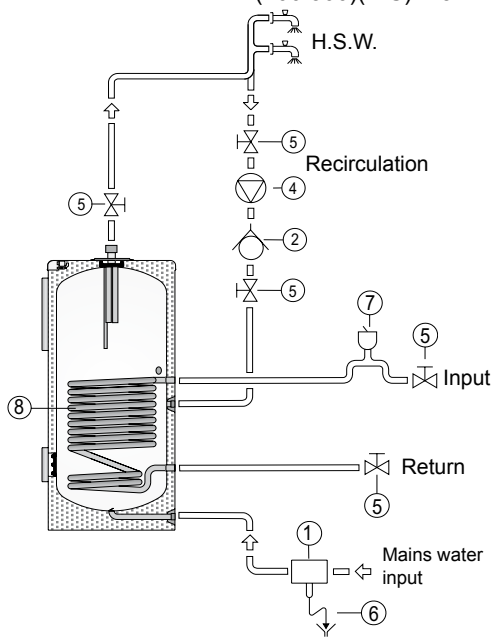
Check periodically:

- *Water flow and pressure*
- *Water leakage's*
- *Fixing points tightening*

CAUTION

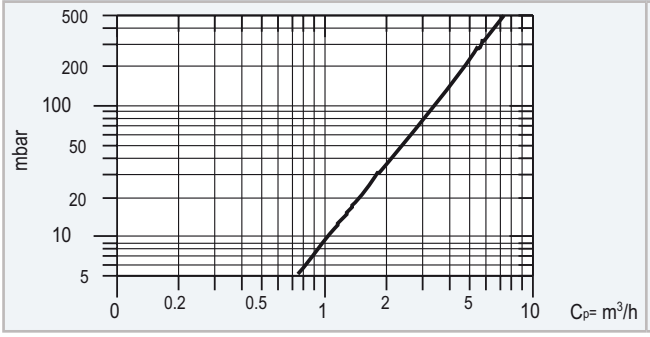
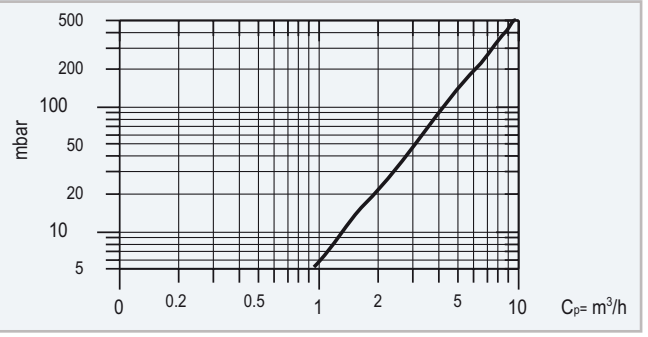
Inlet and outlet connection pipes must be 1G"
It must be kept the water flow direction indicated in previous drawing.

DHWT(200/300)(E/S)-2.5H1E



1	Sanitary safety valve unit
2	Non-return valve
3	Circulator
4	Recirculation pump
5	Shutoff cock
6	Drain
7	Drain valve
8	Heating coil

◆ Pressure drops

DHWT(200/300)E-2.5H1E	DHWT(200/300)S-2.5H1E
	

10. Electrical and control settings

Index

10.1 General check

- Make sure that the following conditions related to power supply installation are satisfied:
  - The power capacity of the electrical installation is large enough to support the power demand of the YUTAKI M system.
  - The power supply voltage is within ±10% of the rated voltage.
  - The impedance of the power supply line is low enough to avoid any voltage drop of more than 15% of the rated voltage.
- Following the Council Directive 2004/108/EC, relating to electromagnetic compatibility, the table below indicates the Maximum permitted system impedance Zmax at the interface point of the user's supply, in accordance with EN61000-3-11.

MODEL	Zmax (Ω)
RHUE-3AVHN1	0.34
RHUE-3AVHN-HM	0.41
RHUE-4AVHN-HM	0.41
RHUE-5AVHN-HM	0.29
RHUE-6AVHN-HM	0.26
RHUE-5AHN-HM	-
RHUE-6AHN-HM	-

NOTE

In case of outdoor unit three phases connection, Z_{max} is not considered.

- The status of Harmonics for each model, regarding compliance with IEC 61000-3-2 and IEC 61000-3-12, is as follows:

Status regarding compliance with IEC 61000-3-2 and IEC 61000-3-12	Models
Equipment complying with IEC 61000-3-12	RHUE-3AVHN1 RHUE-3AVHN-HM RHUE-4AVHN-HM RHUE-5AVHN-HM RHUE-6AVHN-HM
Equipment complying with IEC 61000-3-2 (professional use only)	RHUE-5AHN-HM RHUE-6AHN-HM

- Check to ensure that the field supplied electrical components (mains power switches, circuit breakers, wires, connectors and wire terminals) have been properly selected according to the electrical data indicated on this chapter and they comply with national and local codes. If it is necessary, contact with your local authority in regards to standards, rules, regulations, etc.
- Use wires which are not lighter than the polychloroprene sheathed flexible cord (code designation 60245 IEC 57).
- Ensure specifically that there is an Earth Leakage Breaker (ELB) installed for the system.
- If the installation is already equipped with an Earth Leakage Breaker (ELB), ensure that its rated current is large enough to hold the current of the units (indoor, outdoor and the optional DHW tank).

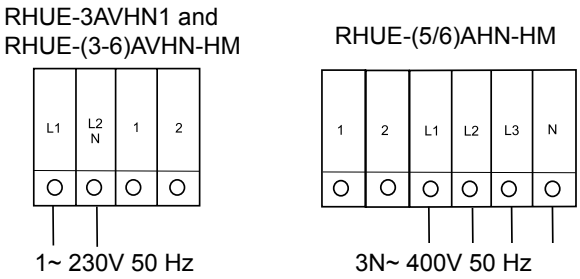
NOTE

- *Electric fuses can be used instead of magnetic Circuit Breakers (CB). In that case, select fuses with similar rated values as the CB.*
- *The Earth Leakage Breaker (ELB) mentioned on this manual is also commonly known as Residual Current Device (RCD) or Residual Current Circuit Breaker (RCCB).*
- *The Circuit Breakers (CB) are also known as Thermal-Magnetic Circuit Breakers or just Magnetic Circuit Breakers (MCB).*

10.2 YUTAKI M unit

10.2.1 System wiring diagram

Connect the YUTAKI M unit according to the following figure:



10.2.2 Electrical connection

◆ Wiring size

Model	Power supply	Max. current (A)	Power supply cables	Transmission cables
			EN60335-1	EN60335-1
RHUE-3AVHN1	1~ 230V 50Hz	21.8 (*)(18.5)	2 x 4.0 mm² + GND	2 x 0.75 mm²
RHUE-3AVHN-HM		21.0 (*)(18.0)	2 x 4.0 mm² + GND	
RHUE-4AVHN-HM		21.0 (*)(18.0)	2 x 4.0 mm² + GND	
RHUE-5AVHN-HM		29.0 (*)(26.0)	2 x 6.0 mm² + GND	
RHUE-6AVHN-HM		32.0 (*)(29.0)	2 x 6.0 mm² + GND	
RHUE-5AHN-HM	3N~ 400V 50 Hz	14.0 (*)(11.0)	4 x 2.5 mm² + GND	
RHUE-6AHN-HM		18.0 (*)(15.0)	4 x 4.0 mm² + GND	

◆ Minimum requirements of the protection devices

Model	Power supply	Applicable voltage		MC (A)	CB (A)	ELB (no. of poles/A/mA)
		U max. (V)	U min. (V)			
RHUE-3AVHN1	1~ 230V 50Hz	253	207	21.8 (*)(18.5)	32	2/40/30
RHUE-3AVHN-HM				21.0 (*)(18.0)	32	
RHUE-4AVHN-HM				21.0 (*)(18.0)	32	
RHUE-5AVHN-HM				29.0 (*)(26.0)	32	
RHUE-6AVHN-HM				32.0 (*)(29.0)	32	4/40/30
RHUE-5AHN-HM	3N~ 400V 50 Hz	440	360	14.0 (*)(11.0)	20	
RHUE-6AHN-HM				18.0 (*)(15.0)	20	
MC: Maximum current; CB: Circuit breaker; ELB: Earth leakage breaker						

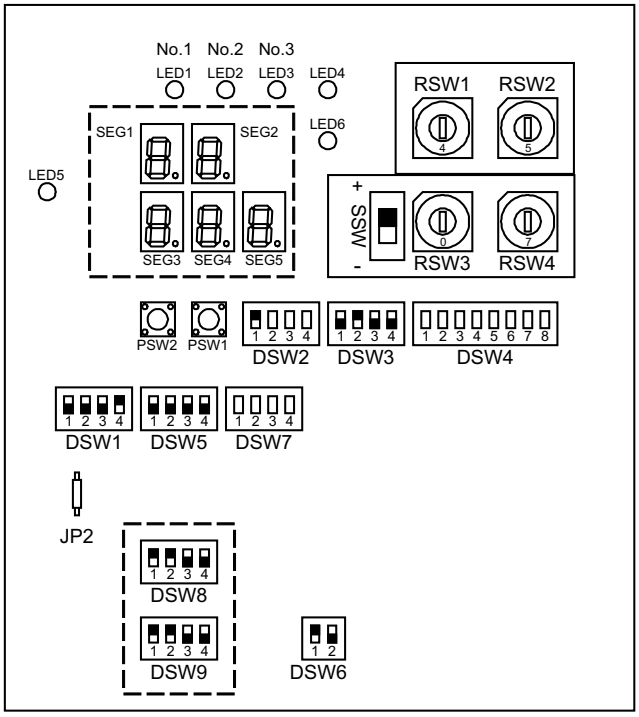
NOTE

(*): Values without connected pump.

10.2.3 Setting of DIP switches and RSW switches

◆ Location of DIP switches and RSW switches

The PCB in the outdoor unit is operated with different dip switches, rotary switches and push switches.



RSW1 & RSW2	Heating Setting Temperature
RSW3 & RSW4	Not used
SSW	Up = “+ Temp.” / Down = “-Temp.”
DSW1	Optional Functions
DSW2	Unit Control Configuration / Unit HP
DSW3	Unit Control Configuration
DSW4	Unit Model Configuration
DSW5	H-Link Available / H-Link Address
DSW6	End Resistance / Fuse Recovery
DSW7	Unit Control Configuration
DSW8	Setting Pd Pressure Sensor Type
DSW9	Setting Ps Pressure Sensor Type
LED1,2 & 3	Power Supply Indication
LED4	Operation Status Indication
LED5	Alarm Indication
LED6	Setting Mode Indication
JP2	Cut: Re-Start after Power Failure

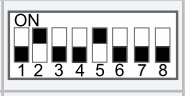
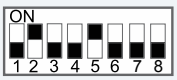
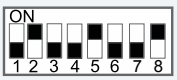
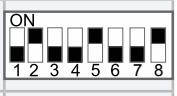
◆ Function of the of DIP switches and RSW switches

NOTE

- *The mark "■" indicates the position of dips switches.*
- *No mark "■" indicates pin position is not affecting.*
- *The figures show the settings before shipment or after selection.*

CAUTION

Before setting dips switches, first turn the power source off and then set the position of the dips switches. In case of setting the switches without turning the power source off, the contents of the setting are invalid.

DSW	RHUE-3 AVHN1	RHUE-3 AVHN-HM	RHUE-4 AVHN-HM	RHUE-5 AVHN-HM	RHUE-6 AVHN-HM	RHUE-5 AHN-HM	RHUE-6 AHN-HM
DSW1							
DSW2							
DSW3							
DSW4							
DSW5							
DSW6							
DSW7							

DSW8 = DSW9 (For all units)	

◆ Jumpers

Jumper lead setting (JP2): Automatic restart after power failure

Keep the same status as before. Setting before shipment:

JP2
1

0 = Open; 1 = Short circuit

The function selection using the jumper lead setting is shown in the table below.

Setting	Function	Details
0	Enable	If this function is 'Enable', in case of power failure the unit will restart automatically once the power is recovered
1	Disable	

◆ LED indication

LED1, LED2 and LED3: Power supply indication

Status	LED1	LED2	LED3
Power supply ON	ON	OFF	OFF
Power supply OFF	OFF	OFF	OFF
		Not available	

LED4: Operation status indication

Status	LED4
Unit stopped	OFF
Unit running	ON
Alarm	OFF

LED5: Alarm indication

Status	LED5
Normal	OFF
Alarm	ON

LED6: Setting mode indication

Status	LED6
Setting mode disable	OFF
Setting mode enable (DSW1#3: ON)	ON

10.3 Accessories

10.3.1 Advanced system controller

◆ General notes

CAUTION

- *Disconnect the mains power supply before installing the System Controller.*
- *Do not reconnect the mains power supply until you have completed the installation.*
- *The System Controller must be installed by a suitably qualified person, in accordance with local standards and guidelines.*

For safety reasons the wiring of the mains and the low voltage wires are separated and in different compartments of the mounting base.

- On the top side the low voltage wiring is laid out (inputs, mainly sensors).
- On the bottom side the mains and the earth wiring is situated (power and output relay contacts).

NOTE

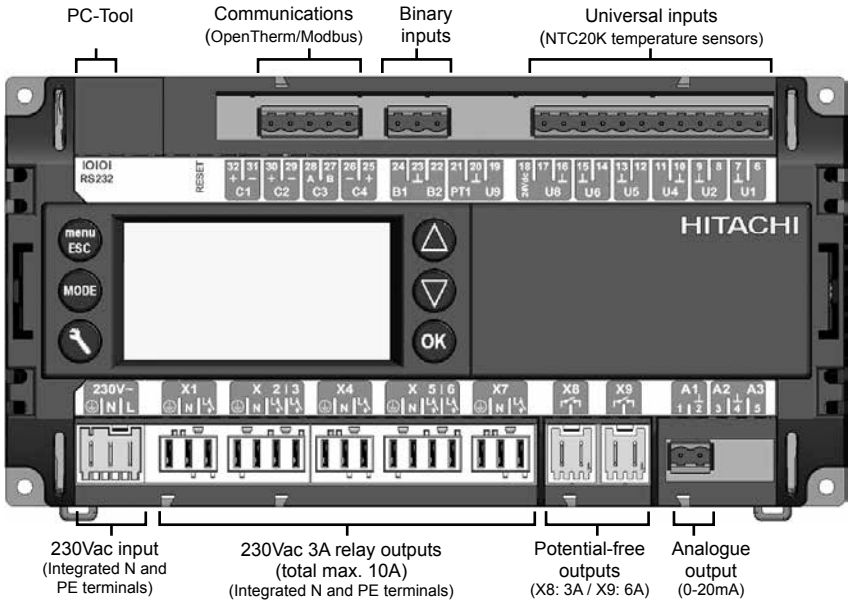
It is important that power supply lines are kept separate from signal / data communications lines. This is to minimise the risk of electrical interference.

◆ Wiring connections location

CAUTION

- *The electronic components within the System Controller are susceptible to damage from static electricity. Therefore, appropriate measures must be taken when handling the device.*
  - *Do not touch the internal components.*
  - *Touch an earthed piece of metal to discharge static electricity from your body.*
- *A short circuit or incorrect installation will damage the System Controller.*

Separate push-on terminal blocks are supplied for connection to the System Controller. These are labelled with the ID of each connection and can be wired prior to pushing onto the appropriate location on the System Controller.



◆ Summary of wiring connections

The water temperature sensors can be inserted into suitable immersion wells or strapped on to a pipe using the supplied metal clip.

Mains input and control wiring connections

ID	Description	Type & rating	CONF 1.1	CONF 1.2	CONF 2.1	CONF 2.2	CONF 3.1	CONF 3.2	CONF 4.1
230V~	Mains power	230V~ input	●	●	●	●	●	●	●
X1	HC1 Pump	230V~ Relay with N & E, 3A	●	●	●	●	●	●	●
X2:X3	HC1 Mixing Valve	230V~ 2 x Relay with N & E, 3A	–	●	–	●	●	●	●
X4	HC2 Pump	230V~ Relay with N & E, 3A	–	●	–	●	●	●	●
X5:X6	HC2 Mixing Valve	230V~ 2 x Relay with N & E, 3A	–	●	–	–	–	●	–
X5	Electric Heater stage 1	230V~ Relay with N & E	–	–	●	●	–	–	–
X6	Electric Heater stage 2	230V~ Relay with N & E	–	–	●	●	–	–	–
X5:X6	Bypass / Mixing Valve	230V~ 2 x Relay with N & E, 3A	–	–	–	–	–	–	●
X7	DHW Pump	230V~ Relay with N & E	–	●	–	●	●	●	●
X7	DHW Valve	230V~ Relay with N & E	●	–	●	–	–	–	–
X8	Heat Pump	230V~ Potential-free 3A, min 5Vdc	●	●	●	●	●	●	●
X9	DHW Electric Heater	230V~ Potential-free 6A, min 5Vdc	●	●	●	●	–	–	–
X9	Boiler	230V~ Potential-free 6A, min 5Vdc	–	–	–	–	●	●	●
X5	Boiler Pump	230V~ Relay with N & E, 3A	–	–	–	–	●	–	–
A1	Heat Pump Control	0-20mA	●	●	●	●	●	●	●

Communications and input wiring connections

ID	Description	Type & rating	CONF 1.1	CONF 1.2	CONF 2.1	CONF 2.2	CONF 3.1	CONF 3.2	CONF 4.1
C2	RF Receiver	OpenTherm 2-wire (polarity-free)	●	●	●	●	●	●	●
C3	Yutaki communication	RS485 Modbus (polarity-sensitive)	●	●	●	●	●	●	●
B1	Blocking/Tariff Input	Potential-free contact (24Vdc, 1mA)	●	●	●	●	●	●	●
B2	DHW Boost Input	Potential-free contact (24Vdc, 1mA)	●	●	●	●	●	●	●
U1	System Supply Sensor	NTC 20k @ 25ºC	●	●	●	●	●	●	●
U2	HC1 Supply Sensor	NTC 20k @ 25ºC	–	●	–	●	●	●	●
U4	HC2 Supply Sensor	NTC 20k @ 25ºC	–	●	–	–	–	●	–
U5	DHW Sensor	NTC 20k @ 25ºC	●	●	●	●	●	●	●
U6	Boiler Sensor	NTC 20k @ 25ºC	–	–	–	–	–	–	●
U8	Outside Sensor	NTC 20k @ 25ºC (Optional)	○	○	○	○	○	○	○

NOTE

- *Connections X1 to X7 have integrated Neutral and protective Earth terminals.*
- *Connections X8 and X9 are potential free.*
- *Connection A1 is 0-20mA.*
- *Maximum combined load of all relays 1-7 is 10A.*
- *Connection C2 is OpenTherm*
- *Connection C3 is Modbus*
- *Connection U8 is optional - if not connected, the outside temperature measured by the Outside Unit is used.*
- ***For the detailed information about the different installation configurations, refer to the chapter "11. System settings and control system". For the detailed description of terminal connections, refer to the Service Manual.***

◆ Minimum requirements of the protection devices

Model	Power supply	Applicable voltage		MC (A)	CB (A)	ELB (no. of poles/A/mA)
		U min. (V)	U max. (V)			
ATW-CPA-02	1~ 230V 50Hz	207	253	5.0	6	2/40/30

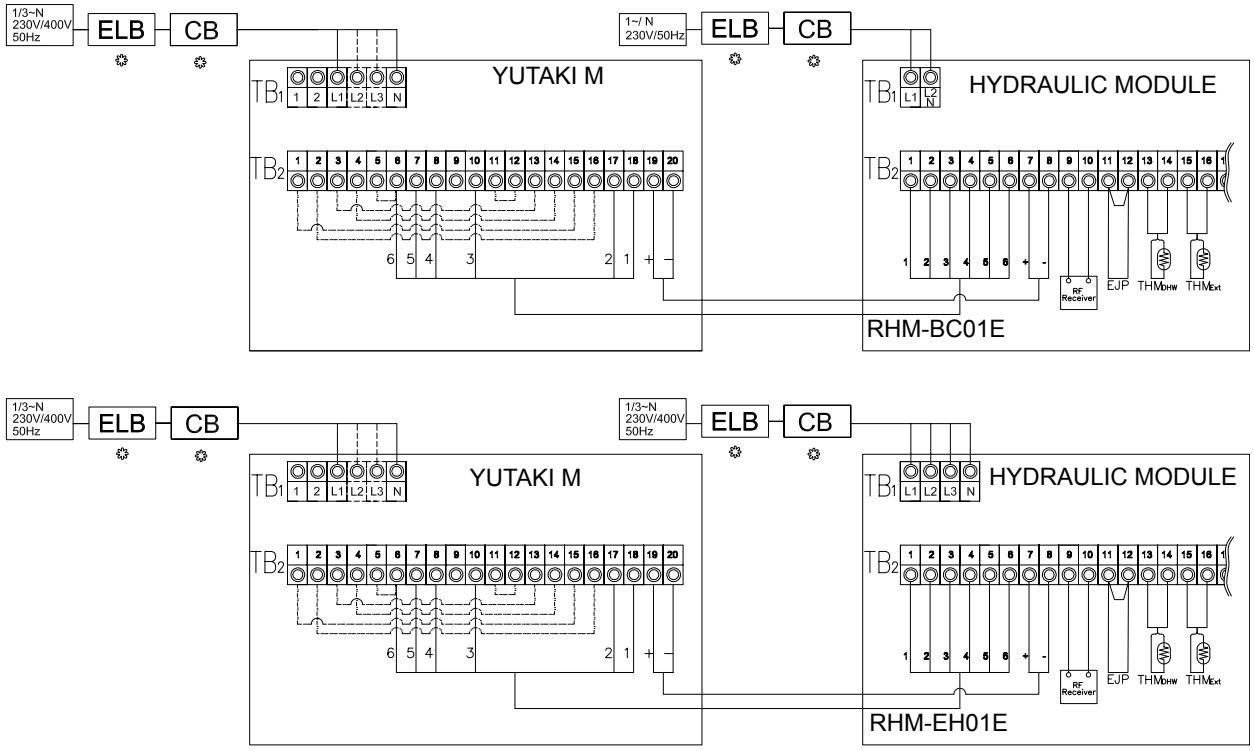
10.3.2 Hydraulic module

◆ System wiring diagram

- Connect the units (YUTAKI and Hydraulic module) according to the following electrical diagram.
- Follow the local codes and regulations when performing the electrical wiring.
- Use wires (more than 0.75 mm²) for operation wiring between Hydraulic Module and Yutaki M unit.
- The System Controller controls the heat pump outlet water temperature by a 4-20mA signal. When there is no demand for the heat pump to be on, the System Controller directly switches the heat pump off. The heat pump can signal to the System Controller when it has a fault so that a fault code can be displayed and appropriate action taken.

⚠ DANGER

- ***The 4-20mA signal is polarity-sensitive. You must connect the wires as shown.***
- ***Be sure to use a dedicated power circuit for the Hydraulic Module. Never use a power circuit shared by another appliance (Yutaki M unit).***



TB	Terminal board
CB	Circuit breaker
ELB	Earthleakage breaker

- - -	Internal wiring
——	Field wiring
⚙	Field-supplied

10

◆ Electrical connection

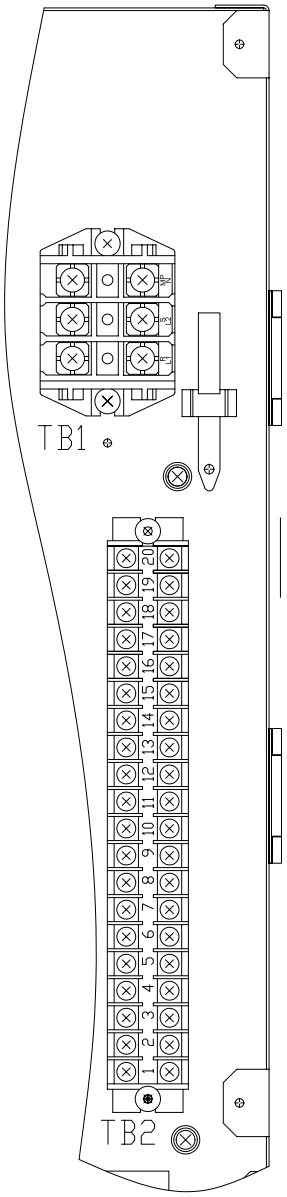
Wiring size

Model	Power supply	Max. current (A)	Power supply cables
			EN60335-1
RHM-EH01E	1~ 230V 50Hz	32.0	2 x 4.0 mm² + GND
	3N~ 400V 50 Hz	15.0	2 x 4.0 mm² + GND
RHM-BC01E	1~ 230V 50Hz	5.0	2 x 0.75 mm² + GND

Minimum requirements of the protection devices

Model	Power supply	Applicable voltage		MC (A)	CB (A)	ELB (no. of poles/A/mA)
		U max. (V)	U min. (V)			
RHM-EH01E	1~ 230V 50Hz	253	207	32.0	32	2/40/30
	3N~ 400V 50 Hz	440	360	15.0	15	4/40/30
RHM-BC01E	1~ 230V 50Hz	253	207	5.0	6	2/40/30
MC: Maximum current; CB: Circuit breaker; ELB: Earth leakage breaker						

◆ Summary of the terminal board connections



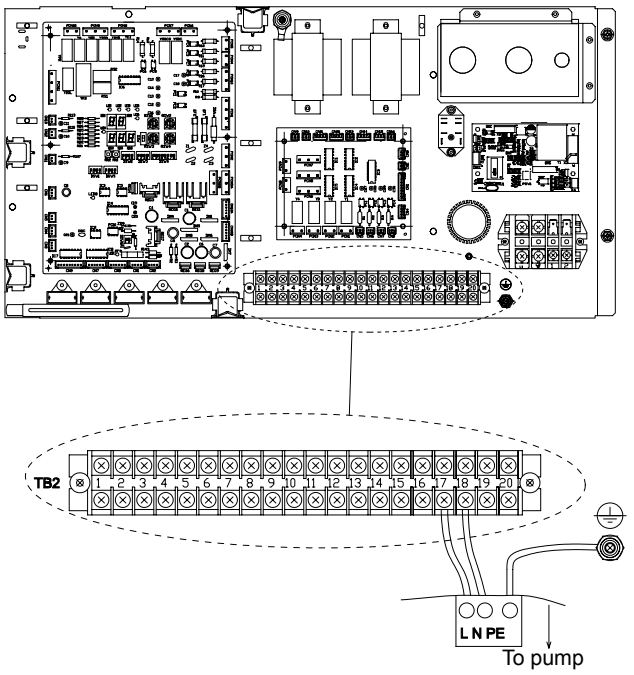
Mark	Part name		Description
TERMINAL BOARD 1			
N	AC 230V	AC 400V	-
L1			
L2	-		
L3			
TERMINAL BOARD 2			
1	YUTAKI M & Hydraulic Module connection (WP1)		Connection for primary water pump controlled by YUTAKI M outdoor unit
2			
3	YUTAKI M & Hydraulic Module connection (Alarm signal)		Connection for YUTAKI M alarm signal feedback
4			
5	YUTAKI M & Hydraulic Module connection (Remote signal)		Connection for remote ON/OFF YUTAKI M by System Controller (Hydraulic Module)
6			
7	YUTAKI M & Hydraulic Module connection (4-20mA signal)		The System Controller of Hydraulic Module controls the heat pump outlet water temperature by a 4-20 mA signal. When there is no demand for the heat pump to be on, the System Controller directly switches the heat pump off. The heat pump can signal to the System Controller when it has a fault so that a fault code can be displayed and appropriate action taken.
8			
9	RF receiver box		The RF receiver is connected to the polarity-free terminals 9 and 10. The room unit and RF receiver are already configured to communicate with each other. If the room unit or RF receiver is replaced, it is necessary to use the RF binding procedure.
10			
11	Tariff-switch device		If a tariff-switching device (load shedding management) is provided by the electricity utility, it can be used to prevent the heat pump switching on condition and the System Controller will use the boiler instead to satisfy the heating requirements (RHM-BC01E systems only). The input can be configured so that the heat pump is blocked (disabled) on either an open circuit or closed circuit. Note that the tariff/timer input can be used for DHW timer OR tariff-switching, not both. In case of use input as tariff switching, put timer (TM1) at PERMANENT OVERRIDE and set the parameter P24 of System Controller to 1 or 2 (depending configuration)
12			
13	DHW temperature sensor		The DHW sensor (T DHW) is used for control of the domestic hot water storage tank
14			
15	Outdoor temperature sensor		The outdoor sensor (T EXT) is used for OTC control, frost protection, summer switch-off, and bi-valent system management.
16			
17	DHW electric heater for RHM-EH01E. Boiler output for RHM-BC01E		If the DHW storage tank contains a thermostatic electric heater, the System Controller can enable it if the heat pump cannot achieve the required DHW temperature by itself. The boiler is used when the heat pump cannot achieve the desired supply temperature on its own.
18			
19	Boiler pump control for RHM-BC01E		In order to switch ON boiler water pump when boiler demand
20			

10.3.3 Water pump

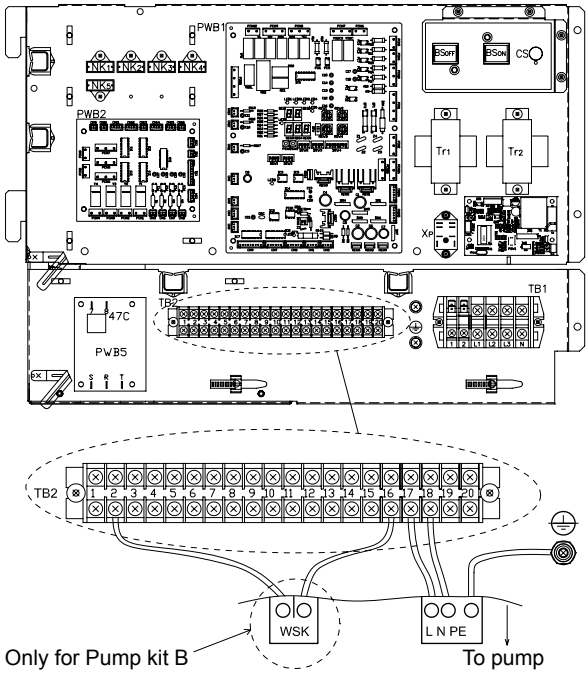
◆ System wiring diagram

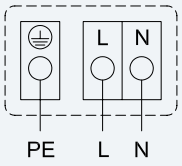
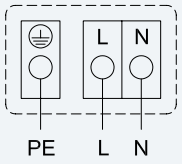
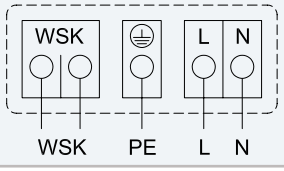
YUTAKI M is controlling the pump by itself. The pump kit must be always connected according to the wiring below.

RHUE-3AVHN1 + ATW-PK(1/2/3)-01



RHUE-(3-6)A(V)HN-HM + Pump kit (A/B)



Model	Pump kit	Protection type (Cut-out)	Connection terminals	
RHUE-3AVHN1	ATW-PK1-01 ATW-PK2-01 ATW-PK3-01	Auto reset		1~ 230V 50Hz
RHUE-(3-6)AVHN-HM	Pump kit A	Auto reset		
	Pump kit B	Manual reset		

NOTE

- *The pump power supply must be connected to the terminals 17, 18 of TB2 and earth terminal. Terminals 17 and 18 were designed for 230V/3A. Take it into account when installing the pump. An external relay might be necessary. Do not install a pump with more than 3A consumption.*
- *Earth screw terminal is used for both pump and power supply wiring connection.*
- *For Pump kit B accessory, connect wires from WSK to terminal 2 and 16 in the terminal board (TB2).*
- *Shunt between 2 and 16 have to be removed.*
- *Hitachi recommends the use of these accessory pump.*

◆ Motor protection

Model	Pump kit	Max. power consumption P_1max (see rating plate data)	Tripping	Reset	Speed switching
RHUE-3 AVHN1	ATW-PK1-01	P_1max ≤ 165W	Internal switch off of the motor main power supply	Auto-reset-once the motor has cooled down the pump will automatically switch back on	Speed adjustment switch, 3 settings
	ATW-PK2-01	P_1max ≤ 345W			
	ATW-PK3-01	P_1max ≤ 140W			
RHUE-(3-6) AVHN-HM	Pump kit A	P_1max ≤ 245W	Internal switch off of the motor main power supply	Auto-reset-once the motor has cooled down the pump will automatically switch back on	Speed adjustment switch, 3 settings
	Pump kit B	330W ≤ P_1max ≤ 400W	WSK and external switch (SK602/ SK622, C-SK or other control unit)	Manually at the external switch box once the motor has cooled down	Speed adjustment switch, 3 settings

◆ Electrical connection

Wiring size

Model	Pump kit	Power supply	Fuse protection for pump current (A)	Pump power cables
				EN60335-1
RHUE-3 AVHN1	ATW-PK1-01	1~ 230V 50Hz	3.0	2 x 0.75 mm² + GND
	ATW-PK2-01			
	ATW-PK3-01			
RHUE-(3-6) AVHN-HM	Pump kit A			
	Pump kit B			

Minimum requirements of the protection devices

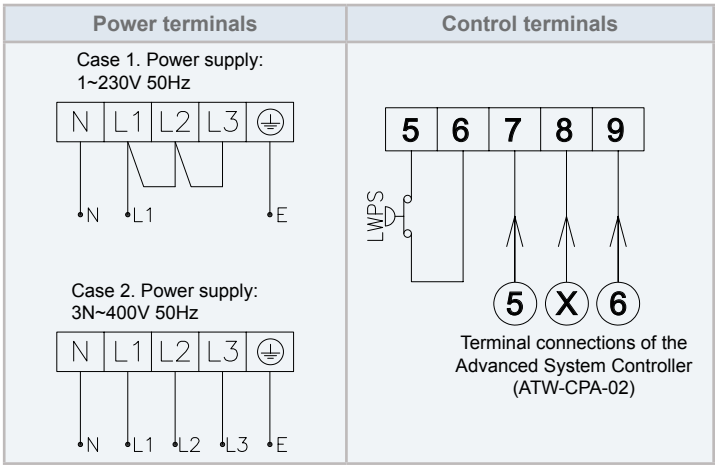
NOTE

Refer to the section "10.2.2 Electrical connection". In the tables, the maximum current of the pumps is considered.

10.3.4 WEH - Water electric heater

◆ System wiring diagram

The water electric heater accessory needs to be connected to the YUTAKI M unit and Advanced system controller. Perform the connection according to the following electrical diagram.



◆ Electrical connection

Wiring size

Model	Power supply	Max. current (A)	Power supply cables	Transmission cables
			EN60335-1	EN60335-1
WEH-6E	1~ 230V 50Hz	30.0	2 x 6.0 mm² + GND	2 x 0.75 mm²
	3N~ 400V 50 Hz	10.0	4 x 2.5 mm² + GND	

Minimum requirements of the protection devices

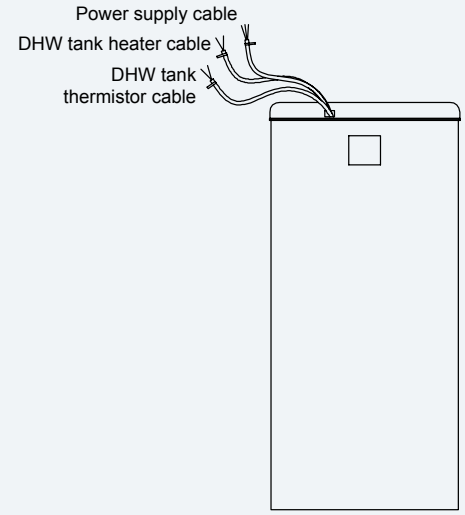
Model	Power supply	Applicable voltage		MC (A)	CB (A)	ELB (no. of poles/A/mA)
		U max. (V)	U min. (V)			
WEH-6E	1~ 230V 50Hz	253	207	30.0	32	2/40/30
	3N~ 400V 50 Hz	440	360	10.0	10	4/40/30
MC: Maximum current; CB: Circuit breaker; ELB: Earth leakage breaker						

10.3.5 DHWT - Domestic hot water tank

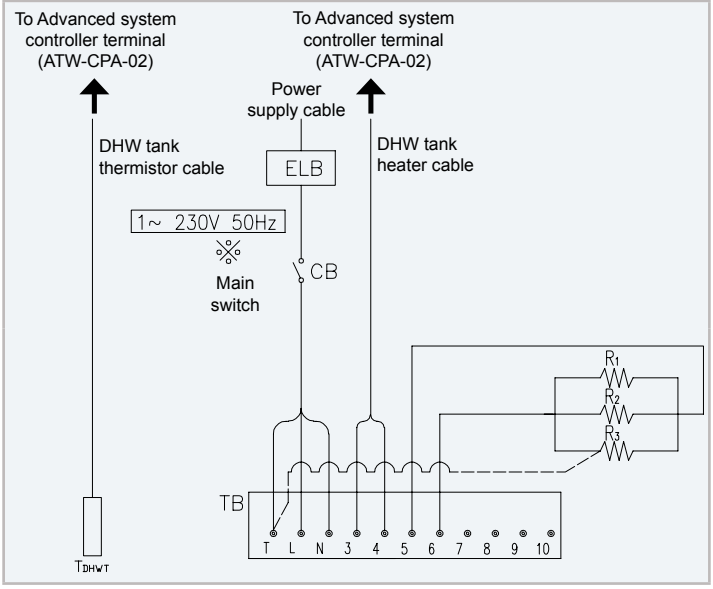
◆ System wiring diagram

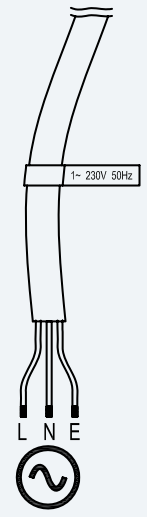
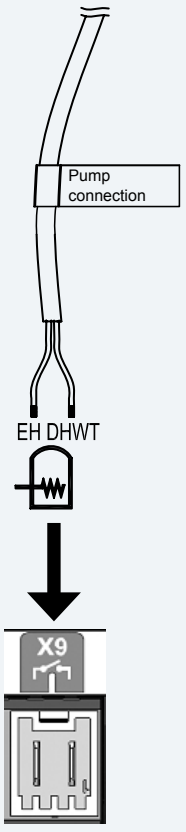
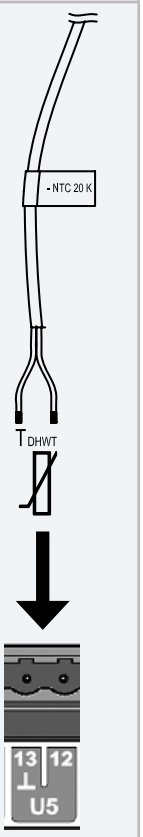
One end of the supplied wires for the connection of the DHW tank is already connected to the DHW tank (located on the upper side of the tank). The other free end must be connected according to the following electrical diagrams:

Location of the DHW tank electrical cables



DHW tank wiring diagram



Power supply cable (A)	DHW tank heater cable (B)	DHW tank thermistor cable (C)
		

DANGER

Be sure to use a dedicated power circuit for the DHW tank. Never use a power circuit shared by another appliance.

◆ Electrical connection

Wiring size

Model	Power supply	Max. current (A)	Power supply cable size	DHW tank heater cable size	DHW tank thermistor cable size
			EN60335-1	EN60335-1	EN60335-1
DHWT(200/300) (E/S)-2.5H1E	1~ 230V 50Hz	15.0	2 x 2.5 mm² + GND	2 x 1.0 mm²	2 x 0.75 mm²

Minimum requirements of the protection devices

Model	Power supply	Applicable voltage		MC (A)	CB (A)	ELB (no. of poles/A/mA)
		U min. (V)	U max. (V)			
DHWT(200/300) (E/S)-2.5H1E	1~ 230V 50Hz	207	253	15.0	20	2/40/30
MC: Maximum current; CB: Circuit breaker; ELB: Earth leakage breaker						

11. System settings and control system

Index

11.1 General information

11.1.1 Description

The System Controller is a configurable outdoor temperature compensated heating controller.

The System Controller is a part of the Heat Pump Controller Pack and is linked to the other components of the hydronic control system, such as the wireless Room Unit, RF Receiver, Water Temperature Sensors.

The Room Unit communicates with the System Controller using radio signals detected by the RF Receiver, enabling simpler installation and offering the end user a choice of how they operate the system.

The System Controller operates the Heat Pump, electric heater or boiler, valves and pumps to ensure optimal operation of the heating system.

The System Controller has a digital display with a simple menu structure operated by six buttons, so that it can easily be configured to many different applications with specific installation settings.

11.1.2 Safety instructions

- When performing any work with this product (installation, mounting, start-up), all instructions given by the manufacturer and in particular the safety instructions provided in the Installation instructions must be followed.
- The System Controller may only be installed and mounted by authorised and suitably trained personnel.
- If the unit is modified in any way, except by the manufacturer, all warranties concerning operation and safety are invalidated.
- Make sure that local standards and regulations are respected at all times.
- Use only accessory equipment that comes from or has been approved by the manufacturer.
- Before the controller is dismantled, disconnect the mains power supply.

CAUTION

- *Disconnect the mains power supply before you start to install the System Controller.*
- *Do not reconnect the power supply until you have completed installation.*

11.1.3 System overview

The System Controller is designed for controlling the Heat Pump in a mono-valent, mono-energetic or bi-valent heating system. It provides efficient control and reduces energy use while maintaining comfort in the building.

Features:

- Modulating Control of Heat Pump
- Control of an Auxiliary Heat Source (3-stage electric heater or boiler)
- Outside Temperature Compensated (OTC) Control
- Control of up to two Heating Circuits
- Control of Domestic Hot Water Storage with integrated time-program
- Control of DHW electric heater
- DHW Anti-Legionella Protection
- Frost Protection
- Automatic Summer Switch-Off
- RF interface to Room Units (user heating time-programs, setpoint adjustment, room temperature sensing)
- Communication with Heat Pump improves system performance, and reduces installation cost/effort
- Installation/Commissioning aids (manual overrides)
- Input for tariff switch device to switch between Heat Pump and boiler operation.
- Integrated simple multi-language user interface
- Installation mounting options
- Easy-to-wire (one-wire per terminal / one-plug per device)

NOTE

- *The functionality of the System Controller depends on the installed components and the selected configuration.*
- *The System Controller is designed in a way that it can be configured and upgraded to meet many application requirements.*

11.1.4 Contents of the controller pack

System Controller

- Controls the Heat Pump
- Controls other system components
- Measures system sensors and Heat Pump parameters
- Allows system configuration and settings
- 2x Terminal covers for protection
- 2x Terminal kits for connections
- 1x Strain-relief kit

System Controller

System MMI Pack

- Room Unit - The user interface for the system and allows time / temperature profile programming.
- RF Receiver - Receives wireless signals from the Room Unit and is wired directly to the System Controller.

Room Unit

RF Receiver

Sensors

- 2 x Water Temperature Sensors
- Sensors connect directly to System Controller for mixing circuit and DHW tank control

Water Temperature Sensors

Plug terminal kit

- 1 x Plug terminals kit for easy connection
- 1 x Installation and operation manual

Plug in terminals

Installation and operation manual

- 1 x Installation and operation manual

Installation and operation manual

11.2 System configurations

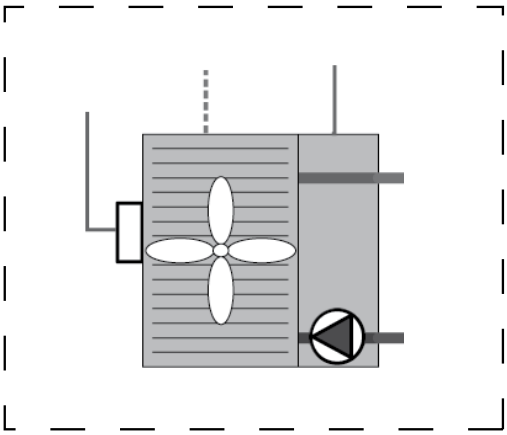
The System Controller can be used for several different hydraulic system configurations, including mono-valent systems, mono-energetic systems with auxiliary electric heater, and bi-valent systems with gas/oil boiler.

Valid hydraulic configurations are:

Hydraulic configuration	Description	Heat pump	Electric heater	Boiler	Boiler pump	Boiler by-pass	DHW	DHW E-Heater	HC1 Circuit	HC2 Circuit
CONF 1.1	**Mono-Valent System** Heat pump only without hydraulic separator 1x Direct Circuit	✓	-	-	-	-	✓ DHW valve	✓	Direct circuit	-
CONF 1.2	**Mono-Valent System** Heat pump only 2x Mixing/Direct circuits	✓	-	-	-	-	✓ DHW pump	✓	Direct or mixing circuit	Direct or mixing circuit
CONF 2.1	**Mono-Energetic System** Heat pump & electric heater without hydraulic separator 1x direct circuit	✓	✓	-	-	-	✓ DHW valve	✓	Direct circuit	-
CONF 2.2	**Mono-Energetic System** Heat pump & electric heater 1x Mixing/Direct circuit 1x Direct circuit	✓	✓	-	-	-	✓ DHW pump	✓	Direct or mixing circuit	Direct circuit
CONF 3.1	**Bi-Valent Parallel System** Heat pump & boiler Boiler pump control 1x Mixing/Direct circuit 1x Direct circuit	✓	-	✓	✓	-	✓ DHW pump	-	Direct or mixing circuit	Direct circuit
CONF 3.2	**Bi-Valent Parallel System** Heat pump & boiler 2x Mixing/Direct circuits	✓	-	✓	-	-	✓ DHW pump	-	Direct or mixing circuit	Direct or mixing circuit
CONF 4.1	**Bi-Valent Series System** Heat pump & boiler 1x Mixing/Direct circuit 1x Direct circuit	✓	-	✓	-	✓	✓ DHW pump	-	Direct or mixing circuit	Direct circuit

NOTE

In the following illustrations, the YUTAKI M main pump is located at the outlet (corresponding to RHUE-3AVHN1 unit). Take into account that for the other units RHUE-(3-6)A(V)HN-HM this pump is located at the inlet.

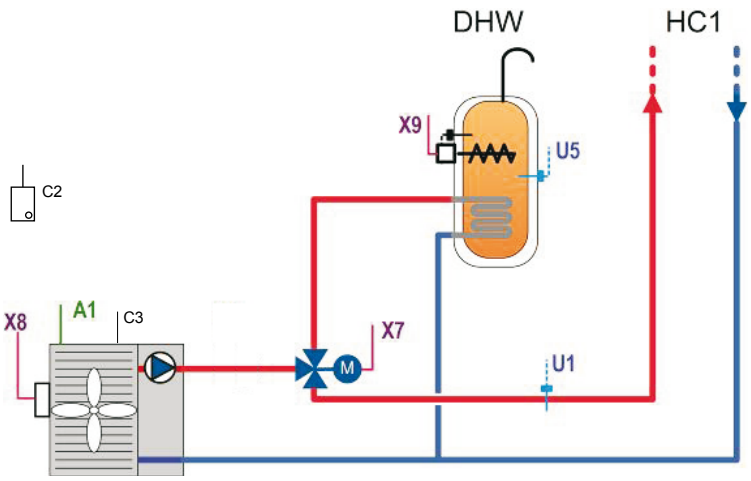


11.2.1 Configuration 1: Mono-Valent Systems

In mono-valent systems, the Heat Pump is the sole provider of heating energy to the system. The Heat Pump is sized to provide 100% of the heating requirements on the coldest day of the year. It is recommended for low-energy houses and for moderate climates without severe winters. Used in new builds or in boiler-replacement applications. This configuration is suitable for low-temperature radiators and underfloor heating systems. In order to achieve higher DHW temperatures, the system can operate with an auxiliary DHW electric heater.

◆ CONF 1.1 – Simple system without hydraulic separator

The maximum system configuration is shown in the diagram below. (DHW can be selected with a parameter).

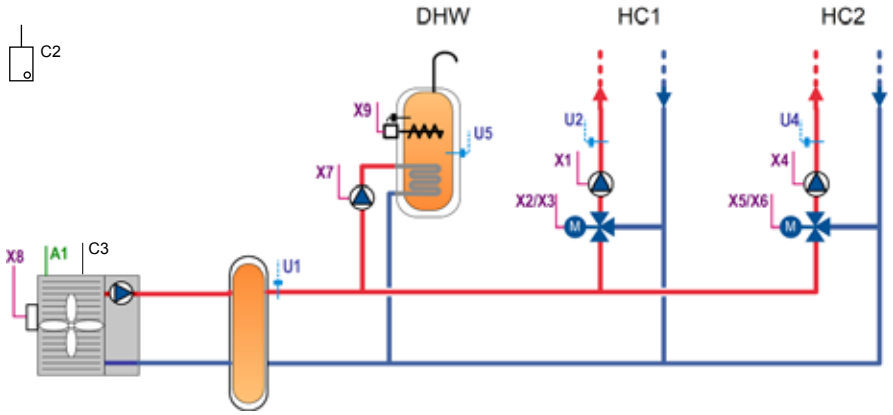


Inputs	
U1	System supply temperature sensor
U5	DHW temperature sensor
U8	(optional) Outside temperature sensor
B1	Blocking input
B2	DHW boost input

Outputs	
X7	DHW valve
X8	Heat pump on/off
X9	DHW electric heater
A1	Heat pump control signal
C2	RF Receiver
C3	Heat Pump communication signal

◆ CONF 1.2 – System with hydraulic separator, up to two heating circuits

The maximum system configuration is shown in the diagram below. (DHW, HC1 and HC2 options can be selected with parameters).



Inputs	
U1	System supply temperature sensor
U2	HC1 Supply temperature sensor
U4	HC2 Supply temperature sensor
U5	DHW temperature sensor
U8	(optional) Outside temperature sensor
B1	Blocking input
B2	DHW boost input

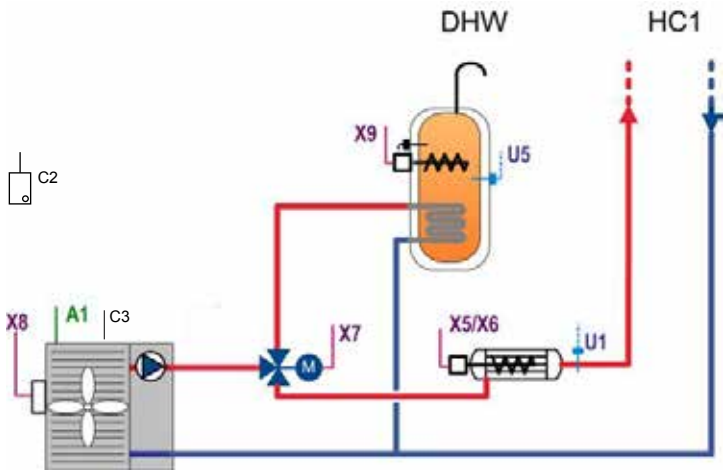
Outputs	
X1	HC1 pump
X2/X3	HC1 mixing valve : 2x relays
X4	HC2 pump
X5/X6	HC2 mixing valve : 2x relays
X7	DHW pump
X8	Heat pump on/off
X9	DHW electric heater
A1	Heat pump control signal
C2	RF Receiver
C3	Heat Pump communication signal

11.2.2 Configuration 2: Mono-energetic systems

In mono-energetic systems, the Heat Pump is supplemented by a 3-stage electric heater to provide additional heating energy to the system. The Heat Pump is sized to provide around 60% of the heating requirements on the coldest day of the year, and will typically provide 90-95% of the heating requirements over the whole heating season. An electric auxiliary heater is used to provide the additional heating required on cold days. Used in new builds or in boiler-replacement applications. In order to achieve higher DHW temperatures, the system can operate with an auxiliary DHW electric heater.

◆ CONF 2.1 – System with electric heater control, without hydraulic separator

The maximum system configuration is shown in the diagram below (DHW can be selected with a parameter).

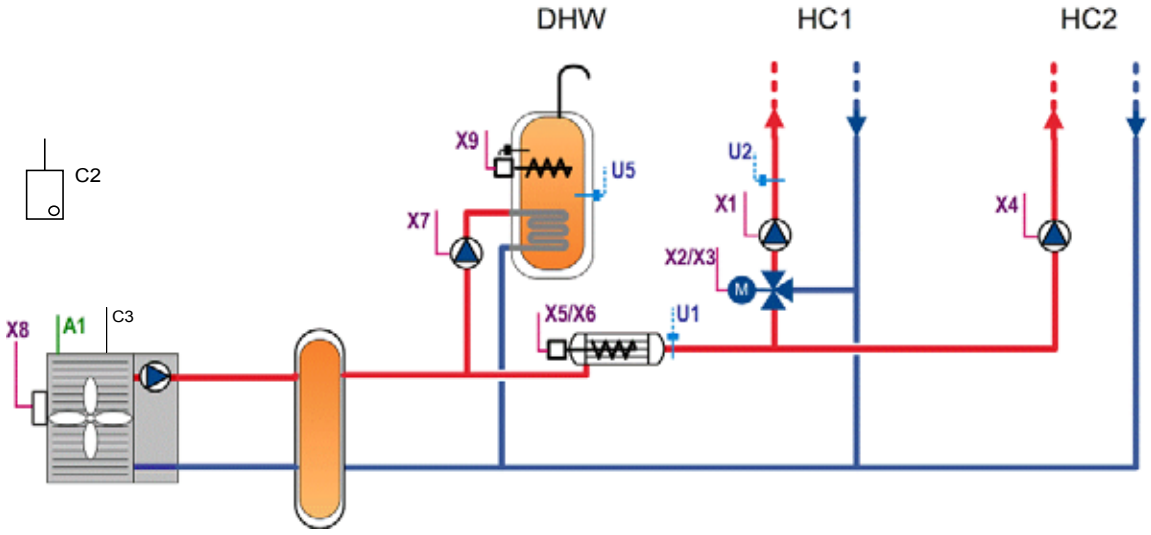


Inputs	
U1	System supply temperature sensor
U5	DHW temperature sensor
U8	(optional) Outside temperature sensor
B1	Blocking input
B2	DHW boost input

Outputs	
X5/X6	Electric heater: 2x relays
X7	DHW valve
X8	Heat pump on/off
X9	DHW electric heater
A1	Heat pump control signal
C2	RF Receiver
C3	Heat Pump communication signal

◆ CONF 2.2 – System with electric heater control, hydraulic separator, up to two heating circuits

The maximum system configuration is shown in the diagram below (DHW, HC1 and HC2 options can be selected with parameters).



Inputs	
U1	System supply temperature sensor
U2	HC1 Supply temperature sensor
U5	DHW temperature sensor
U8	(optional) Outside temperature sensor
B1	Blocking input
B2	DHW boost input

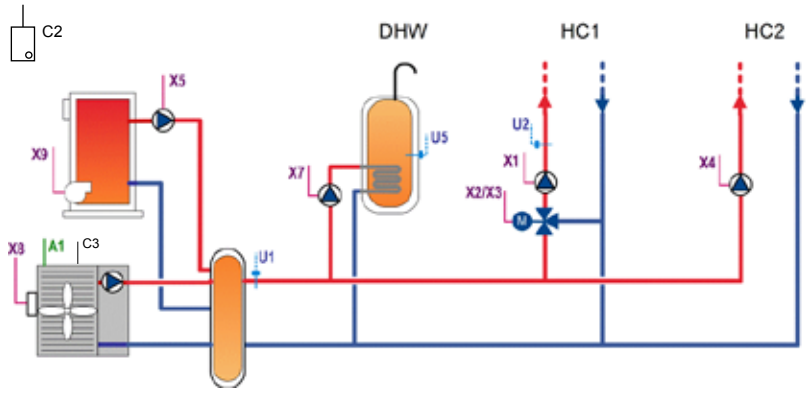
Outputs	
X1	HC1 pump
X2/X3	HC1 mixing valve : 2x relays
X4	HC2 pump
X5/X6	Electric heater: 2x relays
X7	DHW pump
X8	Heat pump on/off
X9	DHW electric heater
A1	Heat pump control signal
C2	RF Receiver
C3	Heat Pump communication signal

11.2.3 Configuration 3: Bi-valent parallel (alternative) system

This is a bivalent system where the boiler is configured in parallel with the Heat Pump. A hydraulic separator or buffer tank has to be used to ensure proper hydraulic balancing. This system is recommended for retrofit (upgrade) applications where an existing gas/oil boiler will be retained to provide the full heating requirements on the coldest days of the year.

◆ CONF 3.1 – System with boiler pump control

The maximum system configuration is shown in the diagram below (DHW, HC1 and HC2 options can be selected with parameters).

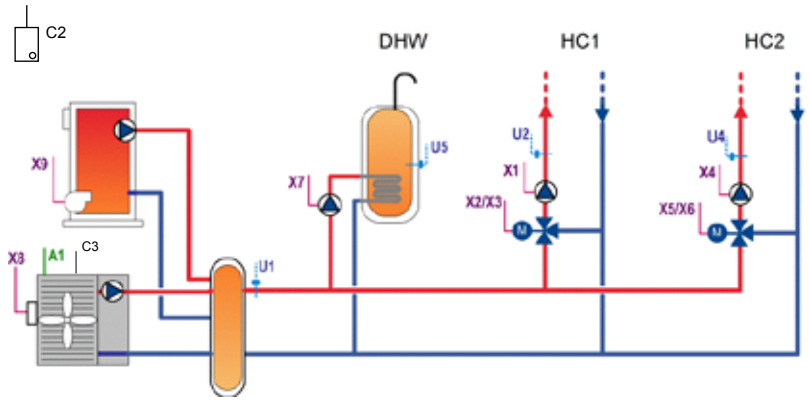


Inputs	
U1	System supply temperature sensor
U2	HC1 Supply temperature sensor
U5	DHW temperature sensor
U8	(optional) Outside temperature sensor
B1	Blocking input
B2	DHW boost input

Outputs	
X1	HC1 pump
X2/X3	HC1 mixing valve : 2x relays
X4	HC2 pump
X5	Boiler pump (no output on X6)
X7	DHW pump
X8	Heat pump on/off
X9	Boiler on/off
A1	Heat pump control signal
C2	RF Receiver
C3	Heat Pump communication signal

◆ CONF 3.2 – System without boiler pump control, up to two mixing heating circuits

The maximum system configuration is shown in the diagram below.(DHW, HC1 and HC2 options can be selected with parameters)



Inputs	
U1	System supply temperature sensor
U2	HC1 Supply temperature sensor
U4	HC2 Supply temperature sensor
U5	DHW temperature sensor
U8	(optional) Outside temperature sensor
B1	Blocking input
B2	DHW boost input

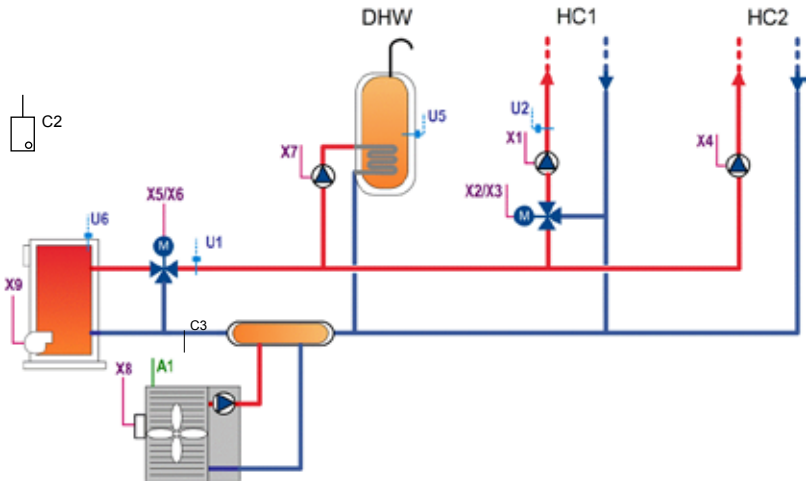
Outputs	
X1	HC1 pump
X2/X3	HC1 mixing valve : 2x relays
X4	HC2 pump
X5/X6	HC2 mixing valve : 2x relays
X7	DHW pump
X8	Heat pump on/off
X9	Boiler on/off
A1	Heat pump control signal
C2	RF Receiver
C3	Heat Pump communication signal

11.2.4 Configuration 4: Bi-valent series system

This is a bivalent system where the boiler is configured in series with the Heat Pump. A hydraulic separator or buffer tank has to be used to ensure proper hydraulic balancing. This system is also used for retrofit (upgrade) applications, but operates like the mono-energetic system using the gas/oil boiler, similarly to the electric heater, in series with the heat-pump. The boiler only needs to provide the additional peak load capacity.

◆ CONF 4.1 – System with boiler bypass/mixing valve

The maximum system configuration is shown in the diagram below (DHW, HC1 and HC2 options can be selected with parameters).



Inputs	
U1	System supply temperature sensor
U2	HC1 Supply temperature sensor
U5	DHW temperature sensor
U6	Boiler temperature sensor
U8	(optional) Outside temperature sensor
B1	Blocking input
B2	DHW boost input

Outputs	
X1	HC1 pump
X2/X3	HC1 mixing valve : 2x relays
X4	HC2 pump
X5/X6	Bypass/mixing valve : 2x relays
X7	DHW pump
X8	Heat pump on/off
X9	Boiler on/off
A1	Heat pump control signal
C2	RF Receiver
C3	Heat Pump communication signal

11.2.5 Mono-valent, mono-energetic and bi-valent operation

Bi-valent and mono-energetic systems use an auxiliary heat source (boiler or electric heater respectively) in addition to the Heat Pump. At higher outside temperatures, the Heat Pump can provide all heating requirements of the system, and it is not necessary to switch on the auxiliary heat source.

However at lower outside temperatures, the electric heater or boiler is used to provide the increased heating demand. The changeover point for bi-valent or mono-energetic operation is called the Balance Point (BP). Furthermore, at very low outside temperatures the Heat Pump should not operate, and the boiler will operate on its own. This setting is the Minimum Outside Temperature for Heat Pump Operation (P601).

◆ For mono-energetic systems (CONF 2):

- IF average outside temperature (T003) ≥ Maximum outside temperature for electric heater operation (P801), THEN heating source (K001) = ehat pump only
- IF (average outside temperature (T003) < Maximum outside temperature for electric heater operation (P801) – 0.5K) AND (average outside temperature (T003) > Minimum outside temperature for heat pump operation (P601) + 0.5K), THEN heating source (K001) = heat pump & electric heater
- IF average outside temperature (T003) ≤ Minimum outside temperature for heat pump operation (P601), THEN heating source (K001) = electric heater only

◆ For bi-valent systems (CONF 3 and 4):

- IF average outside temperature (T003) ≥ Maximum outside temperature for boiler operation (P701), THEN heating source (K001) = heat pump only
- IF (average outside temperature (T003) < Maximum outside temperature for boiler operation (P701) – 0.5K) AND (average outside temperature (T003) > Minimum outside temperature for heat pump operation (P601) + 0.5K), THEN

heating source (K001) = heat pump & boiler

- IF average outside temperature (T003) ≤ Minimum outside temperature for heat pump operation (P601), THEN heating source (K001) = boiler only

◆ In configuration 3:

If Bi-valent Alternative Operation is selected (P007 = 1), meaning the Heat Pump and boiler shall not be used for heating at the same time, then P601 is always set = P701 (P601 cannot be changed by the installer) and then:

- IF average outside temperature (T003) ≥ Maximum outside temperature for boiler operation (P701), THEN heating source (K001) = heat pump only
- IF average outside temperature (T003) < Maximum outside temperature for boiler operation (P701), THEN heating source (K001) = boiler only

Parameters	P701	Maximum Outside Temperature for Boiler Operation = Balance Point (BP)
	P801	Maximum Outside Temperature for Electric Heater Operation = Balance Point (BP)
	P601	Minimum Outside Temperature for Heat Pump Operation
	P007	Bi-valent Alternative Operation (enable/disable)
Datapoints	T003	Average Outside Temperature
	K001	Heating Source

11.3 Settings for combination of system controller with RHUE-(3-6)A(V)HN-HM units

In order to combine the new System controller with Yutaki M RHUE-(3~6)A(V)HN-HM (55ºC) model, special setting procedure must be performed in System Controller.

Detailed instructions on this procedure are shown below:

First at all it is necessary to access into parameter settings screen. To do this, log in with a service access code

1 Press and hold button from the home screen (for 1 second).
2 Enter the access code wWhen the screen prompts for a PASS. Use the 6 buttons to enter the 4 digit code:

Service access code is:**6565**

3 If the correct access code is entered, the display shows:W

• Double spanner icon for service access / Message “Passcode OK – Service”

4 The MENU then allows access to setting and system information.

- Press ▽ to scroll though the menu items
- Go down to 04 Parameters
- Press OK to select the menu item (enter sub-menu)
- Go down to 04>04 Heat Pump
- Press OK to select the menu item (enter sub-menu)
- Change the following parameters:

Parameter	Description	Default	New value
P603	Heat Pump Supply Setpoint at 20mA	60ºC	**55ºC**
P604	Heat Pump Maximum Inlet Temperature	60ºC	**55ºC**
P606	Heat Pump Maximum Supply Setpoint above P609	60ºC	**55ºC**

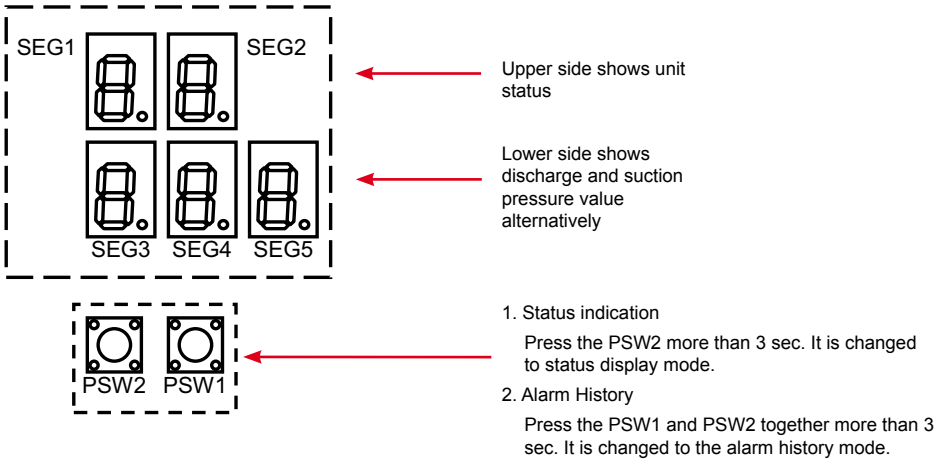
5 After changing these parameters, return to the main screen by pressing the “Esc” button

12. Troubleshooting

Index

12.1 Troubleshooting (From YUTAKI M unit)

12.1.1 Alarm code display



12.1.2 General indication

General indication	Content
88	Proceeding initialization
88	Power ON (During unit stoppage)
PU	Pump operation (During unit stoppage)
PU	Waiting of pump feedback (During unit operation)
oF	Stoppage by Thermo-OFF
HE	Heating operation (Normal operation)
HE↔P0	Heating operation (Activation of forced compressor frequency control due to low pressure difference:forced up)
HE↔P1	Heating operation (Activation of forced compressor frequency control due to high pressure difference:forced down)
HE↔P2	Heating operation (Activation of forced compressor frequency control due to excessively high discharge pressure: forced down)
HE↔P3	Heating operation (Activation of forced compressor frequency control due to excessively high current :forced down)
HE↔P4	Heating operation (Activation of forced compressor frequency control due to excessively high inverter fin temperature: forced down)
P-↔06	Retry operation (by alarm 02-91, t1)
P-↔11	Retry operation (by alarm 02-e1)
P-↔12	Retry operation (by alarm 02-h1)
P-↔17	Retry operation (by alarm 51, 52, 53, 54)
P-↔18	Retry operation (by alarm 04, 06)
E0(Flickering)	Initializing electronic expansion valve
Fo	Fun manual operation

12.1.3 Alarm indication

Alarm indication	Content
02↔H 1	Activation of high pressure switch
02↔h 1	Activation of protection control for excessively high pressure
02↔L 1	Activation of low pressure control
02↔E 1	Excessively low pressure difference
02↔b 1	Excessively high discharge gas temperature
02↔9 1	Excessively low temperature of heat exchanger refrigerant inlet
02↔t 1	Excessively low suction gas temperature
04	Abnormal transmission between Inverter PCB and Main PCB
05	Abnormality of Power Supply Phase
06	Excessively low voltage or excessively high voltage for the inverter
11	Failure of water inlet temperature thermistor
12	Failure of water outlet temperature thermistor
13	Activation of freeze protection control (water inlet)
02↔ 13	Activation of freeze protection control (water outlet)
14	Excessively high water temperature (compressor running)
21	Failure of refrigerant evaporating temperature thermistor (Open/Short)
22	Failure of ambient temperature thermistor (Open/Short)
23	Failure of discharge gas temperature thermistor (Open/Short)
24	Failure of refrigerant liquid temperature thermistor (Open/Short)
26	Failure of suction gas temperature thermistor (Open/Short)
27	Failure of discharge gas pressure sensor (Open/Short)
28	Failure of suction gas pressure sensor (Open/Short)
30	Incorrect PCB Setting
40	Incorrect PCB operation
51	Abnormal operation of the current sensor
52	Activation of protection for inverter instantaneous over current
53	Transistor module protection activation
54	Increase in the inverter fin temperature
57	Abnormality of fan motor protection
5P	No feedback signal from water pump
6E	Cooler water failure (this alarm is not available in this unit)
6C	Condenser water failure (this alarm is not available in this unit)
PU(flickering)	Excessively high water temperature (compressor stop)
FA	Failure of fan motor (MF1)
Fb	Failure of fan motor (MF2)

12.2 Troubleshooting (From Advanced system controller)

Alarms and fault-codes can help diagnose system problems. These are available via the menu screens.

Press MENU from the home screen to enter the menu system. The Alarm menu 00> will appear first.

Press OK to select the Alarm menu item and then Δ or ∇ to scroll through the current active items.

Press ESC repeatedly to return to the home screen.

Code	DESCRIPTION	SYSTEM BEHAVIOUR	REMEDY
F01	No Outside Temperature sensor or short circuit or out of range	System operates normally with fixed outside temperature of 10°C	Check sensor operation and wiring.
F02	No DHW Water Temperature sensor or short circuit or sensor out of range.	DHW is disabled.	Check sensor operation and wiring.
F03	No HC1 Supply Water Temperature sensor or short circuit or sensor out of range (mixing circuit only)	Disable the heating circuit 1	Check sensor operation and wiring.
F04	No HC2 Supply Water Temperature sensor. short circuit or sensor out of range (mixing circuit only)	Disable the heating circuit 2	Check sensor operation and wiring.
F05	No Boiler Water Temperature sensor or sensor failure or sensor out of range (CONF 4.1 only)	Disable the Boiler (if the boiler will be disabled the bypass mixing valve will be closed).	Check sensor operation and wiring.
F06	No System Supply Water Temperature sensor or short circuit or sensor out of range	The Boiler (if present), 3-stage E-Heater (if present) and the Heat Pump will be disabled.	Check sensor operation and wiring.
F07	OpenTherm™ communication failure	System operates normally with fixed OpenTherm™ values: The last received Room Setpoint(s) are used. Room Temperatures are assumed to be equal to the Room Setpoints.	Check wiring to RF Receiver. Refer to the RF Receiver installation guide.
F08	Heat Pump Connection Fault	Heat Pump, 3-stage electric heater and Boiler are disabled and (if present) the Boiler or the 3-Stage Electric Heater can be released via manual release mode. Valid until a load is connected to A1 again.	Refer to the Heat Pump installation guide.
F09	Heat Pump Communications Fault	Outside Temperature is set to 10°C (fixed). Heat Pump, 3-stage electric heater and Boiler are disabled and (if present) the Boiler or the 3-Stage Electric Heater can be released via manual release mode. Valid until the Modbus is working again.	Refer to the Heat Pump installation guide.
	Note: Fault Code F09 will always force F14 and F01 fault codes if the outside sensor in the Heat Pump is used, because these values cannot be transmitted while the communication to the Heat Pump is in a fault condition.		

Code	DESCRIPTION	SYSTEM BEHAVIOUR	REMEDY
F10	Mixing Over-temperature Limit Protection HC1	Heating Circuit Pump of HC1 switched off immediately.	If problem persists, check system sensors and valve operation.
F11	Mixing Over-temperature Limit Protection HC2	Heating Circuit Pump of HC2 switched off immediately.	If problem persists, check system sensors and valve operation.
F12	Heat Pump Fault	Heat Pump, 3-stage Electric Heater, Boiler are disabled if present. The Boiler or 3-Stage Electric Heater can be released manually or automatically depending on parameter configuration. Valid until a reset of a HP failure signal (problem is fixed).	Refer to the Heat Pump installation guide.
F13	RF communication failure	See F07.	Check Room Unit(s).
F14	Heat Pump Maximum Inlet Temperature Protection Active	The Heat Pump is switched off.	Check the temperature.
F15	DHW Anti-Legionella Failure	Time defined in parameter DHW Anti-Legionella Restart Interval (P315) has expired and the control will continue in normal operation.	This alarm (fault) code can be deleted: - if the next DHW Anti-Legionella function was successfully passed or - if DHW Anti-Legionella Protection is disabled (P309=0)
F16	HP Individual Alarm	3-stage Electric Heater or Boiler are disabled if present. The Boiler or 3-Stage Electric Heater can be released manually or automatically depending on parameter configuration.	Refer to the Heat Pump installation guide. Power ON/OFF to remove alarms in Yutaki M and System Controller.
F17	HP Unit Alarm	3-stage Electric Heater or Boiler are disabled if present. The Boiler or 3-Stage Electric Heater can be released manually or automatically depending on parameter configuration.	Refer to the Heat Pump installation guide. Power ON/OFF to remove alarms in Yutaki M and System Controller.

12.3 Troubleshooting of accessories

The information about the Troubleshooting of accessories is shown in the Service Manual.

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ISO 14001 of AENOR Spain for its Environmental Management systems accordance with the standard.

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ISO 14001 of JACO, Japan for its Environmental Management accordance with the standard.

Hitachi fulfills with the Certification NF-PAC that recognize the quality requirements for these heat pumps systems.

HITACHI participates in the Eurovent Certification Programme; the certified data of certified models are listed in the Eurovent Certification Online Directory (www.eurovent-certification.com).

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