HITACHI
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YUTAKI SERIES
RHUE-A(V)HN

Technical catalogue

Air- to- water
Heat Pump

• RHUE-3AVHN
• RHUE-4AVHN
• RHUE-5A(V)HN
• RHUE-6A(V)HN

Specifications in this manual are subject to change without notice in order that HITACHI may bring the latest innovations to their customers.

Whilst every effort is made to ensure that all specifications are correct, printing errors are beyond Hitachi's control; Hitachi cannot be held responsible for these errors.

Contents

General contents

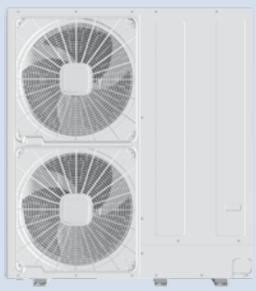
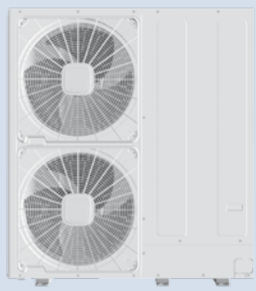
General contents (cont.)

General contents (cont.)

0. Model codification and accessory codes

MODEL CODIFICATION AND ACCESSORY CODES

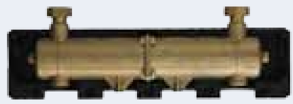
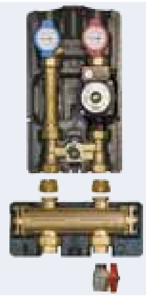
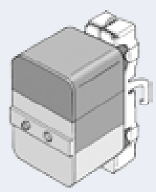
List of air-to-water units and accessories available in this technical catalogue

YUTAKI UNITS			
AVHN UNITS		AHN UNITS	
Unit	Code	Unit	Code
RHUE-3AVHN	9E311100		
RHUE-4AVHN	9E411100		
RHUE-5AVHN	9E511100	RHUE-5AHN	9E531100
RHUE-6AVHN	9E611100	RHUE-6AHN	9E631100
			
1~		3~	

Meaning of model codification: **RHUE - 5 A V H N**

- RHUE: Unit Type (made in Europe)
- 5: Compressor power (HP) 3/4/5/6
- A: Air-to-water unit
- V: Single phase
- H: Heating only
- N: R410A Refrigerant

LIST OF ACCESSORY CODES

Accessory	Name	Code	Figure
Step 1	Water temperature sensor	9E500004	
RMPID1	Extension controller	9E500005	
Pump Kit A	Pump kit A (TOP-S 25/7)	9E500006	
Pump Kit B	Pump kit B (TOP-S 25/10)	9E500007	
WEH-6E	Water Electric Heater	WEH-6E	
BDHM1	Hydraulic separator	BDHM1	
VID3V1	3 way valve	VID3V1	
CDH2Z1	Disconnection vessel	CDH2Z1	
ASMSH1	Aquastat	ASMSH1	

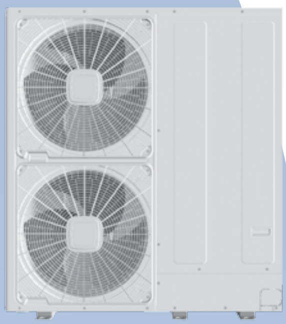
LIST OF ACCESSORY CODES (cont.)

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	70544900	
DHWT-CP-02	Permanent cathode protection for stainless tank	70544901	
DHWT-SWG-01	Security valve	70544902	

1.Features and benefits of Yutaki

Contents

1.1. System description



YUTAKI unit

YUTAKI is a heating and sanitary hot water solution for the home with high energy efficiency.

With the aim of reducing energy expenditure, there is a clear trend in the market to use medium and low temperature heating systems. Technological advances and improvements in insulation in the home enable to use of low temperature water to heat homes. This results in more comfort and greater energy efficiency.

YUTAKI meets the necessary conditions to provide this type of application, fulfilling users' needs.

- **Free energy**

Instead of burning fossil fuels like conventional boilers, heat pumps extract the heat present in the air, increase its temperature and transmit it to the water in the system through an exchanger. The hydrokit then circulates it around the inside, where the heat is taken to radiators, fan-coils or underfloor heating components. The hydrokit does not require any extra service space, since it is built into the YUTAKI module and it contains all of the system's and user's controls.

Instead of burning fossil fuels like conventional boilers, heat pumps extract the latent heat energy present in the floor, air or water. The YUTAKI air/water system extracts enough heat from the outside air to heat a home to a comfortable temperature, even on the coldest winter day.

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

- **Easy and flexible installation.**

The YUTAKI system is straightforward and flexible. It does not require chimneys, fuel tanks or natural gas connections. Its main components are an outdoor unit and a hydrokit (located in the outdoor unit) to supply the indoor system.

The YUTAKI module is designed to be installed outside houses or apartments, whether old or new, even when space is limited.

The YUTAKI system can also be connected to low temperature radiators and to underfloor heating elements.

- **Heating and sanitary hot water options**

YUTAKI 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 55ºC. An electrical resistance, at the top of the stainless steel 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 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 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.

Choice benefits:

The main features of YUTAKI modules include:
- High energy efficiency
- Can be combined with existing systems
- Low noise level
- Inverter compressor
- Broad scope of applications (flexible according to the type of system)
- User-friendly

1.2. Choice benefits

1.2.1. 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 7.

1.2.2. Many options and accessories are available

There are more than 20 different hydraulic configurations, combining the different available accessories.

◆ **Circulatory water pump**
- 2 different pump sizes
- 3 speeds to adapt the flow to the demand
- Internal thermal protection
- The pumps can be easily installed inside the unit

◆ **Water Electric Heater**
- 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**
- Production of sanitary hot water
- Different capacities availabe
- Including Back-up heater

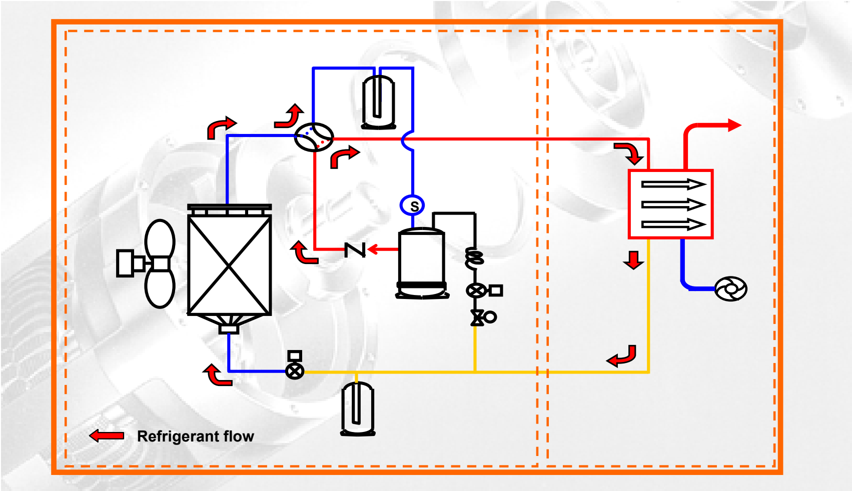
◆ **Other accessories:**
- Hydraulic separator, 3 way valve, Aquastat,...

1.3. Operating benefits

1.3.1. High efficiency system

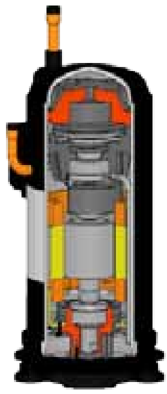
- **Maximum output**

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



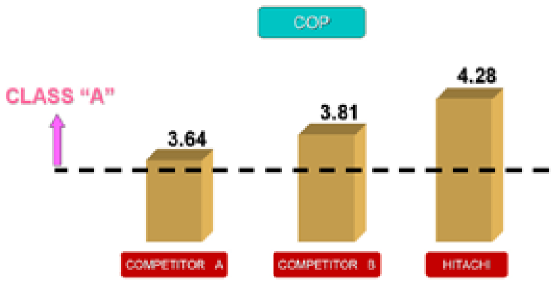
- **Reduced power consumption**

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



- **Maximum energy efficiency (COP)**

  Inverter technology and Hitachi's skilled compressor design and manufacture allow maximum energy efficiency.



- **CO2 reduction**

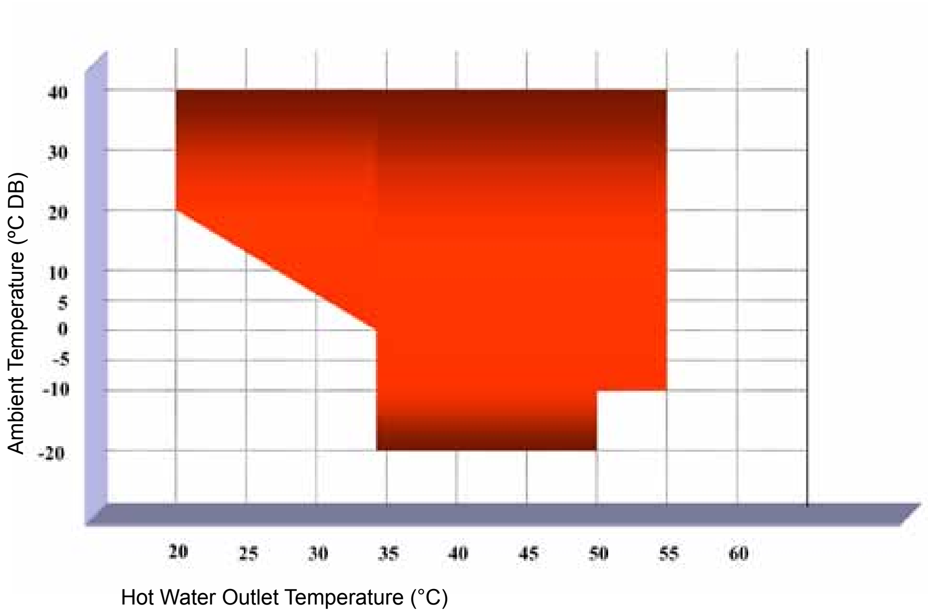
  Installing an Air Source Heat Pump is a straightforward and cost effective method of using renewable energy to heat a home. Practica renewable energy use means reducing the use of fosil fuels and lowering carbon emissions.

☛ Operating benefits:

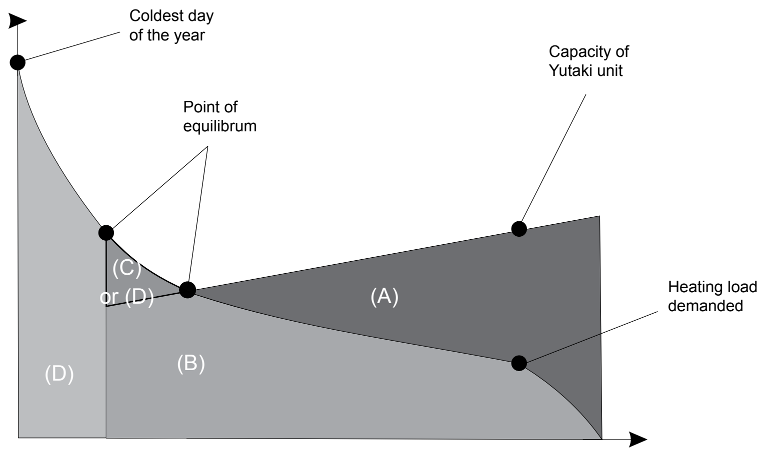
1.3.2. Broad range of working temperatures

◆ **Temperature range**

The YUTAKI module provides a broad temperature range.



◆ **Operating modes**



NOTE

(A) Excess capacity on the Yutaki unit
(B) Capacity covered by Yutaki 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 unit ensures a comfortable room temperature with the lowest energy consumption. Even in extrem conditions (temperature down to -20ºC) Yutaki will give exceptional performances all year long.

1.4. Functionality benefits

1.4.1. 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.

Heat Pump
system controller

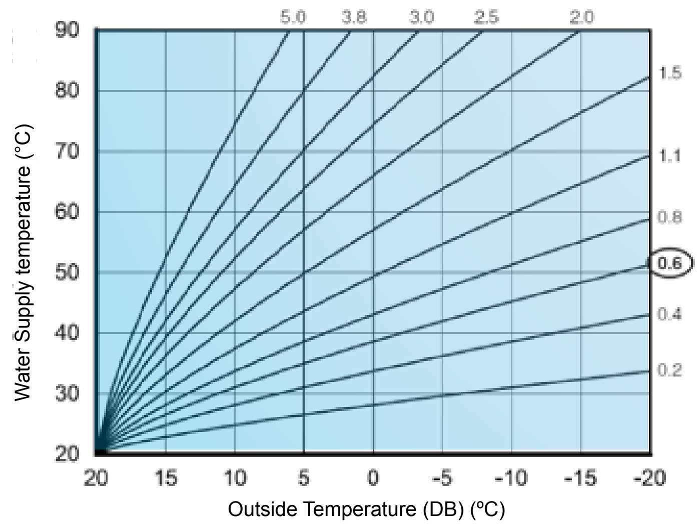
1.4.2. User-friendly

The display of the thermostat is intuitive and quick to use, being controlled with few buttons.

Room unit

1.4.3. Multiple operating conditions

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



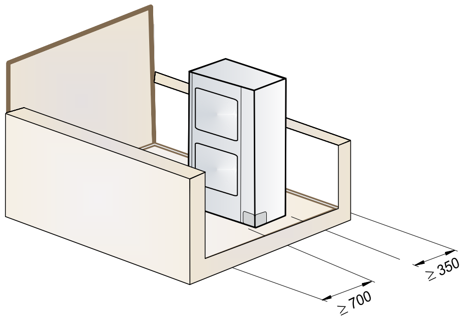
The graph shows the water supply temperature setpoint, when the room setpoint=20ºC and non room compensation is applied. The heating curve can be limited by the maximum supply setpoint parameter to prevent for example high temperatures going to the floor heating system.

1.5. Installation benefits

1.5.1. Minimal space requirement and low noise

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

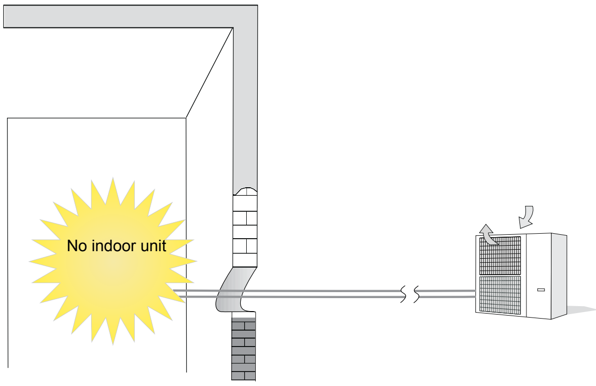
Fot this reason, the necessary space and the noise inside the house are highly reduced.



1.5.2. Reduced pipe work

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

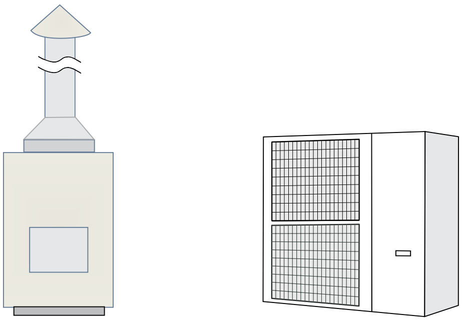
As a result, installation costs are reduced (fewer pipes, less installation time,...)



1.5.3. 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.



1.5.4. 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.

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1.6. Start-up benefits

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

1.6.2. 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.

1.7. 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

1.8. Main features of the components

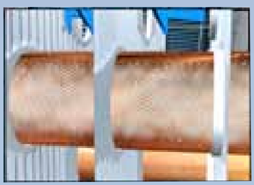
The high energy efficiency and low noise level are the result of the combination of a high-efficiency refrigerant circuit and components made with the latest-generation HITACHI technology.

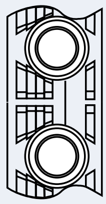
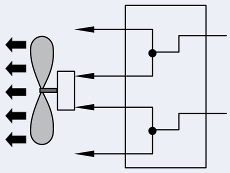
1.8.1. High-efficiency refrigerant circuit

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.

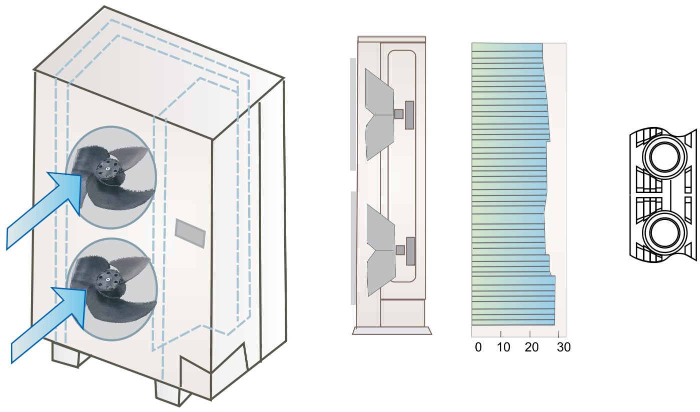
- **New aluminum fins for the heat exchanger**

  The new aluminum 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.

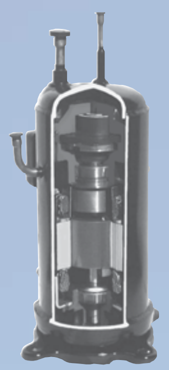


New three-blade fan

- **Larger heat exchanger**

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

Main features
of the components

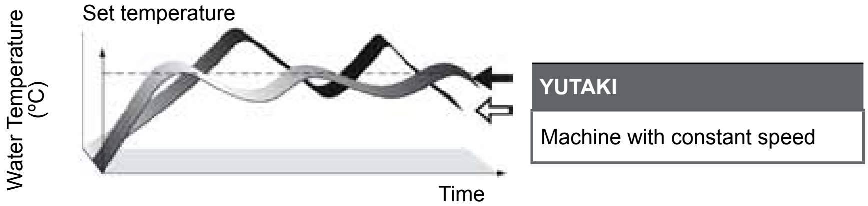


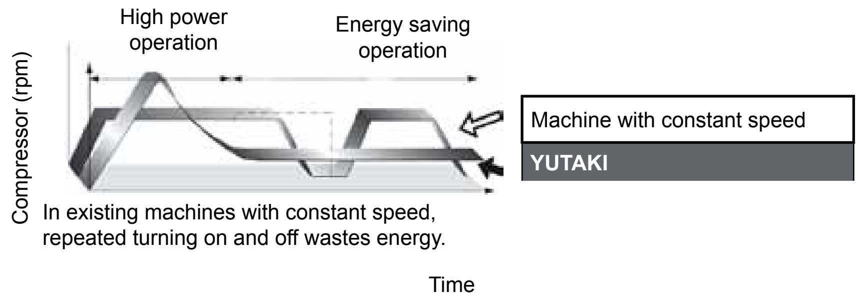
High-efficiency compressor

1.8.2. Highly efficient scroll compressor exclusive to HITACHI

- **The most relevant features of the scroll compressor in YUTAKI modules are:**
  - 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):





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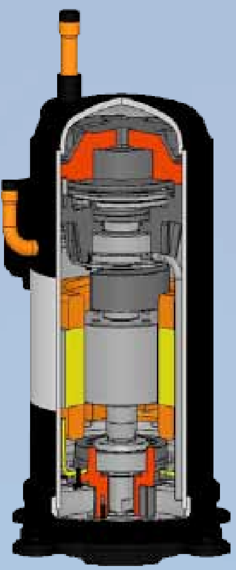


High-pressure shell compressor

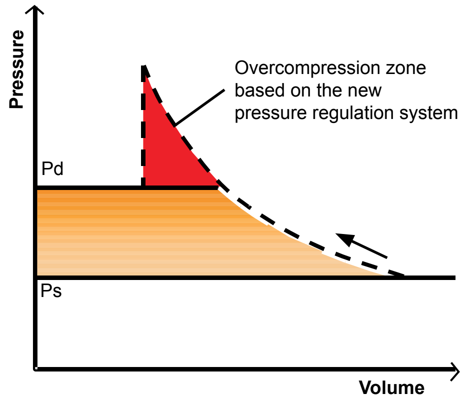
◆ High pressure shell

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.

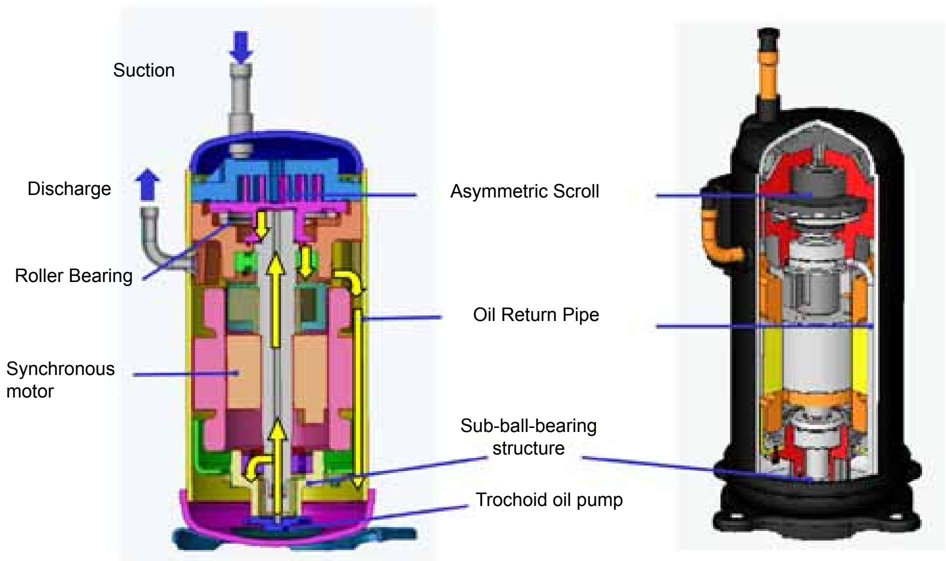
Refrigerant cannot enter the shell during the off cycle causing oil dilution and oil foaming at start up.

New 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:



◆ 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.

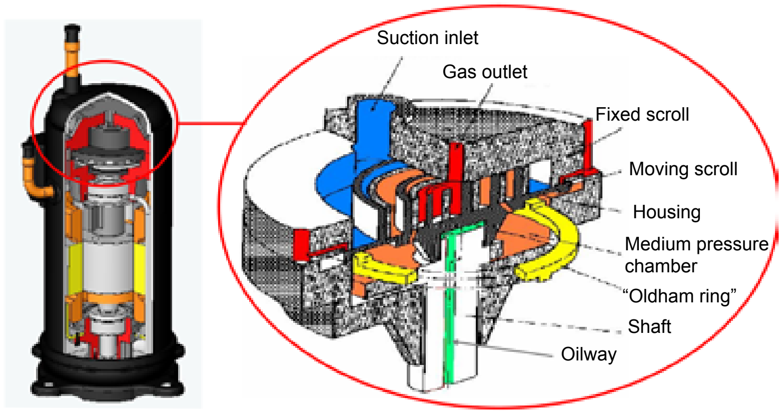


1

"Scroll" technology

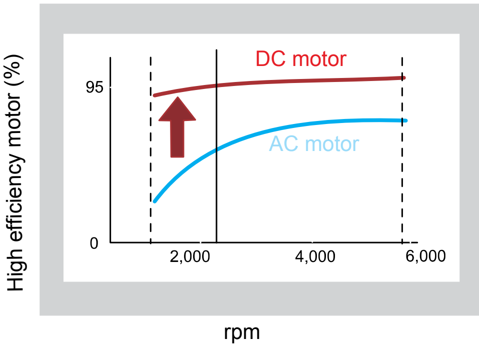
Protection against liquid return

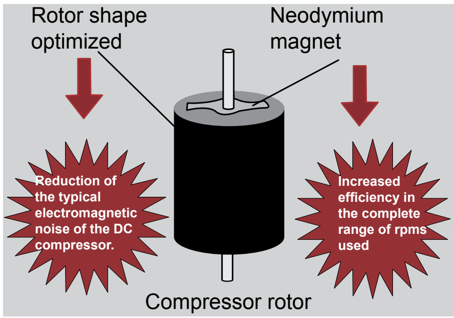
When the compressor is stopped, the moving scroll rests on the casing. When the compressor starts to run, the pressure in the chamber under the scroll builds up through two bleed holes in the medium pressure section of the compression stroke. This pressure then forces the scroll up against the housing 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.



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.

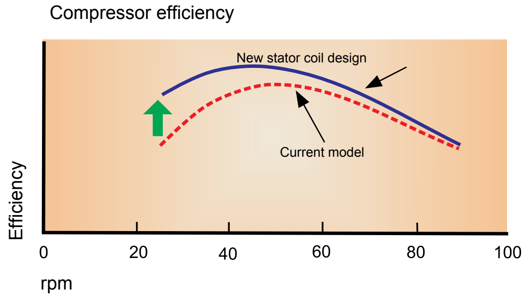




The Hitachi scroll compressor has been designed to provide maximum part load performance, resulting in a lower operating cost by reducing the energy consumption over the year.

New stator coil design

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

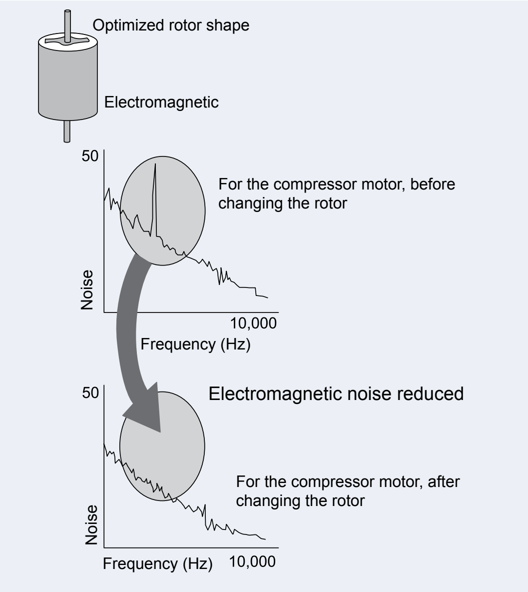


1.8.3. Reduced noise level

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

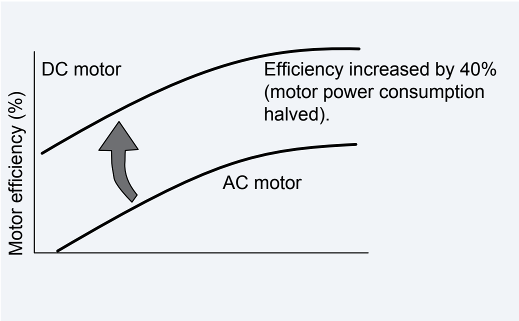
- Compression points evenly distributed along the compression stroke.
- Reduced number of components used
- Use of a high-pressure insulation shell

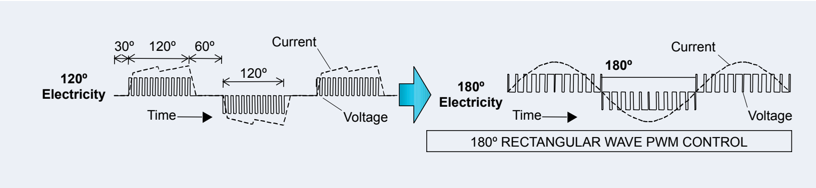
Soundproofed compressor



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.





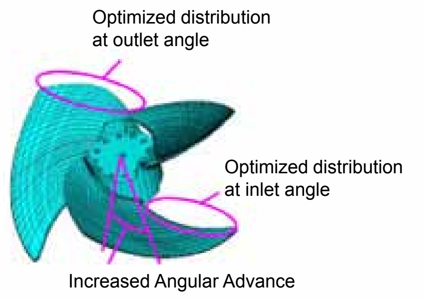
The combination of these two elements also reduces electromagnetic noise.

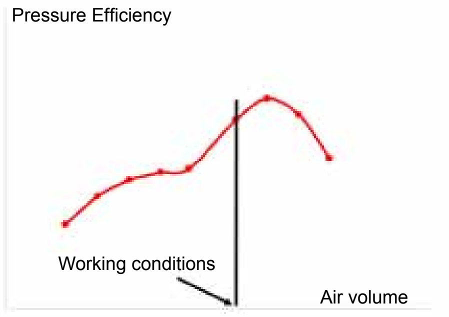
Main features
of the components

New three-blade fan with lower body

◆ **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).





2. General data

Contents

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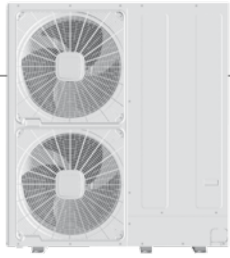
2.1. Air-to-water units



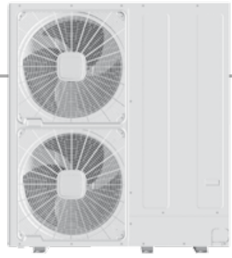
2.1.1. General data

Model			Unit	RHUE-3AVHN	RHUE-4AVHN	RHUE-5AVHN	RHUE-5AHN	RHUE-6AVHN	RHUE-6AHN
Electrical power supply				1~ 230V 50Hz			3N~ 400V 50Hz	1~ 230V 50Hz	3N~ 400V 50Hz
Heating capacity	(Min/Nom/Max) ❶ Conditions: Water Inlet/Outlet: 30/35ºC Outdoor temperature: (DB/WB): 7/6ºC		kW	5.0/7.1/8.2	5.0/9.5/10.9	6.9/12.0/15.0	6.9/12.0/15.0	7.8/14.0/17.5	7.8/14.0/17.5
	COP		-	4.28	4.06	4.01	4.01	4.31	4.31
	(Min/Nom/Max) ❷ Conditions: Water Inlet/Outlet: 40/45ºC Outdoor temperature: (DB/WB): 7/6ºC		kW	5.0/7.1/8.1	5.0/9.2/10.2	6.8/11.3/14.0	6.8/11.3/14.0	7.6/13.3/16.5	7.6/13.3/16.5
	COP		-	3.17	3.05	3.01	3.01	3.35	3.35
	(Min/Nom/Max) ❸ Conditions: Water Inlet/Outlet: 30/35ºC Outdoor temperature: (DB/WB): -7/-8ºC		kW	3.8/5.2/6.1	3.8/6.9/7.9	5.2/8.4/10.9	5.2/8.4/10.9	6.1/9.3/12.3	6.1/9.3/12.3
	COP		-	2.66	2.55	2.61	2.61	2.60	2.60
	(Min/Nom/Max) ❹ Conditions: Water Inlet/Outlet: 40/45ºC Outdoor temperature: (DB/WB): -7/-8ºC		kW	3.7/5.0/5.9	3.7/6.5/7.7	5.0/8.1/10.5	5.0/8.1/10.5	5.8/9.0/12.0	5.8/9.0/12.0
	COP		-	2.27	2.22	2.28	2.28	2.21	2.21
Sound pressure level			dB(A)	48	49	51	51	52	52
Sound power level			dB(A)	64	65	67	67	68	68
External dimensions	Height		mm	1480					
	Width		mm	1250					
	Depth		mm	444					
Net weight			kg	150	150	155	160	159	164
Refrigerant			-	R410A					
Refrigerant	Quantity		kg	2.60	2.60	3.40	3.40	4.20	4.20
	Flow control		-	Microprocessor controlled expansion valve					
Compressor	Type			DC Inverter driven					
	Quantity			1	1	1	1	1	1
	Power		kW	1.38	1.80	2.50	3.00	2.50	3.00
Heat exchanger			-	Multi-pass cross-finned tube					
Fan	Quantity		-	2	2	2	2	2	2
	Air flow rate		m^3/min	85	95	100	100	100	100
	Power		W	70+70	70+70	70+70	70+70	70+70	70+70
Nominal water flow (condition ❶)			m^3/h	1.22	1.63	2.06	2.06	2.41	2.41
Pressure drop at heat exchanger (condition: ❶)			kPa	17.6	30.8	31.6		12.0	12.0
Maximum permisible water pressure			bar	10					
Water pipe connection			-	Rp 1”					
Maximum electrical power consumption			A	18.0	18.0	26.0	11.0	29.0	15.0
Packaging dimensions			m^3	0.97	0.97	0.97	0.97	0.97	0.97
Color (Munsell code)			-	Natural Grey (1.0Y8.5/0.5)					

NOTE:

1. *The nominal heating capacities are based on EN14511. The characterisitcs apply to a new unit with clean heat exchangers.*
2. *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.
3. *The values of pressure drop at heat exchanger correspond to the maximum capacity (maximum compressor freqüency) of the unit.*

2.2. Main component data



2.2.1. Air side heat exchanger and fan

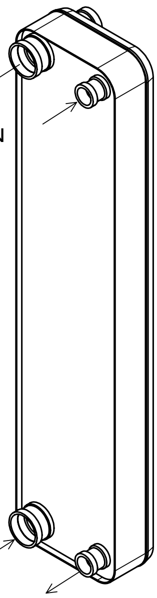
Model				RHUE-3AVHN	RHUE-4AVHN	RHUE-5AVHN	RHUE-5AHN	RHUE-6AVHN	RHUE-6AHN
Air side heat exchanger	Heat Exchanger Type		-	Multi-Pass Cross-Finned Tube					
	Piping	Material	-	Copper Piping					
		Outer Diameter	Ømm	7	7	7	7	7	7
		Rows	-	2	2	3	3	3	3
		Number of Tubes/Coil	-	132	132	198	198	198	198
	Fin	Material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

2.2.2. 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

2.2.3. Water side heat exchanger

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



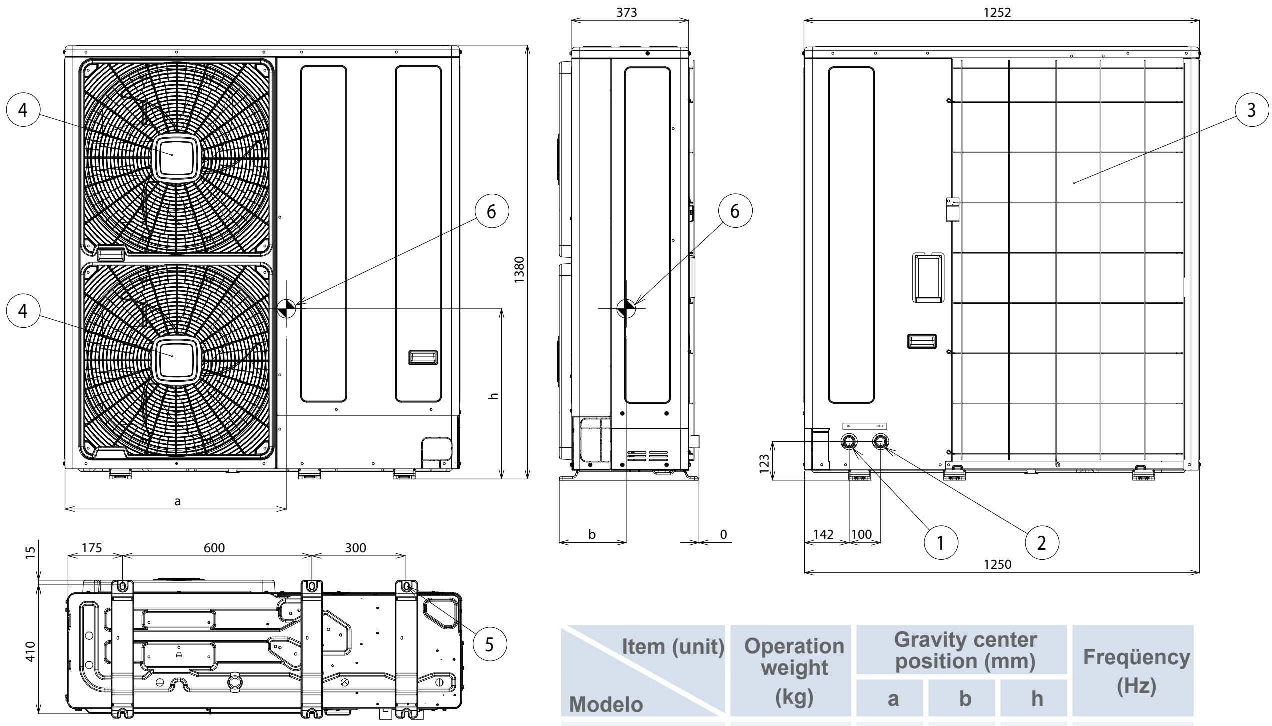
3. Dimensional data

This chapter shows the dimensions and minimum space required to install YUTAKI units.

Contents

3.1. Dimensional drawing

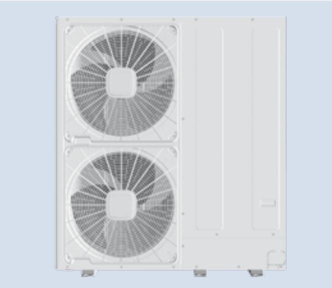
3.1.1. Dimensions



Item (unit) / Modelo	Operation weight (kg)	Gravity center position (mm)			Freqüency (Hz)
		a	b	h	
RHUE-3AVHN	130	705	223	545	55
RHUE-4AVHN	130	705	223	545	55
RHUE-5AVHN	135	695	228	560	58
RHUE-5AHN	140	695	228	560	58
RHUE-6AVHN	139	695	228	560	68
RHUE-6AHN	144	695	228	560	68

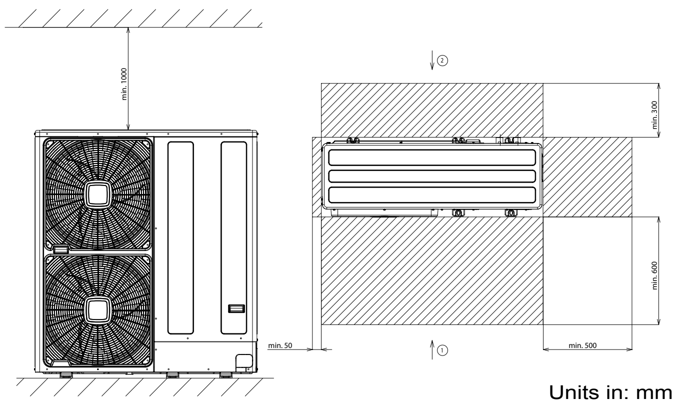
Units in: mm

No.	Description	Remarks
1	Water inlet	Rp1”
2	Water outlet	Rp1”
3	Air inlet	-
4	Air outlet	-
5	Holes for fixing unit	6-M10
6	Gravity center	-



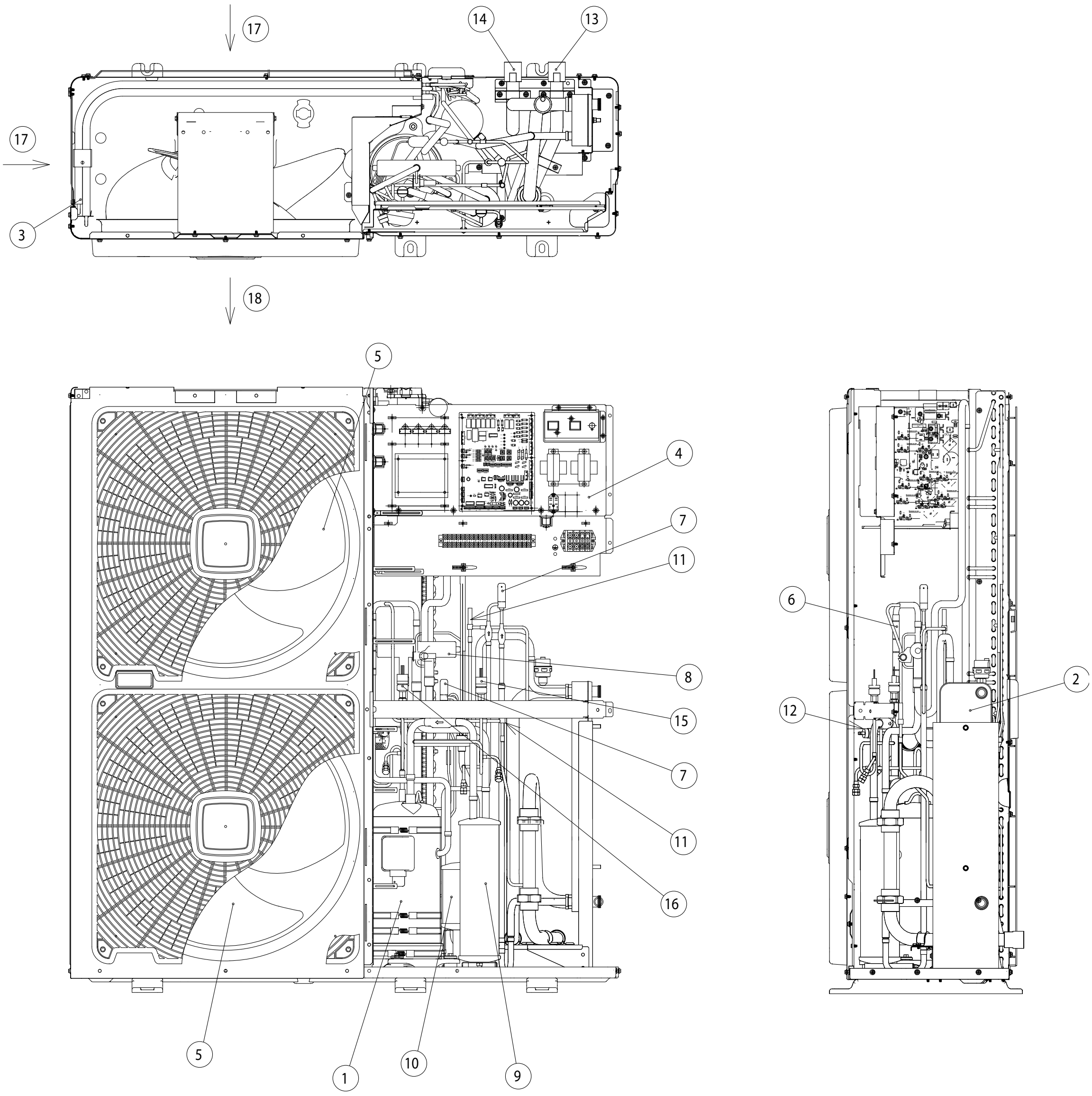
3.1.2. Service space

No.	Description
1	Frontal Side
2	Waterpipe Side

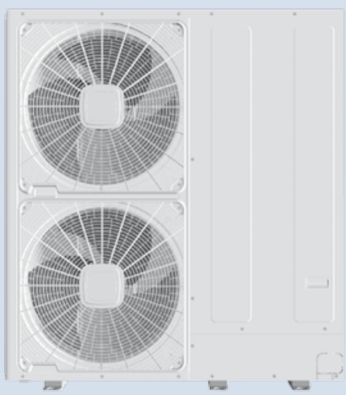


Units in: mm

3.2. Structural drawing



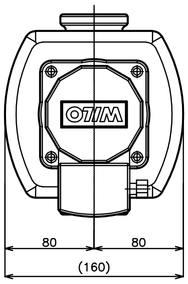
No.	Description	Remarks
1	Compressor	-
2	Water Side Heat Exchanger	-
3	Air Side Heat Exchanger	-
4	Electrical Box	-
5	Fan	x2
6	Check Valve	-
7	Electronic Expansion Valve	x2
8	4-Way Valve	-
9	Accumulator	-
10	Liquid Tank	-
11	Solenoid Valve	x2
12	High Pressure Switch	-
13	Water Inlet	Rp1”
14	Water Outlet	Rp1”
15	Low Pressure Sensor	-
16	High Pressure Sensor	-
17	Air Inlet	-
18	Air Outlet	-



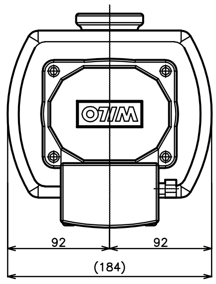
3.3. Dimensional data for accessories

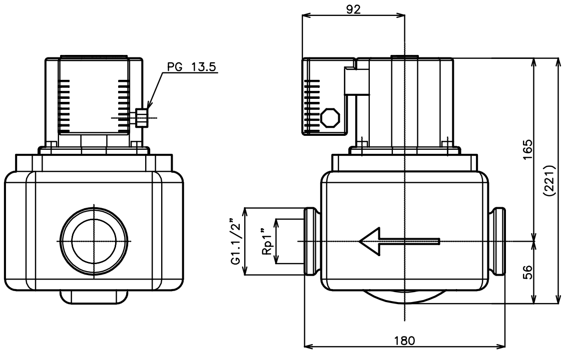
3.3.1. Pump kit

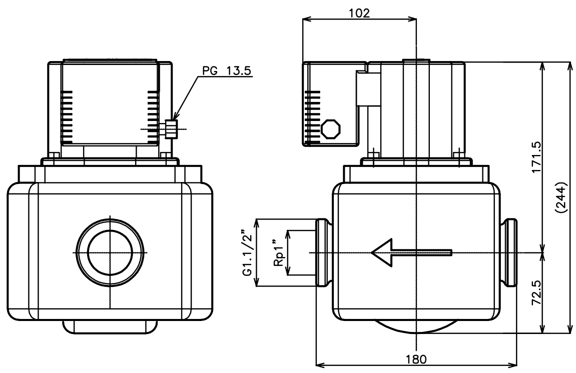
◈ TOP-S 25/7



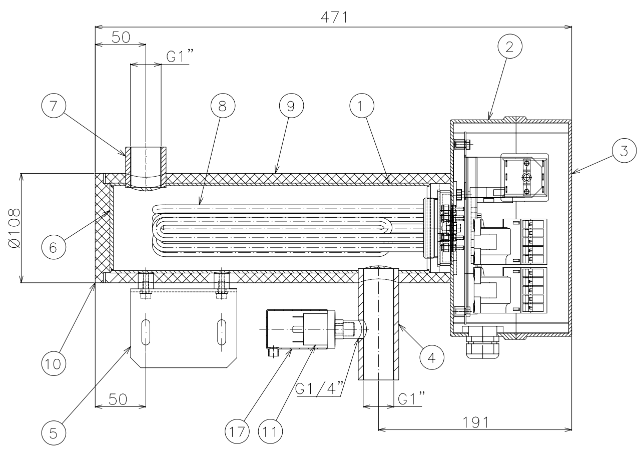
◈ TOP-S 25/10

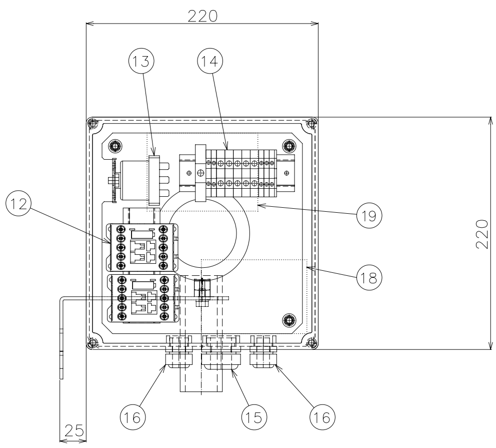






3.3.2. WEH - Water Electric Heater





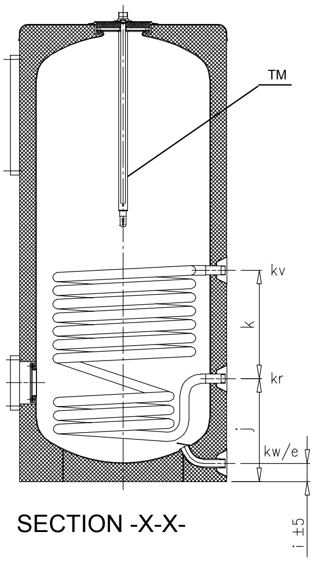
Ref.	Qty.	Name
①	1	Tank body
②	1	Front E-casing
③	1	Back E-casing
④	1	Tank in-connection
⑤	1	Wall support
⑥	1	Tank front cover
⑦	1	Tank out-connection
⑧	1	Resistance
⑨	1	Tank body insulation
⑩	1	Tank body insulation

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

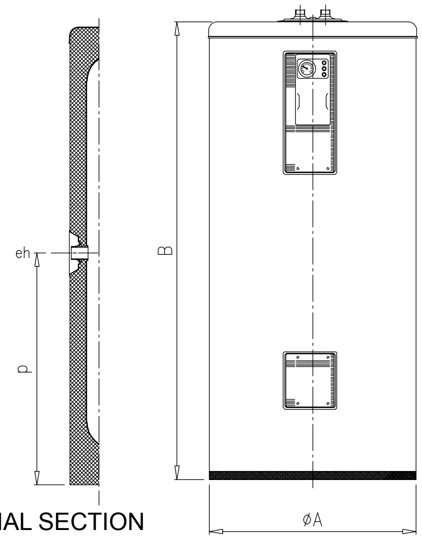
3.3.3. DHWT - Domestic Hot Water Tank

◆ **Dimensional drawings**

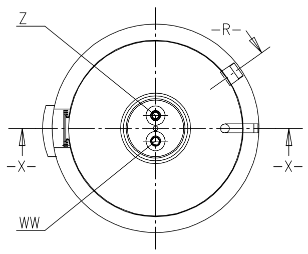
DHWT(200/300)S-2.5H1E



SECTION -X-X-



PARTIAL SECTION FOR -R-



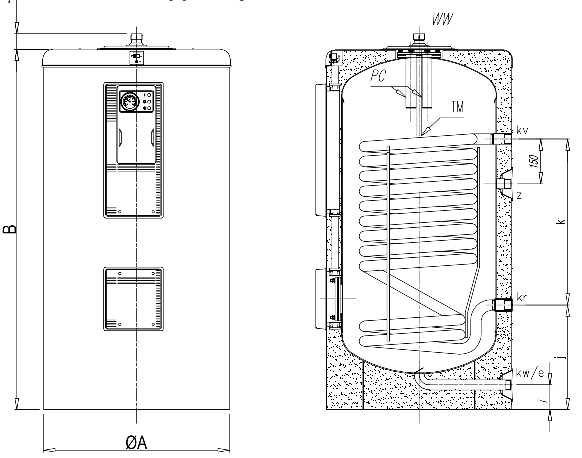
PLAN VIEW

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

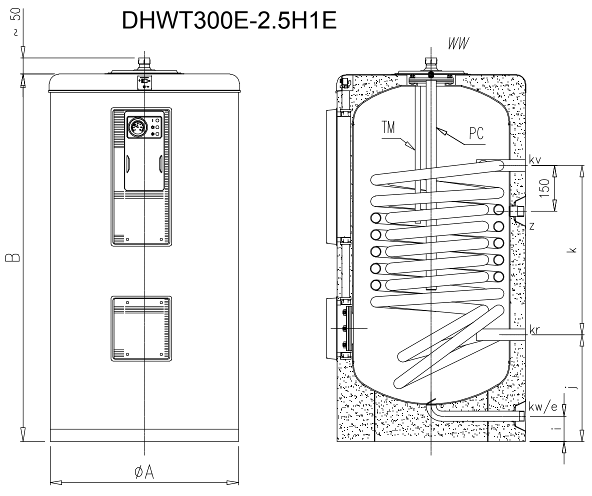
ITEM		DHWT200S-2.5H1E	DHWT300S-2.5H1E
A: External diameter	mm	620	620
B: Total length (without pipes)	mm	1205	1685
Kw: Cold water input/drain (external thread)	in.	1”	1”
ww: Hot water output (external thread)	in.	1”	1”
z: Recirculation (external thread)	in.	1”	1”
kv: Heat Pump feed (external thread)	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

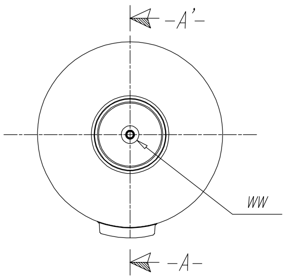
DHWT200E-2.5H1E



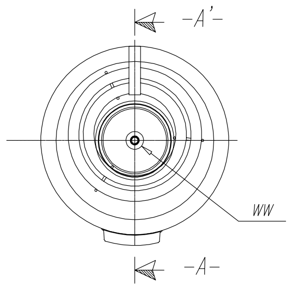
DHWT300E-2.5H1E



SECTION -A-A-



SECTION -A-A-



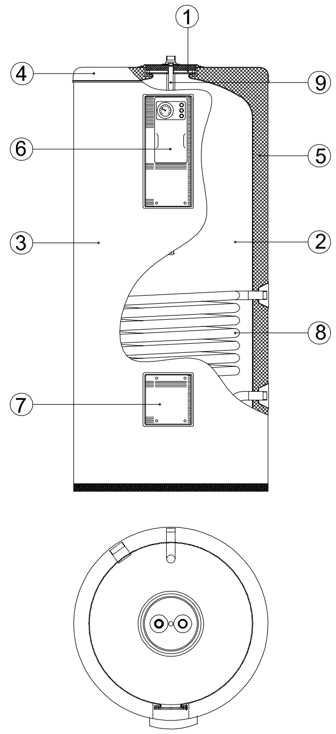
kw/e- Cold water input/drain
ww- Hot water output
z- Recirculation
kv- Heat Pump feed
kr- Heat Pump return
PC- Cathodic protection
TM- Sensor Tube

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

HITACHI
Inspire the Next

◆ Name of parts

DHWT(200/300)S-2.5H1E

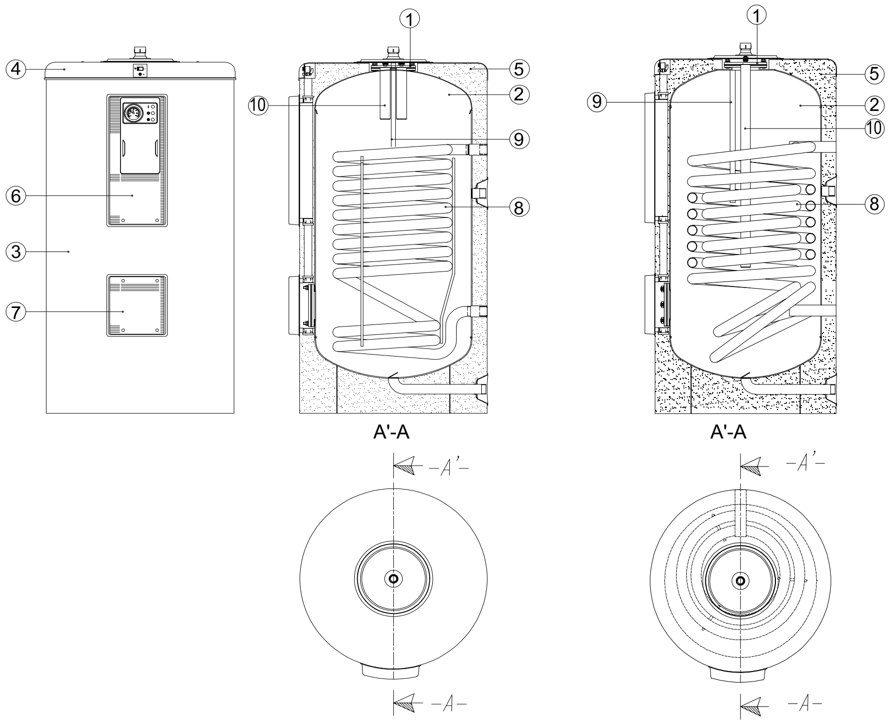


Ref.	Qty.	Name
①	1	Inspection aperture
②	1	HSW storage tank
③	1	External covering
④	1	Top cover
⑤	1	Thermal insulation
⑥	1	Control panel
⑦	1	Electrical Heater
⑧	1	Heating coil
⑨	1	Sensor probe

3

DHWT(200/300)E-2.5H1E

DHWT200E-2.5H1E DHWT300E-2.5H1E



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

4. Capacities and selection data

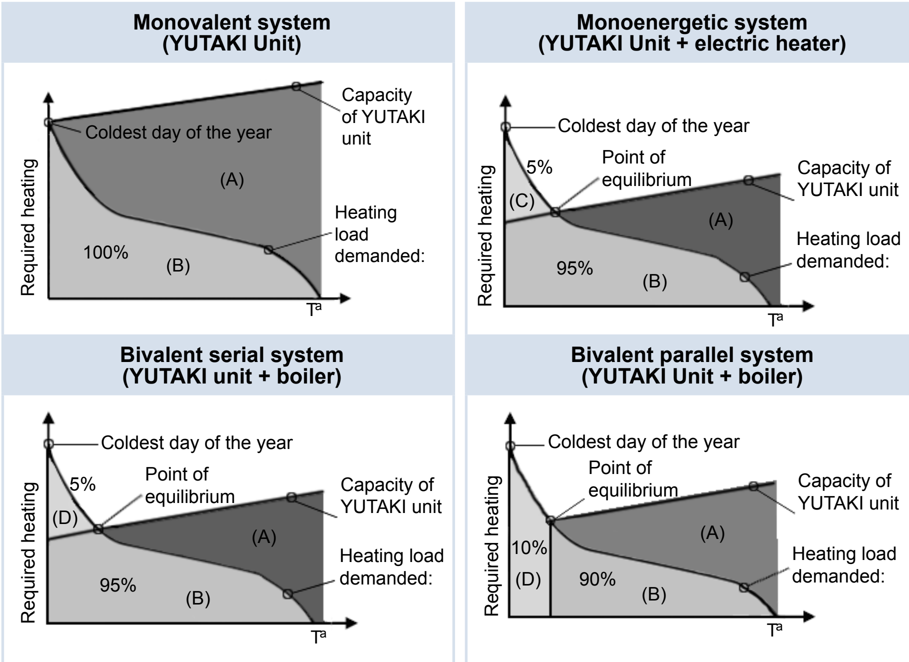
This chapter is a guide for selecting the most suitable units for your requirements and shows you the performance details of each unit YUTAKI

Contents

4.1. Selection procedure for YUTAKI units

The following procedure gives an example of selection of YUTAKI units based on a series of previously defined installation requirements: heating load required, operating temperatures and special characteristics on the installation (energy system used, power source, 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 unit

(B) Capacity covered by the YUTAKI 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 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 2.
- Operation space possibilities: Chapter 3.
- Operating range: Chapter 5.
- Different possible energy systems: Chapter 7.
- Maximum heating capacities: Section 4.2.
- Different correction factors, see: Section 4.4.
- Partial load performance: Section 4.5.
- Circulating pump operating curves: Section 4.6.
- Noise data for the different units: Section 4.7.

4.1.2. Selection procedure

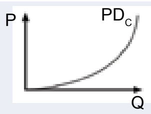
The selection procedure given in this chapter is a simple example structured into three main blocks:

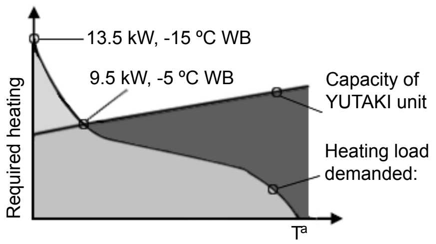
First, a) once the energy system to be used has been chosen (single-energy), a YUTAKI unit is selected depending on the normal heating load. Next, b) a check is made to ensure that the combination (YUTAKI + electric heater) covers the temporary needs of the coldest days of the year. The calculation will 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	1~230 V, 50 Hz
Type of glycol to use	Ethylene
Pressure loss on the client's hydraulic installation (PD_c)	



These conditions will determine the entry in the capacity table (section 4.2), 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).

☛ **Table 1:**

Maximum heating capacity table

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

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

NOTE:

When working with the temperature of an outdoor air inlet with a value not included in the capacities table of section 4.2. (for example, -3 ºC), an interpolation will be 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:

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

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

The maximum heating capacity (Q_{Mh}) of the RHUE-5AVHN 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 see section 4.4.1 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_l:

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., 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 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 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 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 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 (section 4.2) to decide the maximum heating capacity the RHUE-5AVHN 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.

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

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

◈ Calculation of f_d:

The tables in section 4.4.1 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. 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 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 unit + electric heater)

The estimated required heating load for the coldest days of the year is 13.5 kW.

After applying the relative actual heating capacity correction factors provided by the RHUE-5AVHN unit is for the coldest days.

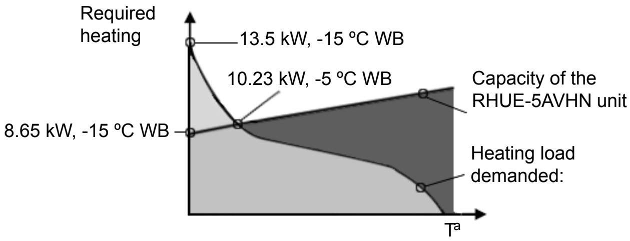
In such cases, the electric heater provides the heating load required to cover temporary heating needs.

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

$$Q_h = 8.65\ \text{kW} + 6\ \text{kW} = \mathbf{14.65\ kW}$$

The heating capacity resulting from the combination (YUTAKI 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 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 units do not have the water circulating pump as standard equipment. However, HITACHI offers the client two 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 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 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., 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**.

4

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 5, where the maximum and minimum flow for each YUTAKI 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. 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, as well as those on the unit itself, working with the flow calculated previously.

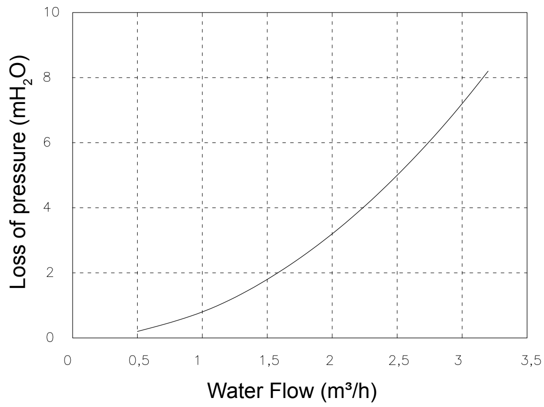
Section 4.6 shows the operating details of the various YUTAKI units (operation of circulating pumps, including heat exchanger pressure losses). Once it is known that the operating data for the 2 pump models include pressure losses from the unit itself, the data needed are the pressure losses from the client's hydraulic unit.

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 installation (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 m³/h.

Step 4:

Selecting the circulating water pump

The next step is to select a water pump from the YUTAKI 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 “Yutaki circulating pumps data” to select the pump which is most suitable for the RHUE-5AVHN 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 unit (operating curves for the circulating pumps with pressure loss in the heat exchanger included, shown in section “Yutaki circulating pumps data”).

NOTE:

B: Circulating water pump

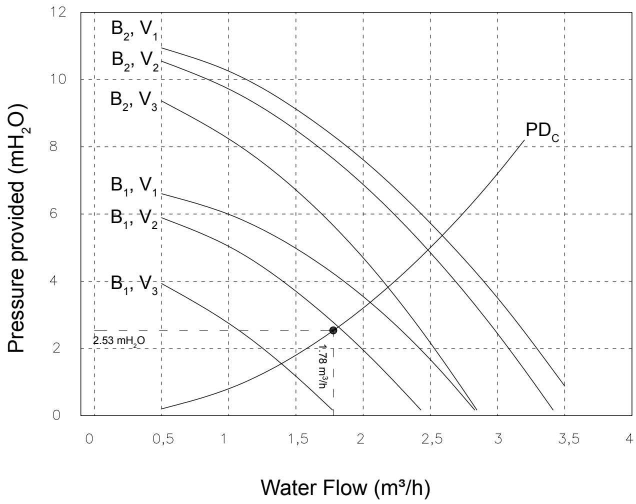
B_1: TOP-S 25/7

B_2: TOP-S 25/10

V: Pump motor speed

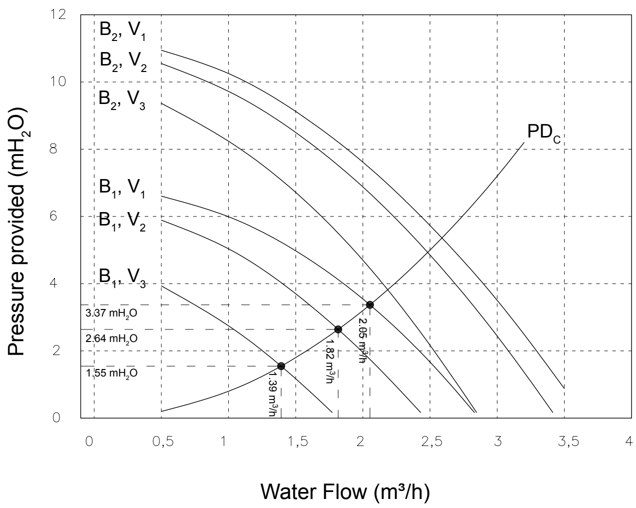
- V_1: High
- V_2: Medium
- V_3: Low

PD_C: Pressure loss in the client’s hydraulic installation



The chart shows that the calculated working point falls between 2 possible pump 1 speed configurations, so this will be the selected pump. Its working speed V2 or V3 must be chosen, assuming that the actual working flow rate will be higher or lower than the theoretical calculation.

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



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 (chapter 6).

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

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

4

4.2. Selection procedure of Domestic Hot Water Tank

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

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

NOTE:

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

4.3. Maximum heating capacities

Ambient temperature (°C WB)	Water outlet temperature (°C)	RHUE-3AVHN Maximum heating capacity (kW)	RHUE-3AVHN Water flow rate (m^3/h)	RHUE-4AVHN Maximum heating capacity (kW)	RHUE-4AVHN Water flow rate (m^3/h)	RHUE-5A(V)HN Maximum heating capacity (kW)	RHUE-5A(V)HN Water flow rate (m^3/h)	RHUE-6A(V)HN Maximum heating capacity (kW)	RHUE-6A(V)HN Water flow rate (m^3/h)
-20	35	4,9	0,84	5.9	1.01	8.4	1.45	9.1	1.56
	40	4,7	0,81	6.0	1.03	8.4	1.44	9.2	1.58
	45	4,5	0,77	6.1	1.05	8.3	1.43	9.3	1.60
	50	4,4	0,76	6.2	1.07	8.2	1.42	9.2	1.58
-15	35	5,5	0,95	6.8	1.17	9.7	1.67	10.7	1.84
	40	5,4	0,93	6.8	1.16	9.5	1.63	10.7	1.84
	45	5,2	0,89	6.7	1.15	9.2	1.58	10.7	1.84
	50	5,2	0,89	6.7	1.14	8.9	1.54	10.6	1.82
-10	35	6,2	1,06	7.9	1.36	11.0	1.89	12.3	2.12
	40	6,1	1,05	7.8	1.33	10.6	1.83	12.2	2.10
	45	5,9	1,01	7.6	1.31	10.3	1.77	12.1	2.08
	50	5,8	1,00	7.4	1.26	10.1	1.73	11.4	1.95
	55	5,7	0,98	7.1	1.22	9.8	1.69	10.6	1.83
-8	35	6,4	1,10	8.3	1.43	11.5	1.97	13.0	2.23
	40	6,3	1,08	8.2	1.41	11.2	1.93	12.8	2.20
	45	6,2	1,06	8.1	1.39	11.0	1.89	12.6	2.17
	50	6,0	1,03	7.8	1.33	10.6	1.82	11.9	2.05
	55	5,9	1,01	7.4	1.27	10.2	1.75	11.3	1.94
-5	35	6,8	1,17	8.6	1.48	11.8	2.03	13.9	2.40
	40	6,7	1,15	8.4	1.44	11.5	1.98	13.7	2.36
	45	6,6	1,14	8.2	1.41	11.3	1.94	13.5	2.32
	50	6,4	1,10	8.0	1.38	11.0	1.89	12.8	2.20
	55	6,3	1,08	7.9	1.36	10.8	1.86	12.2	2.09
0	35	7,5	1,29	9.6	1.65	13.5	2.32	15.6	2.67
	40	7,4	1,27	9.4	1.61	13.0	2.23	15.2	2.61
	45	7,3	1,26	9.1	1.57	12.5	2.15	14.8	2.55
	50	7,1	1,22	8.9	1.52	12.2	2.09	14.3	2.45
	55	6,8	1,17	8.6	1.48	11.8	2.03	13.7	2.35
6	30	8,5	1,46	11.3	1.94	15.5	2.67	18.0	3.10
	35	8,2	1,41	10.9	1.87	15.0	2.58	17.5	3.01
	40	8,2	1,41	10.6	1.81	14.5	2.49	17.0	2.92
	45	8,1	1,39	10.2	1.75	14.0	2.41	16.5	2.84
	50	7,8	1,34	9.9	1.69	13.5	2.32	16.0	2.75
	55	7,5	1,29	9.5	1.63	13.0	2.24	15.5	2.67
10	30	9,1	1,57	12.3	2.11	16.5	2.84	19.3	3.33
	35	8,7	1,50	11.8	2.03	16.0	2.75	18.8	3.23
	40	8,7	1,50	11.4	1.95	15.5	2.67	18.2	3.13
	45	8,7	1,50	10.9	1.87	15.0	2.58	17.6	3.03
	50	8,3	1,43	10.5	1.81	14.4	2.48	17.2	2.95
	55	8,0	1,38	10.1	1.74	13.8	2.37	16.7	2.87
15	25	10,3	1,77	13.6	2.34	19.3	3.32	21.9	3.77
	30	9,8	1,69	13.2	2.27	18.3	3.15	21.2	3.64
	35	9,3	1,61	12.8	2.20	17.3	2.97	20.4	3.51
	40	9,3	1,61	12.3	2.12	16.7	2.88	19.7	3.39
	45	9,3	1,61	11.8	2.03	16.2	2.79	19.0	3.27
	50	9,0	1,55	11.3	1.94	15.5	2.67	18.6	3.20
	55	8,6	1,48	10.8	1.86	14.8	2.55	18.2	3.14
20	20	11,3	1,94	14.7	2.52	22.6	3.89	25.2	4.33
	25	11,1	1,91	14.4	2.48	21.3	3.66	23.9	4.10
	30	10,5	1,81	14.2	2.43	19.9	3.42	23.0	3.95
	35	10,0	1,72	13.9	2.39	18.5	3.19	22.1	3.79
	40	10,0	1,72	13.3	2.29	18.0	3.09	21.2	3.65
	45	10,0	1,72	12.7	2.18	17.4	2.99	20.4	3.50
	50	9,6	1,65	12.1	2.08	16.6	2.86	20.1	3.45
	55	9,2	1,58	11.5	1.98	15.8	2.72	19.7	3.40

4.4. Capacities and COP

Inlet/outlet water temperature: 30/35 ºC Ambient temperature DB/WB: 7 / 6 ºC				
Yutaki Unit	Capacity (kW)	Input Power (kW)	COP	Performance
RHUE-3AVHN	7.1	1.66	4.28	A
RHUE-4AVHN	9.5	2.34	4.06	A
RHUE-5AVHN	12	2.99	4.01	B
RHUE-5AHN	12	2.99	4.01	B
RHUE-6AVHN	14.0	3.25	4.31	A
RNUE-6AHN	14.0	3.25	4.31	A

Inlet/outlet water temperature: 40/45 ºC Ambient temperature DB/WB: 7 / 6 ºC				
Yutaki Unit	Capacity (kW)	Input Power (kW)	COP	Performance
RHUE-3AVHN	7.1	2.24	3.17	B
RHUE-4AVHN	9.2	3.02	3.05	B
RHUE-5AVHN	11.3	3.75	3.01	B
RHUE-5AHN	11.3	3.75	3.01	B
RHUE-6AVHN	13.3	3.97	3.35	A
RHUE-6AHN	13.3	3.97	3.35	A

Inlet/outlet water temperature: 30/35 ºC Ambient temperature DB/WB: -7 / -8 ºC			
Yutaki Unit	Capacity (kW)	Input Power (kW)	COP
RHUE-3AVHN	5.2	1.95	2.66
RHUE-4AVHN	6.9	2.71	2.55
RHUE-5AVHN	8.4	3.22	2.61
RHUE-5AHN	8.4	3.22	2.61
RHUE-6AVHN	9.3	3.58	2.60
RHUE-6AHN	9.3	3.58	2.60

Inlet/outlet water temperature: 40/45 ºC Ambient temperature DB/WB: -7 / -8 ºC			
Yutaki Unit	Capacity (kW)	Input Power (kW)	COP
RHUE-3AVHN	5.0	2.20	2.27
RHUE-4AVHN	6.5	2.93	2.22
RHUE-5AVHN	8.1	3.55	2.28
RHUE-5AHN	8.1	3.55	2.28
RHUE-6AVHN	9.0	4.07	2.21
RHUE-6AHN	9.0	4.07	2.21

◆ Classification of performance depending on the operating conditions of the unit

Performance class	Ambient temperature DB/WB: 7 / 6 ºC	
	Inlet/outlet water temperature: 30 / 35 ºC	Inlet/outlet water temperature: 40 / 45 ºC
A	4.05<COP	3.20<COP
B	4.05≥COP>3.90	3.20≥COP>3.00
C	3.90≥COP>3.75	3.00≥COP>2.80
D	3.75≥COP>3.60	2.80≥COP>2.60
E	3.60≥COP>3.45	2.60≥COP>2.40
F	3.45≥COP>3.30	2.40≥COP>2.20
G	3.30≥COP	2.20≥COP

4.5. Correction factors

4.5.1. Defrosting correction factor

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

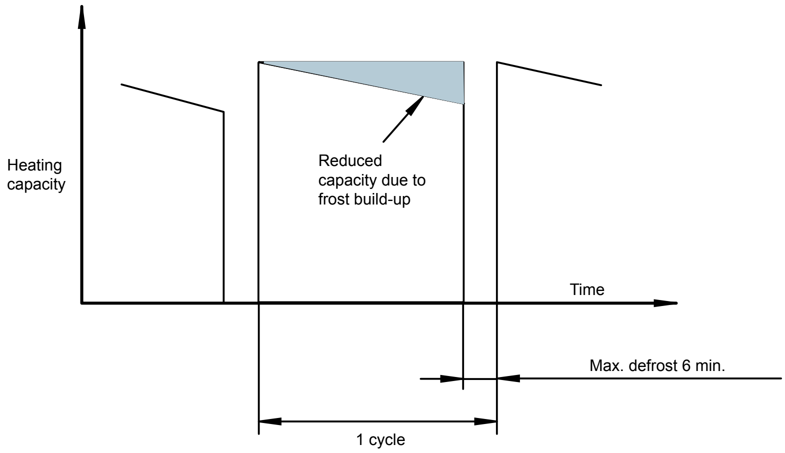
When this type of operation is taken in account, the heating capacity must be corrected according to the following equation.

Corrected Heating Capacity = defrost correction factor x heating Capacity

Ambient temperature (ºC DB) (HR = 85%)	-20	-7	-5	-3	0	3	5	7
Defrosting correction factor f_d	0.95	0.95	0.93	0.88	0.85	0.87	0.90	1.0

NOTE:

The correction factor is not valid for special conditions such as during snow or operation in a transitional period.



4.5.2. 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

4.6. Partial load performance

◆ **Water Outlet Temperature: 45 ºC**

◈ RHUE-3AVHN

Ambient Temperature (ºC WB)	Performance		Compressor Load										
20	Capacity	%					75	80	90	100	110	120	125
	Consumed power	%					69	72	78	85	93	102	106
	COP	%					108	111	115	118	118	118	118
10	Capacity	%				65	70	80	90	100	107		
	Consumed power	%				67	70	78	85	94	102		
	COP	%				97	100	103	106	106	105		
6	Capacity	%				62	70	80	90	100			
	Consumed power	%				66	72	80	89	100			
	COP	%				94	97	100	101	100			
0	Capacity	%			56	60	70	80	89				
	Consumed power	%			64	68	77	87	97				
	COP	%			88	88	91	92	92				
-10	Capacity	%		44	50	60	70	72					
	Consumed power	%		61	67	78	91	93					
	COP	%		72	75	77	77	77					
-20	Capacity	%	37	40	50	59							
	Consumed power	%	58	62	75	89							
	COP	%	64	65	67	66							

▭ : Standard conditions (Ambient: 7 ºC (DB)/6 ºC (WB), water inlet/outlet: 40/45 ºC, máx. Hz)

Standard conditions		
Heating capacity (kW)	Consumed power (kW)	COP
8.1	2.58	3.14

4

◈ RHUE-(4/5)A(V)HN

Ambient Temperature (ºC WB)	Performance		Compressor Load											
20	Capacity	%					61	70	80	90	100	110	120	124
	Consumed power	%					52	57	64	71	79	90	101	106
	COP	%					117	123	125	127	127	122	119	117
10	Capacity	%				52	60	70	80	90	100	107		
	Consumed power	%				49	55	63	71	82	94	102		
	COP	%				106	109	111	113	110	106	105		
6	Capacity	%			49	50	60	70	80	90	**100**			
	Consumed power	%			49	50	57	65	75	87	**100**			
	COP	%			100	100	105	108	107	103	**100**			
0	Capacity	%			44	50	60	70	80	89				
	Consumed power	%			47	53	61	72	84	97				
	COP	%			94	94	98	97	95	92				
-10	Capacity	%		35	40	50	60	70	71					
	Consumed power	%		45	50	60	73	91	93					
	COP	%		78	80	83	82	77	76					
-20	Capacity	%	29	30	40	50	59							
	Consumed power	%	43	44	56	71	89							
	COP	%	67	68	71	70	66							

▭ : Standard conditions (Ambient: 7 ºC (DB)/6 ºC (WB), water inlet/outlet: 40/45 ºC, máx. Hz)

Model	Standard conditions		
	Heating capacity (kW)	Consumed power (kW)	COP
RHUE-4AVHN	10.2	3.47	2.94
RHUE-5A(V)HN	14.0	4.95	2.83

◈ RHUE-6A(V)HN

Ambient Temperature (ºC WB)	Performance		Compressor Load											
20	Capacity	%					55	70	80	90	104	110	120	123
	Consumed power	%					55	57	61	67	80	87	100	105
	COP	%					102	122	131	134	133	127	120	120
10	Capacity	%				49	60	70	80	89	100	107		
	Consumed power	%				52	55	60	68	77	91	101		
	COP	%				115	110	117	118	115	110	105		
6	Capacity	%			46	50	60	70	80	90	100			
	Consumed power	%			50	52	58	66	76	87	100			
	COP	%			93	96	104	107	106	104	100			
0	Capacity	%			42	50	60	70	80	90				
	Consumed power	%			48	53	62	72	84	98				
	COP	%			89	94	98	98	95	92				
-10	Capacity	%		36	40	50	60	70	73					
	Consumed power	%		45	51	66	80	91	95					
	COP	%		82	78	75	75	77	74					
-20	Capacity	%	29	30	40	50	56							
	Consumed power	%	41	44	79	93	91							
	COP	%	73	68	50	54	56							

▭ : Standard conditions (Ambient: 7 ºC (DB)/6 ºC (WB), water inlet/outlet: 40/45 ºC, máx. Hz)

Standard conditions		
Heating capacity (kW)	Consumed power (kW)	COP
16.5	5.24	3.15

4.7. YUTAKI circulating pumps data

As described in the selection process for the YUTAKI module (section 4.1.), HITACHI makes two circulating pump models available for clients to select as accessories.

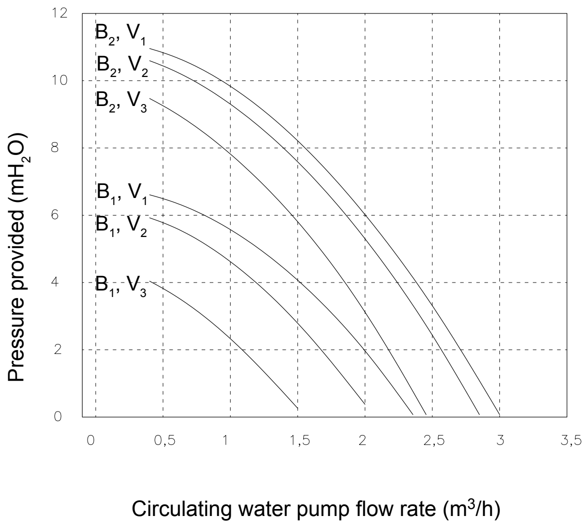
The characteristics of YUTAKI units are given in tables below, with their respective operating curves:

NOTE:

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

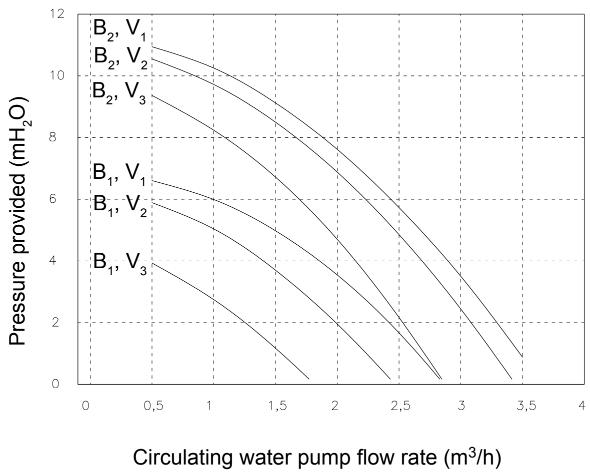
◆ RHUE-(3/4)AVHN

Circulating water pump flow rate (m^3/h) / Pump motor speed	TOP-S 25/7: Pressure provided (mH_2O)			TOP-S 25/10: Pressure provided (mH_2O)		
	Hi	Med	Low	Hi	Med	Low
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	-



◆ RHUE-5A(V)HN

Circulating water pump flow rate (m^3/h) / Pump motor speed	TOP-S 25/7: Pressure provided (mH_2O)			TOP-S 25/10: Pressure provided (mH_2O)		
	Hi	Med	Low	Hi	Med	Low
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	'-	'-



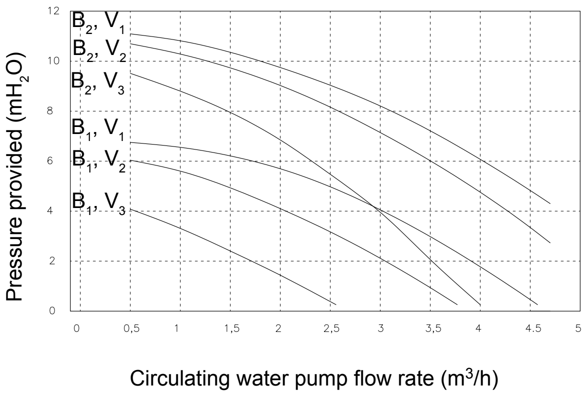
NOTE:

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

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

◆ RHUE-6A(V)HN

Circulating water pump flow rate (m^3/h) \ Pump motor speed	TOP-S 25/7: Pressure provided (mH_2O)			TOP-S 25/10: Pressure provided (mH_2O)		
	Hi	Med	Low	Hi	Med	Low
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:

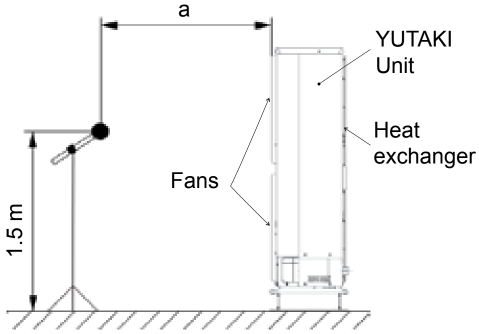
$B_{(1.2)}$: Circulating water pump

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

4

4.8. Noise data

This section shows details of noise on the various Yutaki 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-3AVHN	54.5	47.5	46.5	45.5	43	41	32	34	48
RHUE-4AVHN	55.5	48.5	47.5	46.5	44	42	33	35	49
RHUE-5AVHN	57.5	50.5	49.5	48.5	46	44	35	37	51
RHUE-5AHN	57.5	50.5	49.5	48.5	46	44	35	37	51
RHUE-6AVHN	58.5	51.5	50.5	49.5	47	45	36	38	52
RHUE-6AHN	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-3AVHN	42.5	35.5	34.5	33.5	31	29	20	22	36
RHUE-4AVHN	43.5	36.5	35.5	34.5	32	30	21	23	37
RHUE-5AVHN	45.5	38.5	37.5	36.5	34	32	23	25	39
RHUE-5AHN	45.5	38.5	37.5	36.5	34	32	23	25	39
RHUE-6AVHN	46.5	39.5	38.5	37.5	35	33	24	26	40
RHUE-6AHN	46.5	39.5	38.5	37.5	35	33	24	26	40

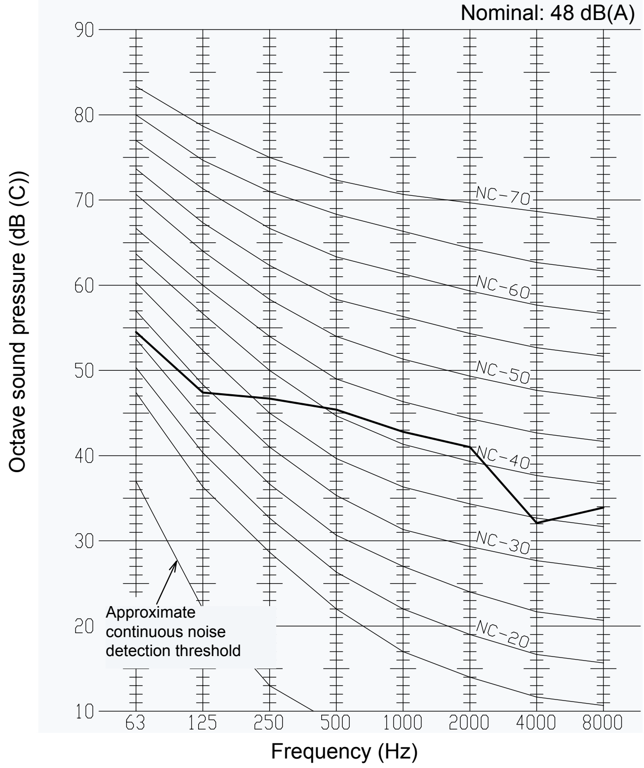
NOTES:

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.*

Model: RHUE-3AVHN	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

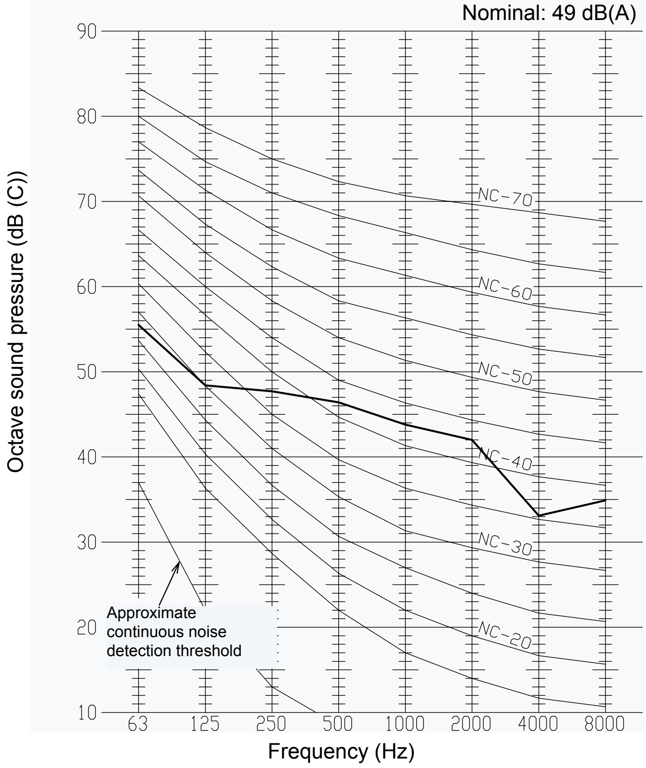
Nominal: 48 dB(A)



Model: RHUE-4AVHN	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)

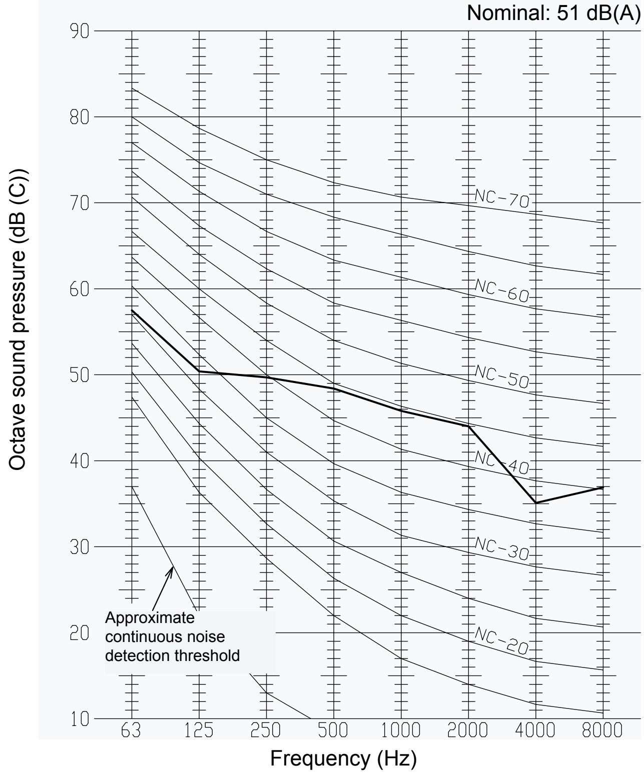


4

Model: RHUE-5AVHN	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

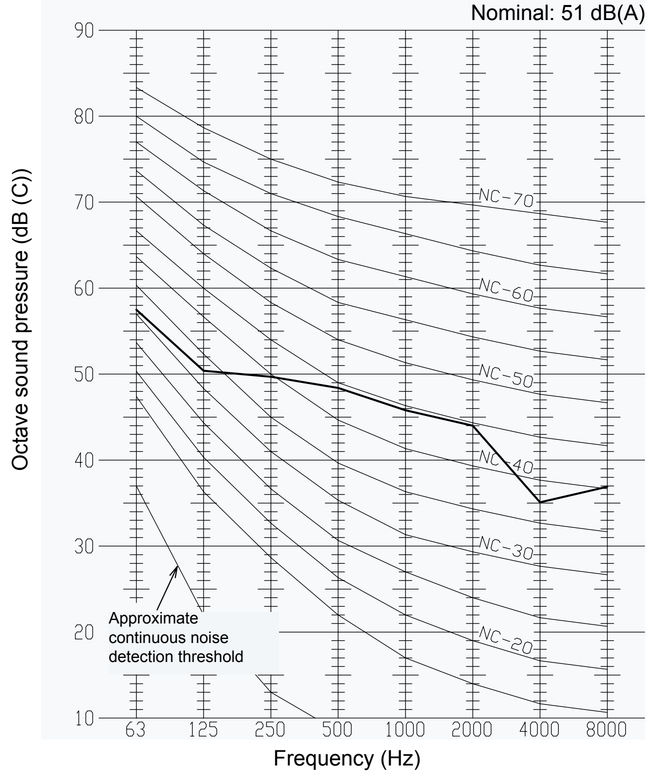
Nominal: 51 dB(A)



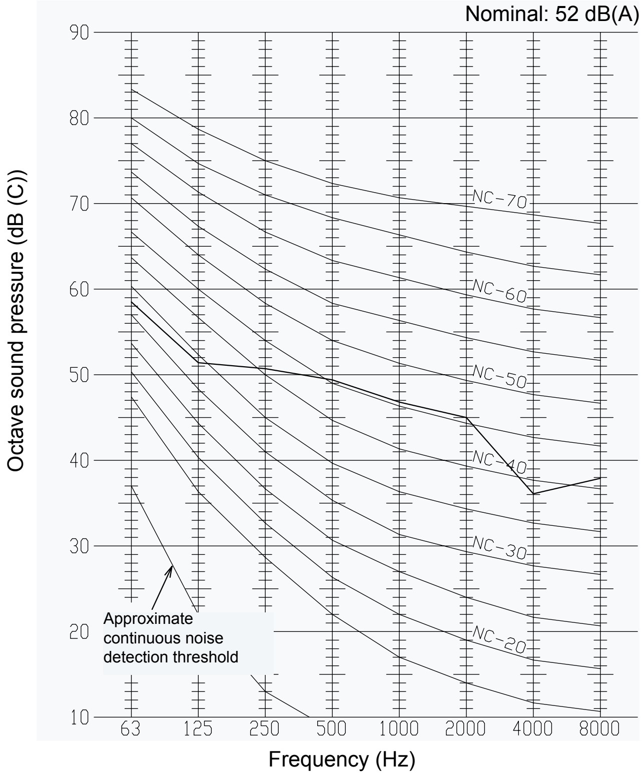
Model: RHUE-5AHN	Power supply: 400 V 50 Hz
Measurement point:	1.5 metres from floor level 1 meter from the front surface of the unit.

Sound criteria curve

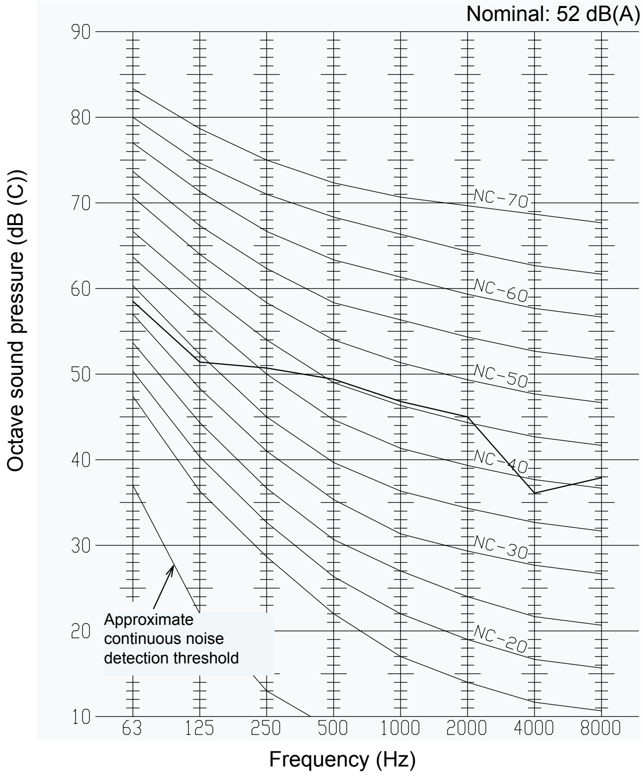
Nominal: 51 dB(A)



Model: RHUE-6AVHN	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



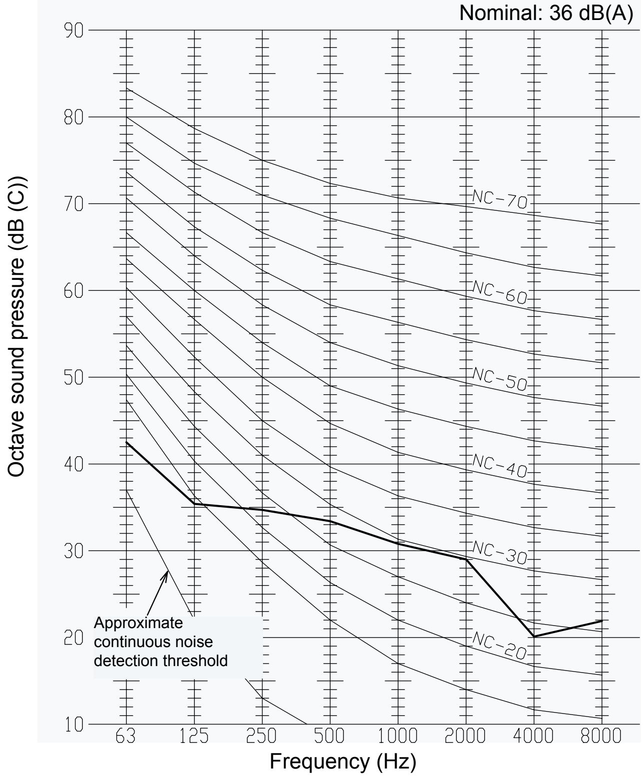
Model: RHUE-6AHN	Power supply: 400 V 50 Hz
Measurement point:	1.5 metres from floor level 1 meter from the front surface of the unit. Sound criteria curve



Model: RHUE-3AVHN | 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

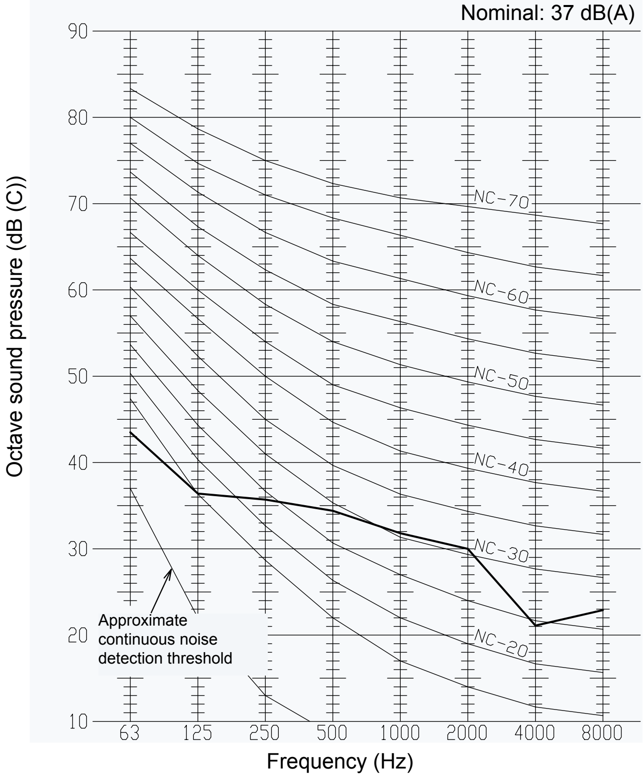
Nominal: 36 dB(A)



Model: RHUE-4AVHN | 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

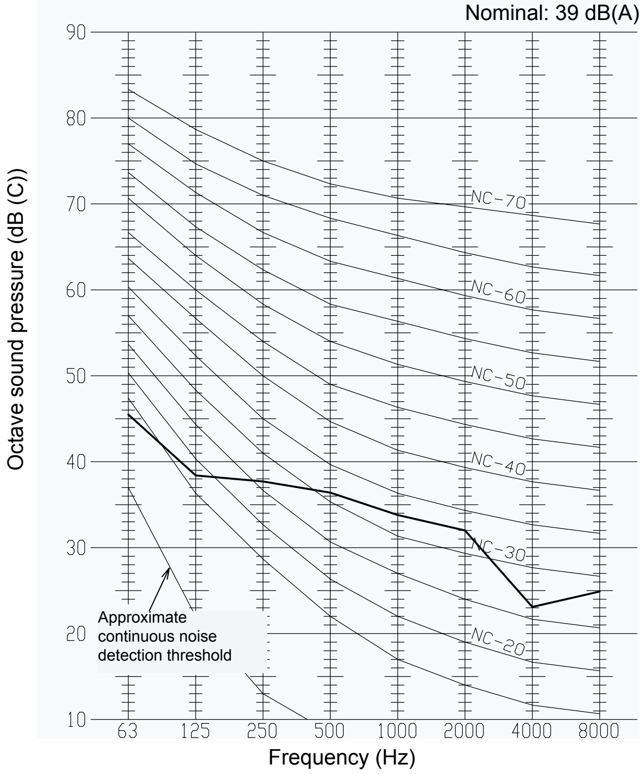
Nominal: 37 dB(A)



Model: RHUE-5AVHN | 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

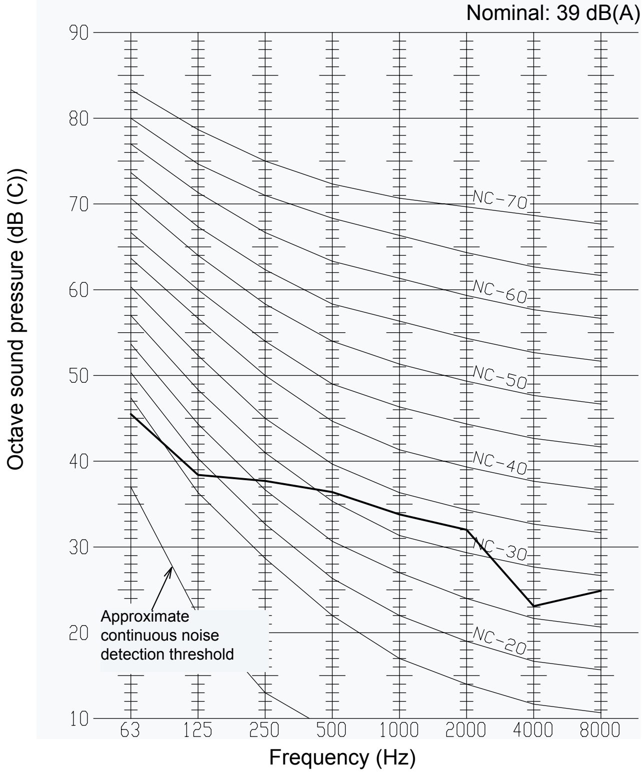
Nominal: 39 dB(A)



Model: RHUE-5AHN | 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

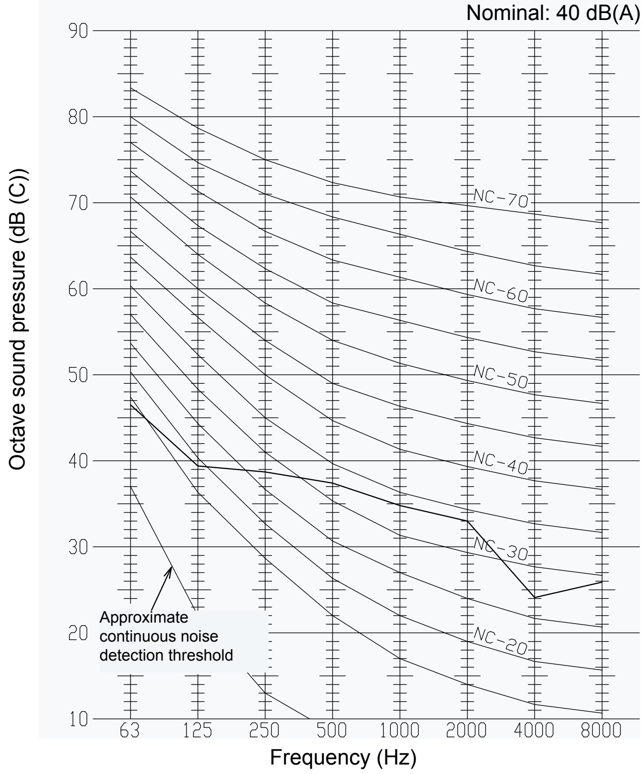
Nominal: 39 dB(A)



Model: RHUE-6AVHN	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

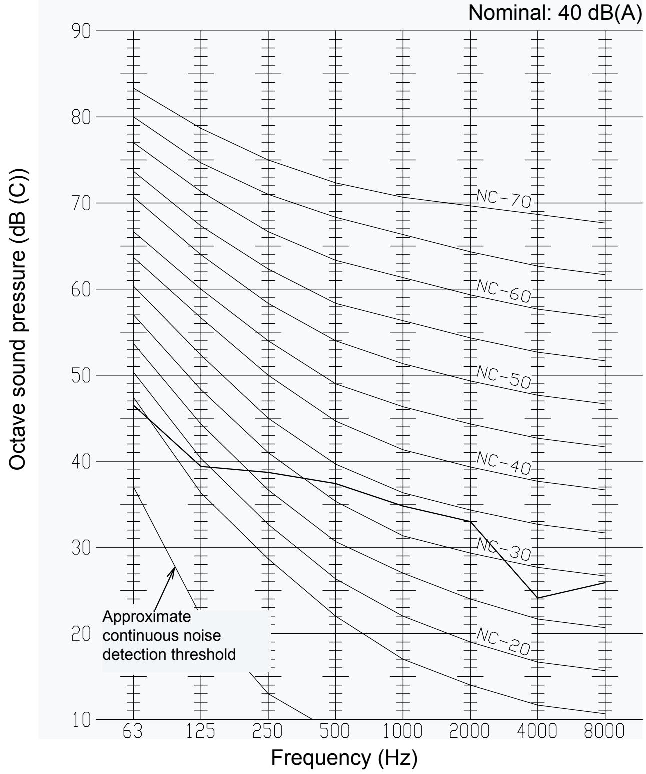
Nominal: 40 dB(A)



Model: RHUE-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)



5. Working range

Contents

5.1. Power supply

Operating voltage	90% to 110% of the nominal voltage
Voltage imbalance	Within a 3% deviation from each voltage at the main terminal of the unit
Starting voltage	Higher than 85% of the nominal voltage

Following Council Directive 89/336/EEC and amendments 92/31/EEC and 93/68/EEC, relating to electromagnetic compatibility, the following table indicates maximum permissible system impedance Z_{max} at the interface point of the user's power supply, in accordance with EN61000-3-11.

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

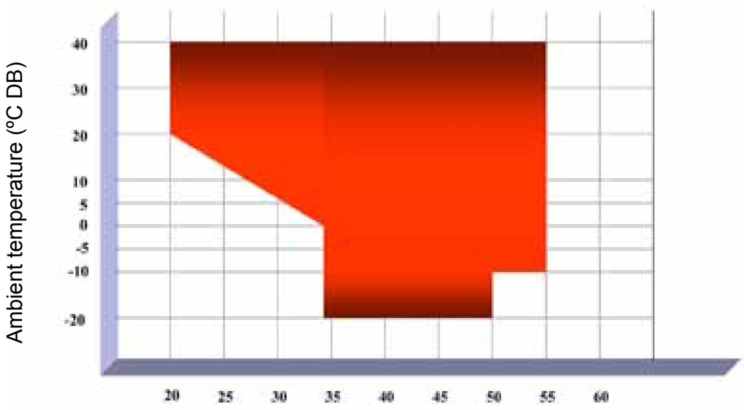
5.2. Working range YUTAKI unit

Model		RHUE-3AVHN	RHUE-4AVHN	RHUE-5AVHN	RHUE-5AHN	RHUE-6AVHN	RHUE-6AHN
Ambient Temperature	ºC	-20 (WB) ~ 37.5 (WB), -19.8 (DB) ~ 40 (DB)					
Hot Water Outlet Temperature	ºC	20 ~ 55					
Minimum Flow Rate	m³/h	0.4	0.6	0.8	0.8	0.8	0.8
Maximum Flow Rate	m³/h	2.5	3.3	4.0	4.0	4.7	4.7
Minimum system water volume	L	28	38	46	46	56	56
Maximum Permissible Water Pressure	MPa	1.0					
Internal Volume in Water Side Heat Exchanger	L	0.89	0.89	1.11	1.11	2.22	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 hidraulic circuit" for the calculation.

Working range for hot water outlet temperature and ambient temperature



Hot water outlet temperature (ºC)

5.3. Working range accesories

5.3.1. Pump kit

– Main Characteristics:

Maximum working temperature	+130ºC (short term (2h) +140ºC)
Minimum working temperature	-20ºC
Medium flow	Water and water glycol mixture of a ratio of up to 1:1
Maximum operating pressure	10 bar
Maximum operating flow	7.5 m^3/h

- Minimum inlet pressure at the pump suction side in order to prevent cavitation noises at an ambient temperature of +40ºC and a water temperature of Tmax:

Tmax	Minimun inlet presure
+50ºC	0.05 bar
+95ºC	0.5 bar

5.3.2. WEH - Water Electric Heater

– Main Characteristics:

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

5.3.3. DHWT - Domestic Hot Water Tank

– Main Characteristics:

		DHWT(200/300)E	DHWT(200/300)S
Maximun operating temperature of heating circuit	ºC	200	200
Maximun operating pressure of heating circuit	bar	25	25
Maximun operating temperature of HSW tank	ºC	90	90
Maximun pressure of HSW tank	bar	8	8

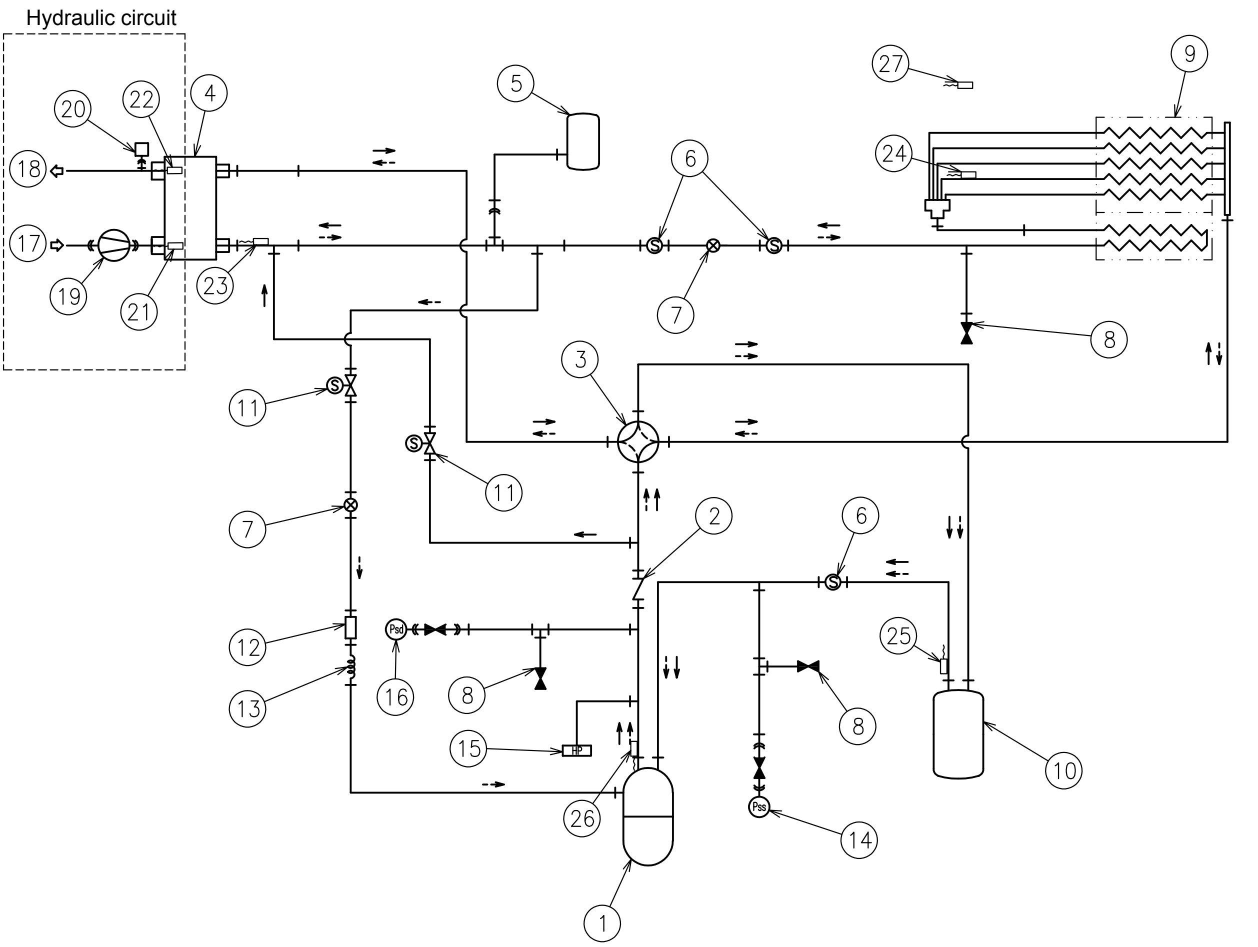
6. Refrigerant cycle and hydraulic circuit

This chapter displays the refrigerant cycle diagrams and the hydraulic circuit for the units of the YUTAKI series.

Contents

6.1. Refrigerant cycle

◈ RHUE-(3~6)A(V)HN



⟶ (solid arrow)	⇠ (dashed arrow)	— — —	))	⊣⊢	⊥	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	No.	Name of item
1	Compressor	15	High Pressure Switch
2	Check Valve	16	Pressure Sensor (High)
3	4-Way Valve	17	Water Inlet
4	Water Side Het Exchanger	18	Water Outlet
5	Liquid Tank	19	Pump (accesory)
6	Strainer	20	Air purge
7	Electronic Expansion Valve	21	Thermistor for water inlet
8	Stop Valve (Check Joint)	22	Thermistor for water outlet
9	Air Side Heat Exchanger	23	Thermistor for evaporation in cooling
10	Accumulator	24	Thermistor for evaporation in heating
11	Solenoid Valve	25	Suction gas thermistor
12	Silencer	26	Discharge gas thermistor
13	Capilary Tube	27	Thermistor for outdoor temperature
14	Pressure Sensor (Low)		

6.2. Refrigerant charging quantity

YUTAKI 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-(3/4)A(V)HN	2.6
RHUE-5A(V)HN	3.4
RHUE-6A(V)HN	4.2

NOTE:
Yutaki 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).

6.3. Hydraulic circuit of YUTAKI

6.3.1. Pressure drop

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

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

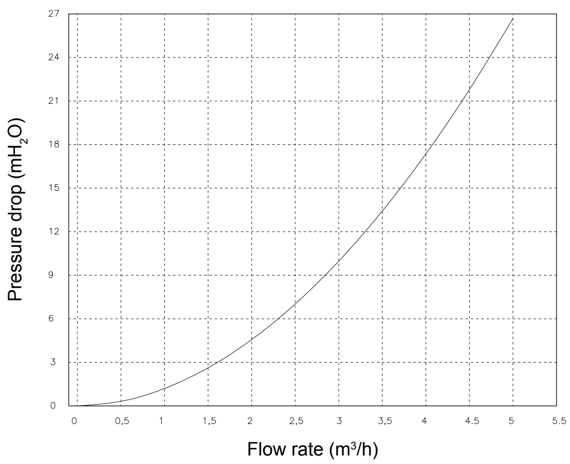
$$PD = \alpha \times Q^{\beta}$$

Where:

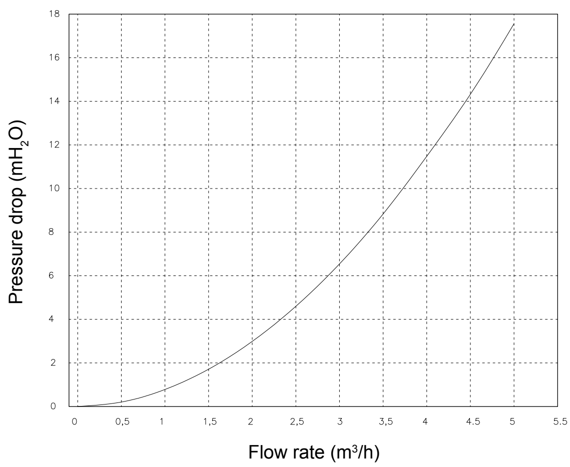
PD: Pressure Drop (mca)
Q: Water flow (m^3/h)
α, β: Parameters (see table)

Model	α	β
RHUE-(3/4)AVHN	1,2006	1,9271
RHUE-5A(V)HN	0,782	1,9334
RHUE-6A(V)HN	0,2197	1,9339

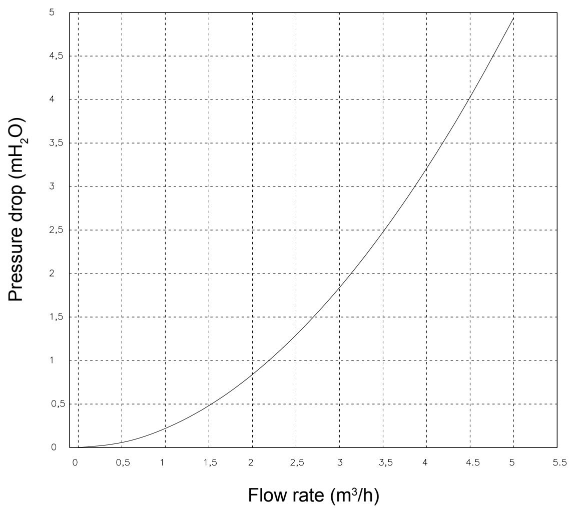
◈ Diagram for RHUE-(3/4)AVHN



◈ Diagram for RHUE-5A(V)HN



◈ Diagram for RHUE-6A(V)HN



6.3.2. 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:

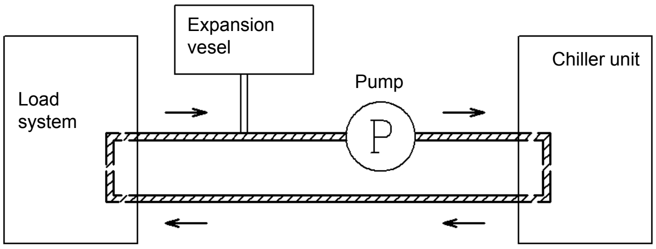
(1) The shaded part of the pipe system below.
** Excluding the expansion tank (cistern)*

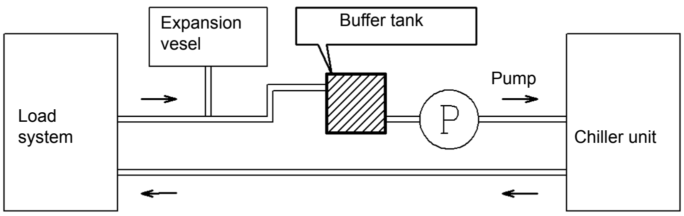
Calculate and ensure that the water volume in the system is equal or greater than the larger value obtained from:

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 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.

IMPORTANT NOTE:

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-3AVHN	RHUE-4AVHN	RHUE-5A(V)HN	RHUE-6A(V)HN
4ºC	28	38	46	56
3ºC	36	48	58	70
2ºC	50	65	80	96
1ºC	80	107	130	156

2. Minimum required water volume during defrosting

- The following formula is used to make the calculation:

Where:

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

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 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 6 minutes per hour.

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

(Unit: l)

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

IMPORTANT NOTE:
The values shown on the table are based on theoretical installation conditions. In addition, Yutaki unit admits several hydraulic circuits configurations (as shown in the Manual of the system controller), 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.

6.3.3. 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.*

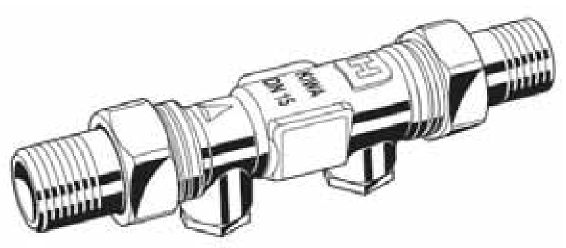
(2) *The value showed in "{}" are for reference only according to the former unit.*

6

6.3.4. Water check valve

Attached to the unit there is a water check valve (non return valve). This component is a safety device to protect the system against back pressure, back flow and back syphonage of non-potable water into service pipe, plants and equipments.

This valve shall be installed at site.



Main Characteristics:

- Maximum working Pressure: 16bar
- Maximum working Temperature: 70ºC (short term 90ºC)
- Threaded connection R1/2"
- Available test and drain plugs 1/4"
- Length: 137mm
- Kvs value: 6
- Weight: 0.24kg

6.4. Hydraulic circuit of accessories

6.4.1. Pump kit

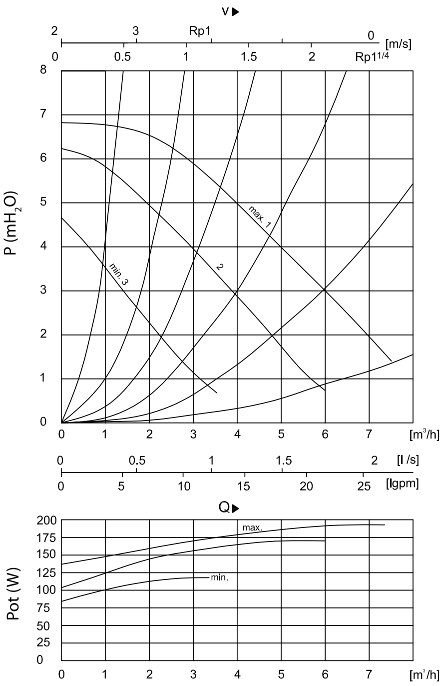
◈ Pump kit assembly

- Minimum inlet pressure at the pump suction side in order to prevent cavitation noises at an ambient temperature of +40ºC and a water temperature of T_{max}.

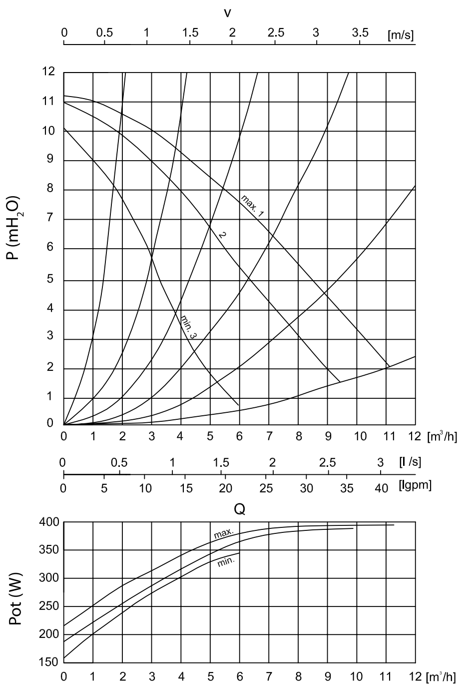
T_{max}	Minimun inlet presure
+50ºC	0.05 bar
+95ºC	0.5 bar

- The followings diagrams show the operating curves for the circulating pumps TOP-S 25/7/ TOP-S/ 25/10:

◆ **TOP-S 25/7**



◆ **TOP-S 25/10**

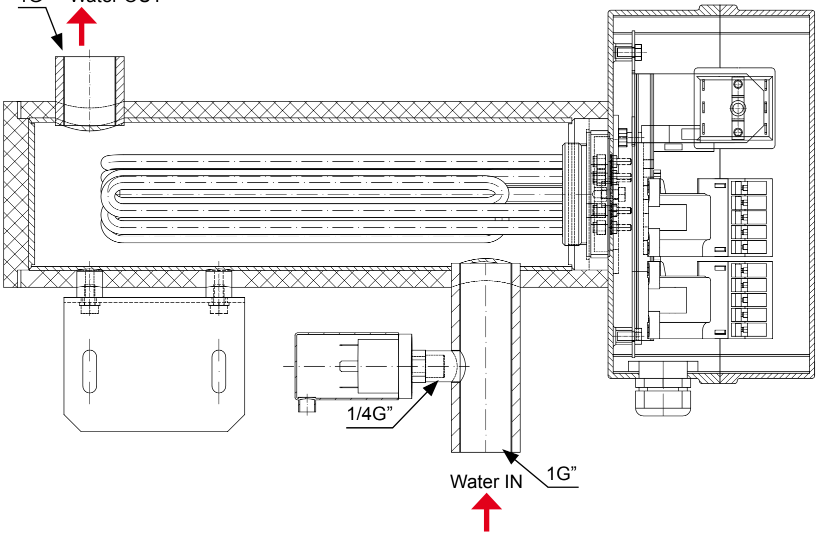


Components supplied

- Complete pump
- Two-part heat insulation (for single pump only)
- 2 seals (for threaded connections only)

6.4.2. WEH - Water Electric Heater

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



LPSW to be connected in inlet pipe: 1/8’’ G

◆ General data

Concept	Range
Electric power supply	1~ 230 V 50 Hz or 3N~ 400 V 50 Hz (See wiring connection diagram)
Electric power input	6 kW
Regulation	3 steps, 2/ 4/ 6 kW
Dimensions	471 mm x 220 mm x 220 mm
Weight	6.5 kg

◆ Supplied components

- Water Electric Heater
- Wall fixing support
- (2)M6 x 15 screw and (2)M6 washers
- Installation and operation manual of Water Electric Heater

6.4.3. DHWT - Domestic Hot Water Tank

◆ **General Data**

Technical specification				DHWT200E-2.5H1E	DHWT300E-2.5H1E	DHWT200S-2.5H1E	DHWT300S-2.5H1E
Main Components	Tank	Water Volume	l	200	300	195	287
		Material		Enmalled Steel (DIN 4753)		Stainless Steel (DIN 14521)	
		Max. Tank temperature	ºC	90	90	90	90
		Max. Tank Water pressure	bar	8	8	8	8
		Max. Coil Water Temperature	ºC	200	200	200	200
		Max. Coil Water Pressure	bar	25	25	25	25
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)	
Thermometer				Yes		Yes	
Mechanical thermostat (security)				Yes		Yes	
Protection				Cathodic Protection		No	

◆ **Supplied components**

- Domestic Hot Water Tank
- Installation and operation manual of Domestic Hot Water Tank

7. System settings and control system

Contents

7.1. Introduction

7.1.1. Software version

This documentation refers to the functionality of software version v9 of the System Controller. The software version is shown on the display for 2 seconds during the power-up sequence. The software and hardware version numbers are also printed on the product label on the top side of the System Controller.

NOTE:
The specification on the version of System Controller is subject to change without notice.

7.1.2. System controller – 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.

- Modulating Control of Heat Pump
- Control of an Auxiliary Heat Source (electric heater or boiler)
- Outside Temperature Compensated (OTC) Control
- Control of Heating Circuit pumps/valves and, optionally, domestic hot water storage.
- System Frost Protection

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.

7.1.3. Operation & user interface

Please refer to the System Controller Installation Guide for details on the user interface of the system controller, and how to operate the device.

7.1.4. Abbreviations & terminology

Mono-Valent
One heating source (electric Heat Pump)

Mono-Energetic
One energy source (electric Heat Pump and electric heater)

Bi-Valent
Two heating sources (electric Heat Pump and gas/oil Boiler)

OTC
Outside Temperature Compensated Control

DHW
Domestic Hot Water

Zone 1
The main heating loop controlled by the System Controller.

Zone 2
The extension mixed heating loop controlled by the Extension Controller.

TSUP
Supply Water Temperature

TRET
Return Water Temperature

TDHW
DHW Temperature

TEXT
Outside (external) Air Temperature

TMIX
Mixed Water Temperature

TR1
Room Temperature

V
Mixing Valve Position

FAUL
Fault status

SSUP
Overall system supply setpoint

S1
Zone 1 supply setpoint

SR1
Zone 1 room temperature setpoint

S2
Zone 2 supply setpoint

DSET
DHW setpoint

SDHW
DHW supply setpoint

7.2. Application manual

7.2.1. Application 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. The hydraulic system configuration should be selected by setting the parameter CONF.

Hydraulic Configuration	Description	Heat Pump	Electric Heater	Boiler	DHW	Direct Circuit	Mixing Circuit
CONF 1	Mono-valent System Heat Pump only Direct Circuit	✓			(✓)	✓	
CONF 2	Mono-Energetic System Heat Pump and Electric Heater Direct Circuit	✓	✓		(✓)	✓	
CONF 3	Bi-Valent Parallel System Heat Pump and Boiler Direct Circuit	✓		✓	(✓)	✓	
CONF 4	Bi-Valent Parallel System Heat Pump and Boiler Mixing Circuit	✓		✓			✓
CONF 5	Bi-Valent Serial System Heat Pump and Boiler Mixing By-pass Circuit	✓		✓	(✓)		✓

- **DHW Storage**

  The System Controller can be used in a system which has a DHW storage tank, with either a diverting valve or pump. If the system has a separate DHW pump, then a hydraulic separator or buffer tank has to be used to ensure proper hydraulic balancing of the system.

  The DHW system type is selected by an installer parameter (P1)

- **Buffer Tank or Hydraulic Separator**

  When a hydraulic separator or buffer tank is used in CONF 1 & 2, the system will contain a secondary pump on the distribution side of the separator/buffer. In this case it is necessary to set installer parameter P2 to 1.

  In bi-valent systems (CONF 3,4,5) a hydraulic separator or buffer tank is always needed.

7.2.2. Principle of bi-valent or mono-energetic operation

- **Function**

Bi-valent and mono-energetic systems use an auxiliary heat source (boiler or electric heater respectively) in addition to the heat pump.

At higher outdoor temperatures, the heat pump can provide all the heating requirements of the system, and it is not necessary to switch on the auxiliary heat source. However at lower outdoor 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. A +/-0.5K control differential is applied to the switching between the operating modes.

Outdoor temperature (TEXT) > Balance Point (BP)+0.5K, the boiler or electric heater is not used. (Exception is that the boiler can be used for DHW loading.)

Outdoor temperature (TEXT) < Balance point (BP)-0.5K, the system controller determines whether to switch on the boiler or electric heater depending on the heating requirements. Refer to the sections on Boiler Control and Electric Heater Control for more details.

- **Installer Parameters**

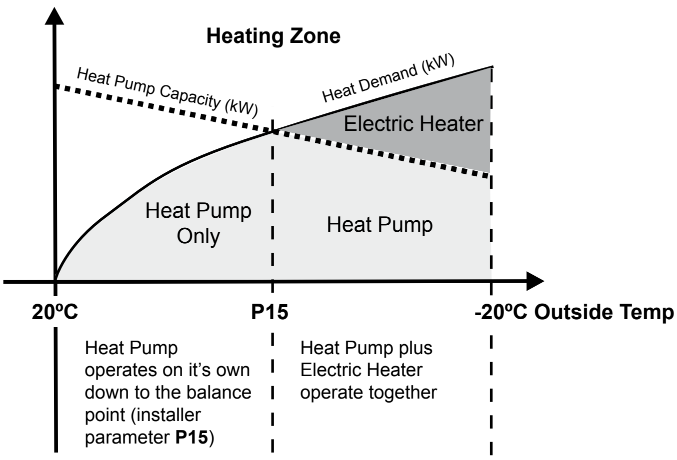
P15 Maximum Outdoor Temperature for Boiler/Electric Heater Operation
= Balance Point (BP) (default 0°C)

P14 Minimum Outdoor Temperature for Heat Pump Operation (CONF 3,4,5 only) (default -20°C)

NOTE:
Parameter P15 can be set to OFF, in which case the boiler or electric heater is allowed to operate at all outdoor temperatures
Parameter P14 can be set to OFF, in which case the heat pump is allowed to operate at all outdoor temperatures.

- **Configuration Specific**

– CONF 2 Mono-Energetic Systems
The electric heater is used to "top-up" the energy required for the system. The System Controller tries to ensure that the heat pump is always running when the electric heater is used, but there may be some circumstances where the electric heater is providing all the energy for the heating system.



- CONF 3,4 Bi-Valent Parallel Systems

  The normal operation in these systems is that when the heat pump cannot meet the heating load, the boiler will take over the full energy requirements of the system (alternative operation).

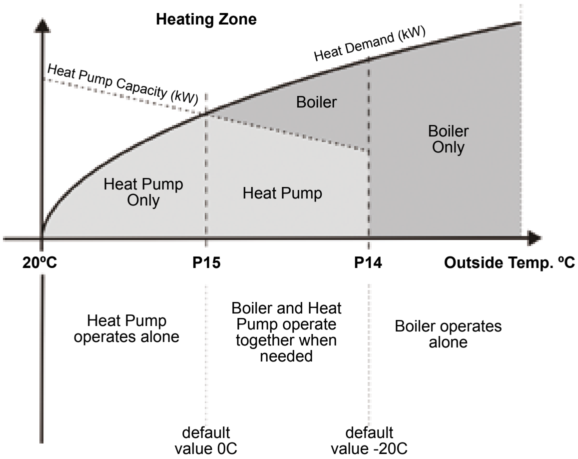
  Alternative Operation can be achieved by setting P14=P15. This means that either the heat pump or the boiler operate but not the two together (exception is during DHW demand).

IMPORTANT NOTE:

P14 should never be set higher than P15, otherwise incorrect operation will result.

- CONF 5 Bi-Valent Series System

  The boiler is used to top-up the energy required for the system, but when the heat pump is outside it's operating limits, the boiler will provide all of the heating requirements.



7.2.3. Mono-Valent Systems (CONF 1)

- **Summary**

  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.

- **Important Parameter Settings**

  CONF = 1

  P1 = 0,1,2 according to DHW system type.

  P2 = 0,1 according to whether a buffer tank/hydraulic separator and secondary pump is installed.

  P4 = heating curve according to building and system characteristics.

  It is also recommended to review all parameter settings, and make modifications as required by the installation.

  In order to achieve higher DHW temperatures, the system can operate with an auxiliary DHW electric heater.

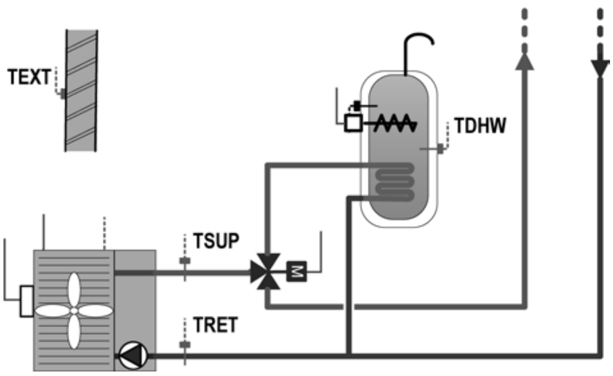
- **Example**

  Mono-Valent System with DHW.

  DHW controlled by diverting valve

  Auxiliary DHW electric heater.

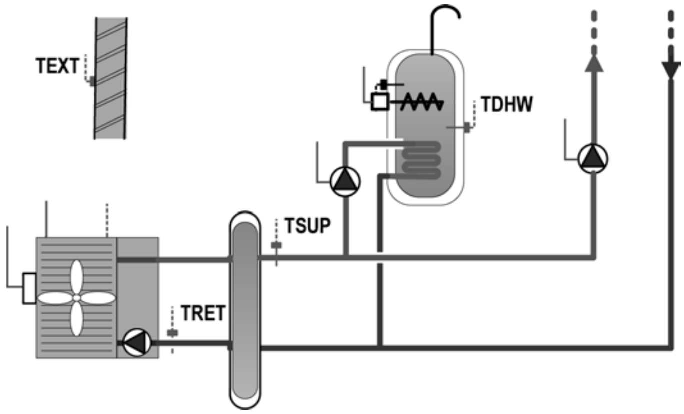
CONF=1	Mono-valent system
P1=1	DHW valve
P2=0	no secondary pump



◆ **Example**

Mono-Valent System with DHW.
Hydraulic separator or buffer tank.
Secondary pump for heating system.
DHW controlled by separate pump.
Auxiliary DHW electric heater.

CONF=1	Mono-valent system
P1=2	DHW pump
P2=1	Secondary pump



7.2.4. Mono-Energetic Systems (CONF 2)

◆ **Summary**

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.

◆ **Important Parameter Settings**

CONF = 2

P1 = 0,1,2 according to DHW system type.

P2 = 0,1 according to whether a buffer tank/hydraulic separator and secondary pump is installed.

P4 = heating curve according to building and system characteristics.

P33 = 5K (electric heater return high limit offset)

The Electric Heater Return High Limit is an important check to help ensure that the heat pump operates as much as possible even when higher supply temperatures are required, thus emphasising energy economy operation. To enable this feature parameter P33 (return temperature limit offset) should be set to a value of 5K. Refer to the section on Electric Heater Control for more information.

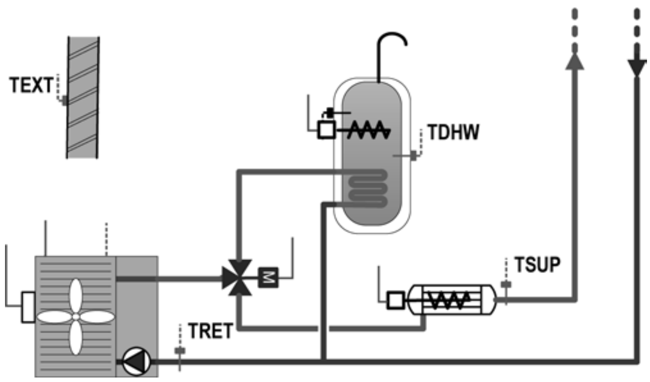
It is also recommended to review all parameter settings, and make modifications as required by the installation.

In order to achieve higher DHW temperatures, the system can operate with an auxiliary DHW electric heater.

◆ **Example**

Mono-Energetic System with DHW.
DHW controlled by diverting valve
Auxiliary DHW electric heater.

CONF=2	Mono-energetic system
P1=1	DHW valve
P2=0	no secondary pump



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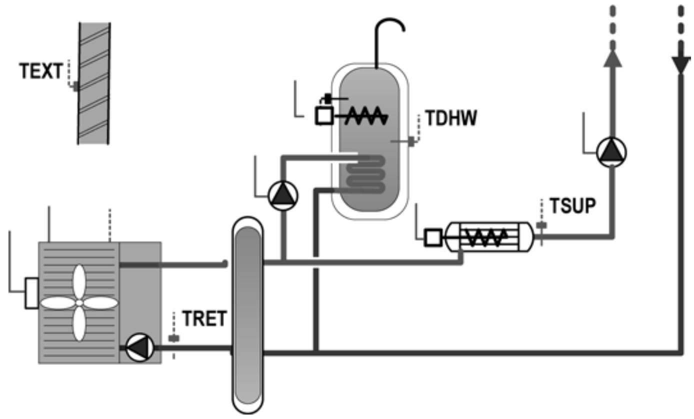
◆ **Example**

Mono-Energetic System with DHW.
Hydraulic separator or buffer tank.
Secondary pump for heating system.
DHW controlled by separate pump.
Auxiliary DHW electric heater.

CONF=1	Mono-energetic system
P1=2	DHW pump
P2=1	Secondary pump



7.2.5. Bi-valent Systems - Parallel Operation (CONF3)

◆ **Summary**

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

◆ **Important Parameter Settings**

CONF = 3

P1 = 0,1,2 according to DHW system type.

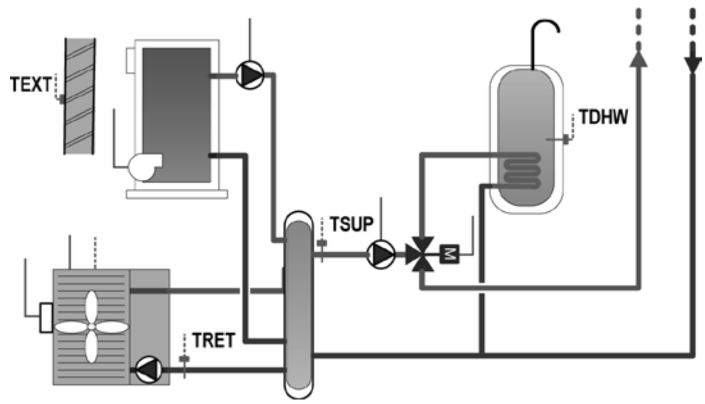
P4 = heating curve according to building and system characteristics.

It is also recommended to review all parameter settings, and make modifications as required by the installation.

◆ **Example**

Bi-Valent System with DHW.
DHW controlled by diverting valve
Hydraulic separator or buffer tank.

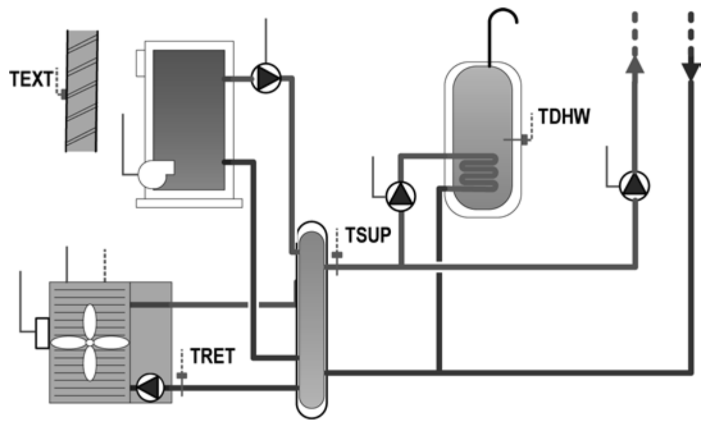
CONF=3	Bi-valent Parallel system
P1=1	DHW valve



◆ **Example**

Bi-Valent System with DHW.
Hydraulic separator or buffer tank.
DHW controlled by separate pump.

CONF=3	Bi-Valent Parallel system
P1=2	DHW pump



7.2.6. Bi-Valent System - Parallel Operation - Mixing Loop (CONF 4)

◆ **Summary**

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.

◆ **Important Parameter Settings**

CONF = 4

P4 = heating curve according to building and system characteristics.

DHW tank control is not possible with this system.

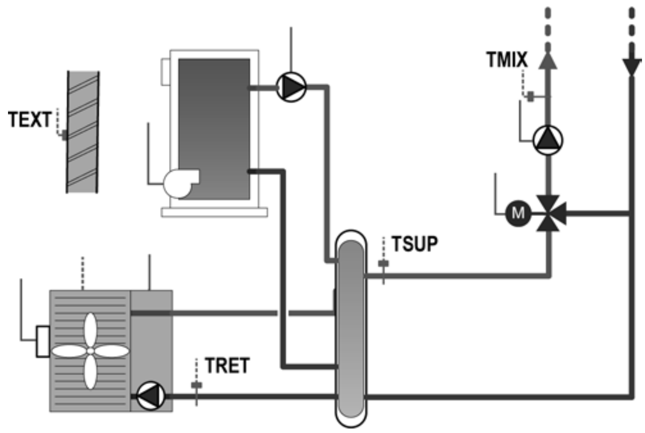
It is also recommended to review all parameter settings, and make modifications as required by the installation.

◆ **Example**

Bi-Valent System with DHW & mixed heating loop.

Hydraulic separator or buffer tank.

CONF=4 Bi-valent Parallel system



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7.2.7. Bi-Valent System - Serial Operation (CONF 5)

◆ **Summary**

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

◆ **Important Parameter Settings**

CONF = 5

P1 = 0,1,2 according to DHW system type.

P4 = heating curve according to building and system characteristics.

It is also recommended to review all parameter settings, and make modifications as required by the installation.

◆ **Example**

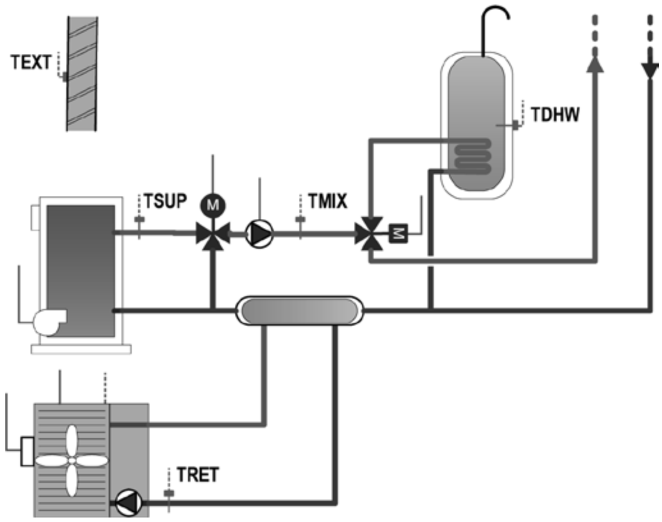
Bi-Valent System with DHW.

Serial operation with bypass/mixing valve.

DHW controlled by diverting valve

Hydraulic separator or buffer tank.

CONF=5	Bi-valent Parallel system
P1=1	DHW valve



◆ **Example**

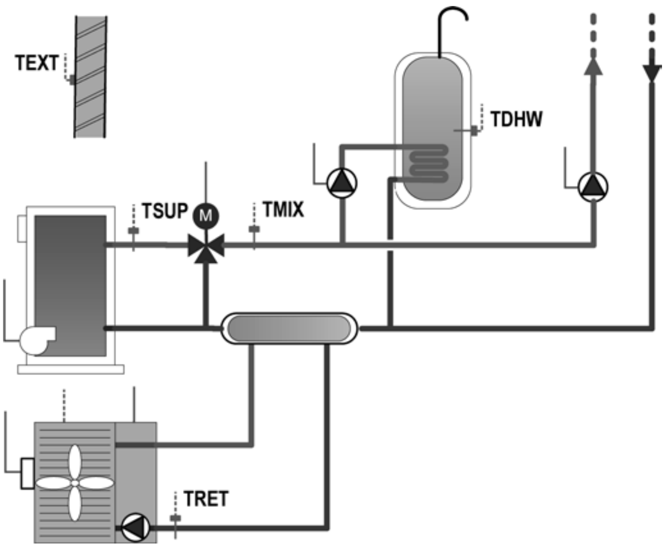
Bi-Valent System with DHW.

Serial operation with bypass/mixing valve.

DHW controlled by separate pump.

Hydraulic separator or buffer tank.

CONF=5	Bi-Valent Parallel system
P1=2	DHW pump



7.3. Supply setpoint calculation

◆ **Calculation**

The System Controller uses the "zone of greatest demand" strategy for calculating the supply water temperature required from the Heat Pump (and/or 3-stage electric heater or boiler).

The system controller recognises three "zones":

Zone 1:	The normal heating loop controlled directly by the System Controller (direct or mixed depending on the system configuration).
Zone 2:	The mixed heating loop controlled by the Extension Controller.
DHW zone:	The DHW storage tank loading loop.

Each zone can generate a demand to the heat pump (and/or boiler/electric heater) for a particular supply water temperature

S1: The supply setpoint water temperature required by the "zone 1" heating loop.

S2: The supply setpoint water temperature required by the "zone 2" heating loop.

SDHW: The supply setpoint water temperature required by the DHW loop.

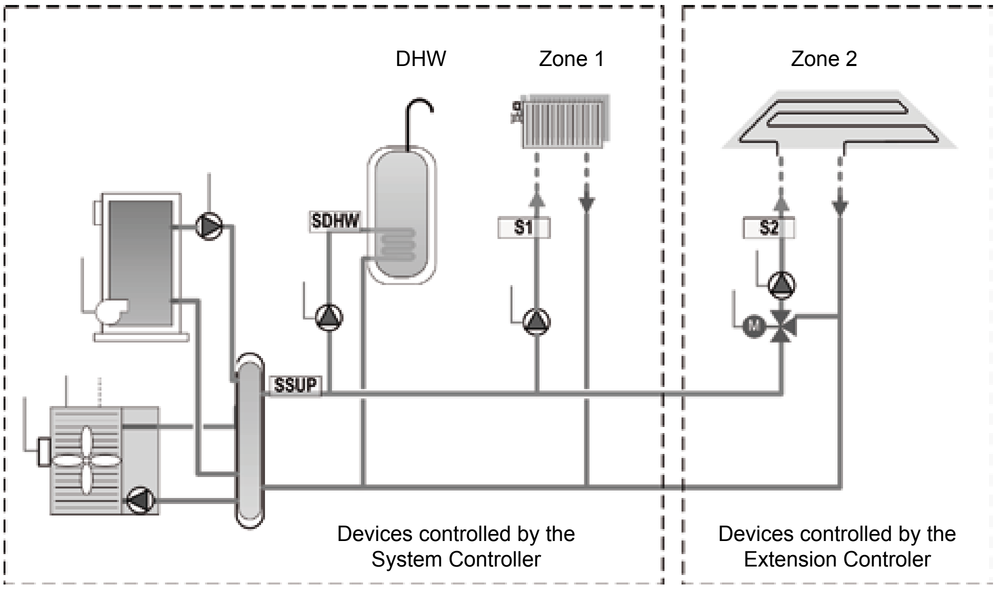
The actual supply setpoint used at any time is the maximum of the three zone supply setpoints.

SSUP = maximum (S1, S2, SDHW)

It is the objective of the system controller to manage the Heat Pump, 3-stage electric heater and boiler appropriately to control the supply water temperature (TSUP) to this setpoint (SSUP).

◆ **Illustration**

The diagram below shows the three possible "zones" and illustrates the required water temperatures (S1, S2, SDHW) for each zone, and the resulting overall supply setpoint (SSUP).



◆ **Example**

Heating zone 1 requires 50°C (calculated from OTC heating curve)

Heating zone 2 requires 35°C (calculated by extension controller)

DHW loading not required

S1 = 50°C, S2 = 35°C, SDHW = 0°C

Therefore SSUP = maximum of (50°C, 35°C, 0°C) = 50°C

Note that the extension controller will then control the mixing circuit to achieve comfort conditions in zone 2.

NOTE:

For more information about control functions, please refer to SMGB0066.

8. Electrical data

This chapter describes the electrical requirements for each unit of the YUTAKI series.

Contents

8.1. Electrical data of Yutaki

◈ RHUE-(3~6)A(V)HN

Model	Main unit power			Applicable voltage		Compressor and fan motor				Max. IPT [kW]	Max. RNC [A]
	U [V]	PH	f [Hz]	U min. [V]	U max. [V]	PH	STC [A] (*)	IPT [kW]	RNC [A]		
RHUE-3AVHN	230	1	50	207	253	1	-	2.24	9.9	3.9	18.0
RHUE-4AVHN	230	1	50	207	253	1	-	3.02	13.4	3.9	18.0
RHUE-5AVHN	230	1	50	207	253	1	-	3.75	16.6	5.8	26.0
RHUE-5AHN	400	3	50	360	440	3	-	3.75	7.7	6.8	11.0
RHUE-6AVHN	230	1	50	207	253	1	-	3.97	17.6	6.5	29.0
RHUE-6AHN	400	3	50	360	440	3	-	3.97	8.2	7.3	15.0

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

NOTES:

1. The compressor data shown in the table above are based on a combined capacity of 100% of the power supplied, with the following working frequency:

RHUE-3AVHN:	48 Hz
RHUE-4AVHN	64 Hz
RHUE-5A(V)HN	62 Hz
RHUE-6A(V)HN	70 Hz

2. This data is based on the following conditions:

   Hot Water Inlet/Outlet Temperature 40/45 ºC

   Ambient Temperature 6 ºC (WB)

3. The “Maximum Unit 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

4. The power supply cables must be sized to cover this maximum current value.

5(*). The compressor with inverter control has low electrical power consumption at start-up

8.2. Electrical data accesories

8.2.1. Pump kit

Model	Electrical Power Supply	Stage/Speed (rpm)	Power Consumption (W)	Current (A)
TOP-S 25/7	1~230V, 50Hz	1 max. 2600 2 2300 3 min. 1800	140-195 110-175 85-120	0.95 0.87 0.62
TOP-S 25/10	1~230V, 50Hz	1 max. 2600 2 2500 3 min. 2300	225-410 185-345 170-340	2.05 1.95 1.75

8.2.2. WEH - Water Electric Heater

Model	Electrical Power Supply	Electrical Power Input	Regulation	Current (A)
WEH-6E	1~230V 50Hz or 3N~400V 50 Hz	6 KW	2 kW 4 kW 6 kW	10A 20A 30A

8.2.3. DHWT - Domestic Hot Water Tank

	Unit Power Source				
Model	U (V)	PH	f (Hz)	IPT (Kw)	RNC (A)
DHWT200E-2.5H1E	230	1~	50	3	13.05
DHWT300E-2.5H1E	230	1~	50	3	13.05
DHWT200S-2.5H1E	230	1~	50	3	13.05
DHWT300S-2.5H1E	230	1~	50	3	13.05

9. Electrical wiring

This chapter describes the electrical wiring connections and how to set the dip switches of the YUTAKI series.

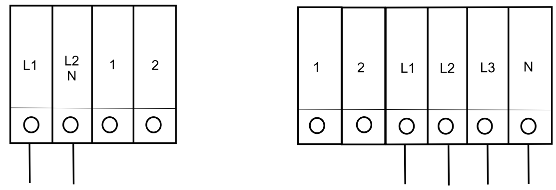
Contents

9.1. Electrical wiring Yutaki unit

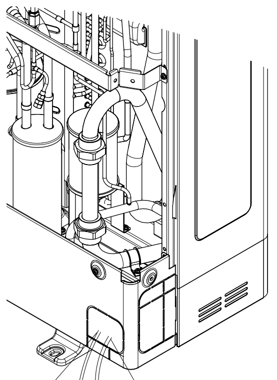
9.1.1. Electrical wiring connection

The electrical wiring connection for the Yutaki unit is shown in figure below:

RHUE-(3~6)AVHN RHUE-(5/6)AHN



1~230V 50 Hz 3N~400V 50 Hz

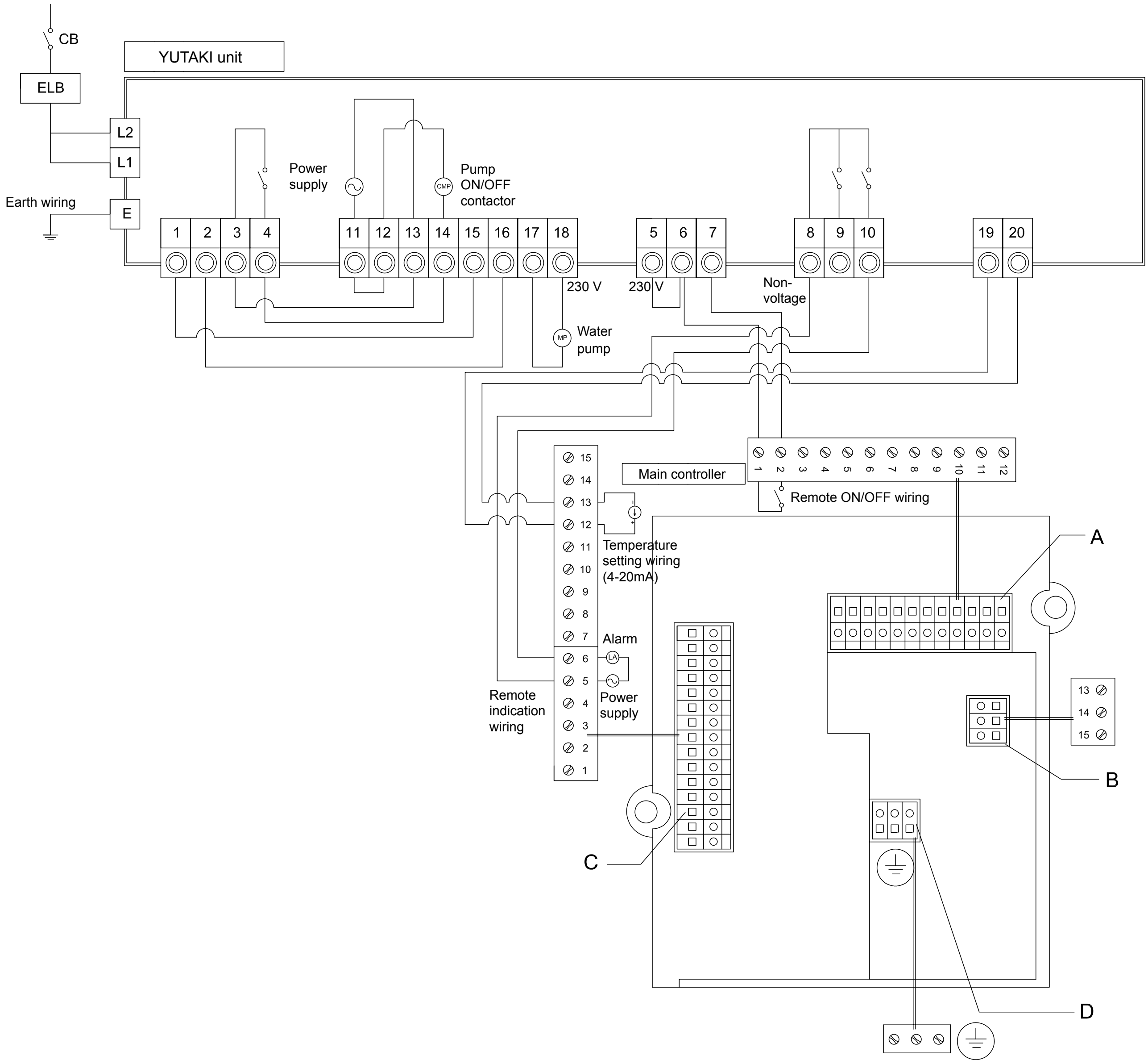


Power supply cables

Control cables

◆ **Wiring connection between system controller and Yutaki.**

Power supply:
1~230V 50 Hz (3N~400V 50 Hz for RHUE-(5/6)AHN)



9.1.2. Wiring size

◆ Connection Wiring

The minimum thickness of the wiring that must be used in the installation.

Model	Power supply	Maximum current (A)	Size of power supply cable	Size of control cable
			EN60 335-1	EN60 335-1
RHUE-3AVHN	1~ 230V, 50Hz	18	4.0 mm²	0.75 mm²
RHUE-4AVHN		18	4.0 mm²	
RHUE-5AVHN		26	6.0 mm²	
RHUE-5AHN	3N~ 400V, 50Hz	11	2.5 mm²	
RHUE-6AVHN	1~ 230V, 50Hz	29	6.0 mm²	
RHUE-6AHN	3N~ 400V, 50Hz	15	4.0 mm²	

If the power cables are connected serially, add together the maximum current of each unit and select the cables according to the following table.

Selection According to EN60 335-1	
Current i (A)	Wire size
I ≤ 6	0.75mm²
6 < i ≤ 10	1.0mm²
10 < i ≤ 16	1.5mm²
16 < i ≤ 25	2.5mm²
25 < i ≤ 32	4.0mm²
32 < i ≤ 40	6.0mm²
40 < i ≤ 63	10.0mm²

◆ Main Switch Protection

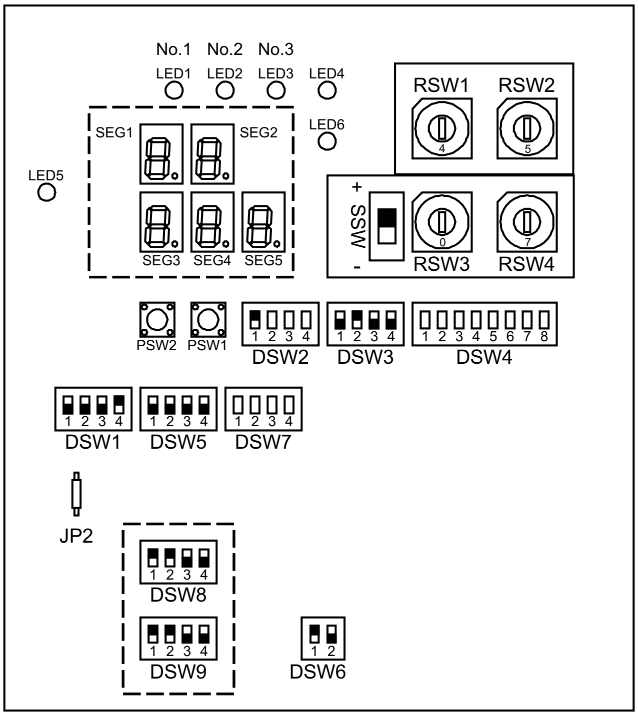
Select the main switches according to the following table.

Model	Power Supply	CB (A)	ELB No. of Poles/A/mA
RHUE-3AVHN	1~ 230V, 50Hz	32.0	2/40/30
RHUE-4AVHN		32.0	
RHUE-5AVHN		32.0	
RHUE-5AHN	3N~ 400V, 50Hz	20.0	4/40/30
RHUE-6AVHN	1~ 230V, 50Hz	32.0	2/40/30
RHUE-6AHN	3N~ 400V, 50Hz	20.0	4/40/30

9.1.3. Setting of the DIP Switches

9.1.3.1. Setting of the DIP Switches

The PCB in the unit can be set by following 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 Resustance / 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

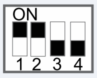
NOTES:

1. *The mark "■" indicates the position of dips switches.*
2. *No mark "■" indicates pin position is not affecting.*

WARNING

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

9.1.3.2. Dip switch factory set

DSW8 = DSW9 (For all units)	

9.2. Electrical wiring of accessories

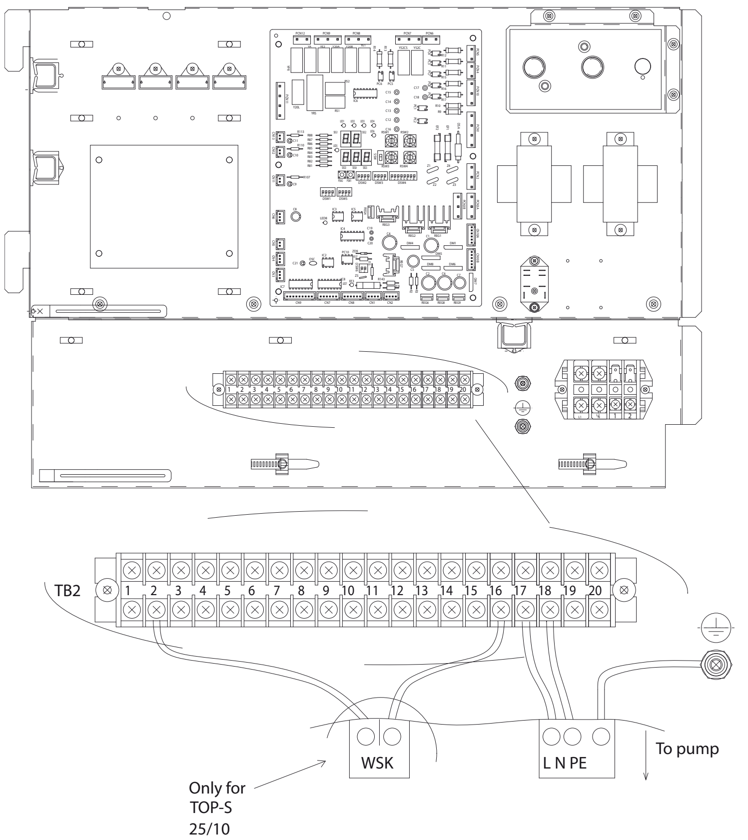
9.2.1. Pump kit

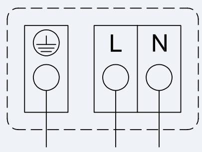
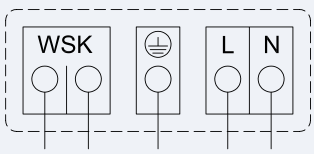
Water pump connection details:

1. Power connection in terminals 17, 18 and earth.
2. Pump protector (only TOP-S 25/10) in terminals 2 and 16

NOTE:

Shunt between 2 and 16 have to be removed.



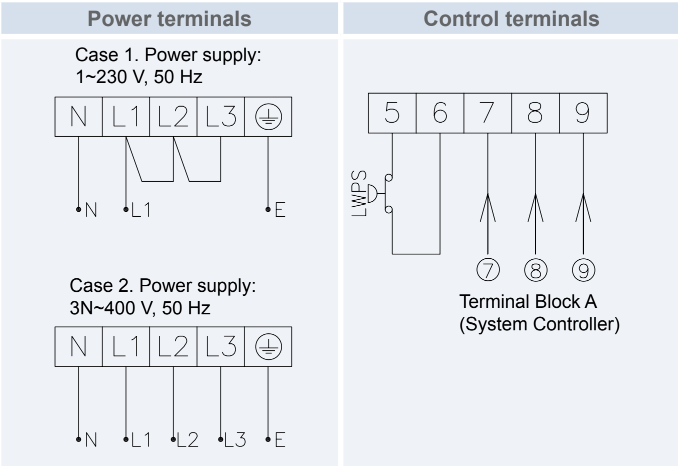
Model	Protection type (Cut-out)	Connection terminals	
TOP-S 25/7	Auto reset	 PE L N	1~ 230 V, 50 Hz
TOP-S 25/10	Manual reset	 WSK PE L N	

9.2.2. WEH - Water Electric Heater

◆ **Electrical wiring connection**

The electrical wiring connection between WEH, Yutaki system controller and the electrical power installation is as follows:

Customer connection:



◆ **Wire size**

Recommended minimum sizes for field provided wires:

Model	Power source	Max. Current (A)	Power source cable size	Control cable size	CB (A)	ELB (no. poles/A/mA)
			EN60 335-1	EN60 335-1		
WEH-6E	1~ 230V 50 Hz 3N~ 400V 50 Hz	30 10	6 mm² 2.5 mm²	0.75 mm² 0.75 mm²	32 10	2/40/30 4/40/30

NOTE:

Follow local codes and regulations when selecting field wires, Circuit Breakers and Earth Leakage Breakers.
Use the wires which are not lighter than the ordinary polychloroprene sheathed flexible cord (code designation H05RN-F).

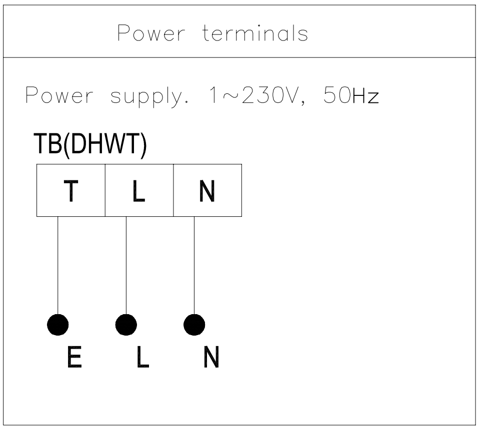
9

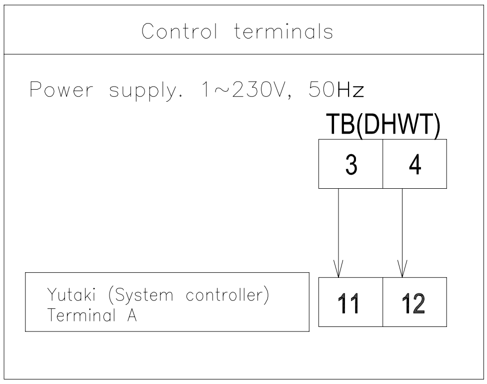
9.2.3. DHWT - Domestic Hot Water Tank

◆ **Electrical wiring connection**

The electrical wiring connection between DHWT, or Yutaki system controller and the electrical power installation is as follows:

Customer connection:





◆ **Wire size**

Recommended minimum sizes for field provided

Model	Power Source	Max. Current (A)	Power source cable size	Control cable size	CB (A)	ELB (nº. poles/A/mA)
			EN60 335-1	EN60 335-1		
DHWT	1~ 230V 50Hz	15	2,5mm²	1mm²	20	2/40/30

NOTE:
Follow local codes and regulations when selecting field wires, Circuit Breakers and Earth Leakage Breakers
Use the wires which are not lighter than de ordinary polychloroprene sheated flexible cord (code designation H05RN-F).

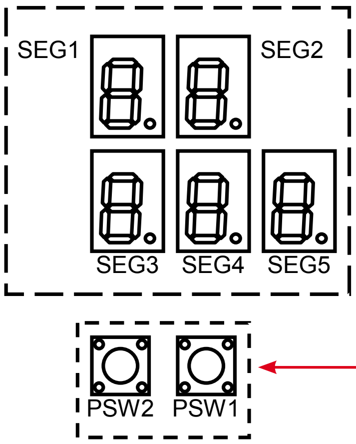
10. Basic troubleshooting

This chapter provides you with a description of the most common alarm codes of the new YUTAKI Series.

Contents

10.1. Troubleshooting Yutaki unit

10.1.1. Alarm code display



Upper side shows unit status

Lower side shows discharge and suction pressure value alternatively

1. Status indication

   Press the PSW2 more than 3 sec. It is changed to status display mode.

2. Alarm History

   Press the PSW1 and PSW2 together more than 3 sec. It is changed to the alarm history mode.

10.1.2. 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

10.1.3. Alarm indication

Alarm indication	Content
02↔H1	Activation of high pressure swicth
02↔h1	Activation of protection control for excessively high pressure
02↔L1	Activation of low pressure control
02↔E1	Excessively low pressure difference
02↔61	Excessively high discharge gas temperature
02↔91	Excessively low temperature of heat exchanger refrigerant inlet
02↔t1	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 feed back 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)

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10.2. Troubleshooting control system

Fault codes are displayed in the default display as “FAUL 1” to “FAUL 13”.

Code	Fault Description
FAUL 0	No fault detected
FAUL 1	No supply water temperature sensor (TSUP) or sensor failure.
FAUL 2	No return water temperature sensor (TRET) or sensor failure.
FAUL 3	No mixed water temperature sensor (TMIX) or sensor failure.
FAUL 4	No DHW temperature sensor (TDHW) or sensor failure.
FAUL 5	No outdoor temperature sensor (TEXT) or sensor failure.
FAUL 6	Loss of communications with RF receiver.
FAUL 7	Loss of connection to the heat pump control signal.
FAUL 8	Water temperature goes above maximum (mixing system only).
FAUL 9	Fault notified by the heat pump.
FAUL 10	Failure of the binding between RF receiver and thermostat
FAUL 11	Incorrect device connected to RF receiver terminals.
FAUL 12	Failure of the RF receiver to receive messages from the thermostat.
FAUL 13	The chosen extension is not allowed in this configuration.

10.3. Troubleshooting of accessories

The information about the Troubleshooting of accessories is shown in SMXX0066.

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08233 Vacarisses (Barcelona) España

Hitachi units certifies that our product have fulfilled EU consumer safety, health and environmental requirements.

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

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