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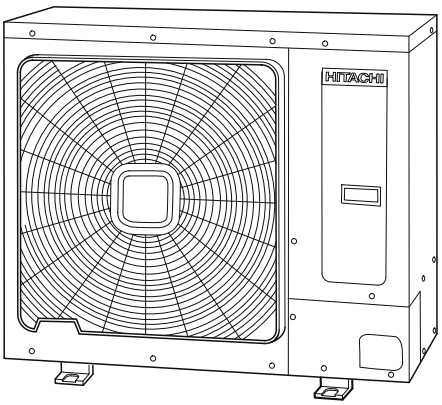
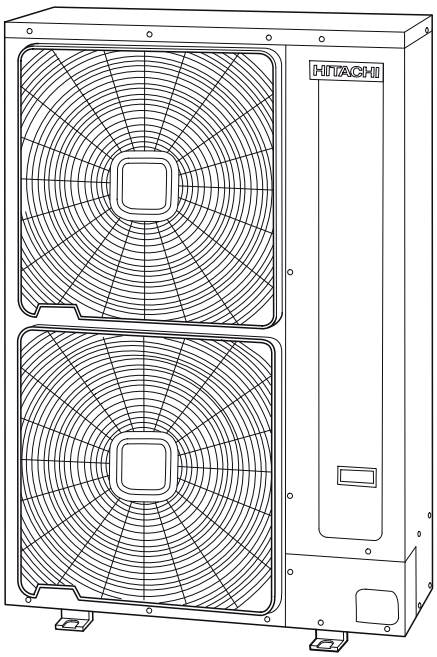
UTOPIA DC-INVERTER ES SERIES
H(V)RNS(2/3)(E)
HRNSE





Technical Catalogue

RAS-3HVRNS3
RAS-4H(V)RNS3E
RAS-5H(V)RNS2E
RAS-6H(V)RNS2E
RAS-8HRNSE
RAS-10HRNSE

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1. General information

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1.1 General information

1.1.1 General notes

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

1.1.2 Introduction

Hitachi UTOPIA series is an outdoor unit series designed with the goal to cover the requirements of the split and multisplit systems, for installations where from one indoor unit (single system) to up to four indoor units (quad system) are connected to the same outdoor unit (depending on the models).

UTOPIA ES series incorporate the Hitachi inverter technology, which makes possible to adapt automatically and without the user operation the capacity of the unit, so the power input, to the real demand of the installation, increasing the system efficiency to unattainable levels with other technologies. All UTOPIA units are equipped with a heat pump, resulting in an air conditioning system valid for the whole year, in which the installation of additional and specific systems a not necessary.

ES (Eco&Small) series stands out because of its efficiency with outdoor units of small dimensions. The series is composed by units with nominal capacities from 7.1 kW to 25.0 kW (cooling mode), allowing also the installation of up to four different indoor units.

Indoor Units

One of the main merits of Hitachi units range is the combinability and flexibility of its indoor units SYSTEM FREE. This outstanding technology makes possible to use the same indoor units with both UTOPIA and SET FREE outdoor units, making easier the design, installation and control of the air conditioning installations.

1.1.3 Environment-friendly units

This range of HITACHI outdoor units uses environmentally-friendly R410A gas refrigerant, and the RoHS and Green Dot regulations are applied throughout the manufacturing and installation process to reflect HITACHI's awareness of environmental respect and commitment.

R410A is totally environmentally-friendly since it does not contain any substances that damage the ozone layer:
ODP (ozone depleting product) =0.
HITACHI's UTOPIA series are very efficient and allow significant energy savings compared with conventional systems.
This energy efficiency means less production of CO2, which causes the greenhouse effect.

1.2 Applied symbols

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

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

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

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

DANGER

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

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

CAUTION

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

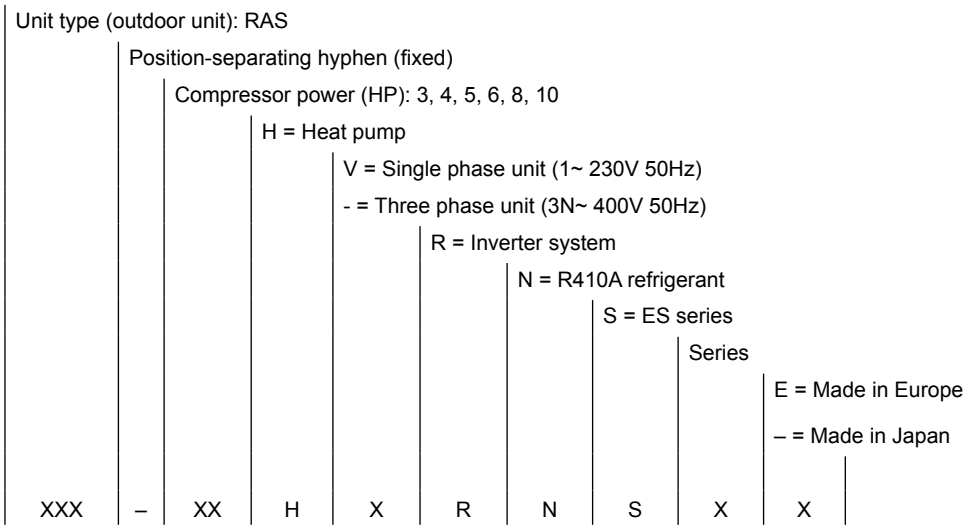
In the texts following the caution symbol you can also find information on safe procedures during unit installation.

NOTE

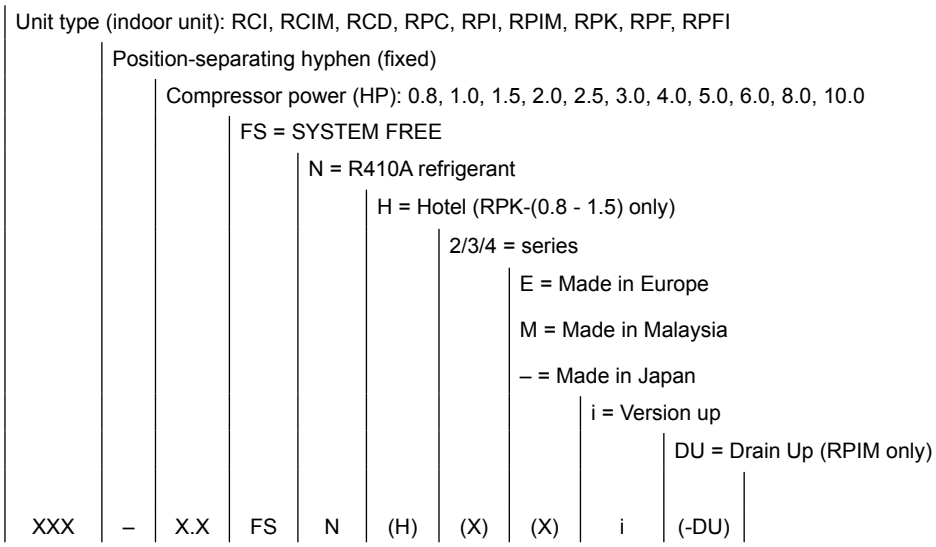
- *The text following this symbol contains information or instructions that may be of use or that require a more thorough explanation.*
- *Instructions regarding inspections to be made on unit parts or systems may also be included.*

1.3 Product guide

1.3.1 Classification of outdoor unit models



1.3.2 Classification of indoor unit models



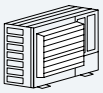
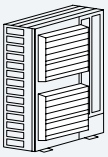
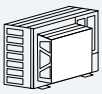
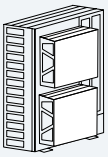
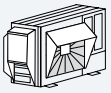
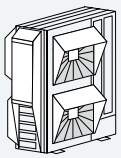
1.3.3 Product guide: Outdoor units

Outdoor Units ES							
1~ 230V 50Hz				3N~ 400V 50Hz			
							
Unit	Code	Unit	Code	Unit	Code	Unit	Code
RAS-3HVRNS3	60288605						
		RAS-4HVRNS3E	7E305033	RAS-4HRNS3E	7E305133		
		RAS-5HVRNS2E	7E306021	RAS-5HRNS2E	7E306108		
		RAS-6HVRNS2E	7E306022	RAS-6HRNS2E	7E306109		
						RAS-8HRNSE	7E314110
						RAS-10HRNSE	7E314111

NOTE

- *Check the exact classification for each unit (model, type, power and series) in Classification of outdoor unit models, see on page 4 .*

1.3.4 Outdoor unit accessory code list

Name	Description	Code	Figure
DBS-26	Drain discharge connection	60299192	
AG-264	Air flow guide (For 3HP)	-	
AG-335A	Air flow guide (For 4-10HP)	60291431	
WSP-264	Wind guard (For 3HP)	60291728	
WSP-335A	Wind guard (For 4-10HP)	60291432	
ASG-NP80F	Snow protection hood; air outlet (Zinc plate) (For 3HP)	-	
ASG-NP80FS2	Snow protection hood; air outlet (Stainless plate) (For 3HP)	-	
ASG-NP335F	Snow protection hood; air outlet (Zinc plate) (For 4-10HP)	60291433	
ASG-NP335FS2	Snow protection hood; air outlet (Stainless plate) (For 4-10HP)	-	
ASG-NP56B	Snow protection hood; air inlet of rear side (Zinc plate) (For 3HP)	-	
ASG-NP63BS2	Snow protection hood; air inlet of rear side (Stainless plate) (For 3HP)	-	
ASG-NP80B	Snow protection hood; air inlet of rear side (Zinc plate) (For 4-6HP)	60291773	
ASG-NP160BS2	Snow protection hood; air inlet of rear side (Stainless plate) (For 4-6HP)	60291774	
ASG-NP280B	Snow protection hood; air inlet of rear side (Zinc plate) (For 8/10HP)	-	
ASG-NP280BS2	Snow protection hood; air inlet of rear side (Stainless plate) (For 8/10HP)	60291778	
ASG-NP56L	Snow protection hood; air inlet of left side (Zinc plate) (For 3HP)	-	
ASG-NP63LS2	Snow protection hood; air inlet of left side (Stainless plate) (For 3HP)	-	
ASG-NP80L	Snow protection hood; air inlet of left side (Zinc plate) (For 4-6HP)	60291775	
ASG-NP160LS2	Snow protection hood; air inlet of left side (Stainless plate) (For 4-6HP)	60291776	
ASG-NP280L	Snow protection hood; air inlet of left side (Zinc plate) (For 8/10HP)	-	
ASG-NP280LS2	Snow protection hood; air inlet of left side (Stainless plate) (For 8/10HP)	60291780	

NOTE

HITACHI has a range of accessories and remote control systems that can be used with the UTOPIA outdoor units. Please, refer to the Controls Technical Catalogue.

1.3.5 Product guide: Indoor units

◆ RCI and RCIM indoor units

FSN(2/3)(E)(i) indoor units					
RCI				RCIM	
					
4-way cassette				4-way cassette (compact)	
Unit	Code	Unit	Code	Unit	Code
RCI-1.5FSN3Ei	7E403015	RCI-1.5FSN3	60278120	RCIM-1.5FSN2	60278013
RCI-2.0FSN3Ei	7E403016	RCI-2.0FSN3	60278121	RCIM-2.0FSN2	60278014
RCI-2.5FSN3Ei	7E403017	RCI-2.5FSN3	60278122		
RCI-3.0FSN3Ei	7E403018	RCI-3.0FSN3	60278123		
RCI-4.0FSN3Ei	7E403020	RCI-4.0FSN3	60278124		
RCI-5.0FSN3Ei	7E403021	RCI-5.0FSN3	60278125		
RCI-6.0FSN3Ei	7E403022	RCI-6.0FSN3	60278126		

Panels (Optional)					
					
P-N23NA	70531000	P-AP160NA1	60297215	P-N23WAM	60197160
		P-AP160NAE (With motion sensor)	60297217		

NOTE

- *Check the exact classification for each unit (model, type, power and series) in Classification of indoor unit models, see on page 4.*
- *The RCI and RCIM models must be used in combination with the panels indicated above.*

◆ RCD and RPC indoor units

FSN2(E) indoor units					
RCD				RPC	
					
2-way cassette				Ceiling type	
Unit	Code			Unit	Code
RCD-1.5FSN2	60278030				
RCD-2.0FSN2	60278031			RPC-2.0FSN2E	7E440003
RCD-2.5FSN2	60278032			RPC-2.5FSN2E	7E440004
RCD-3.0FSN2	60278033			RPC-3.0FSN2E	7E440005
		RCD-4.0FSN2	60278034	RPC-4.0FSN2E	7E440007
		RCD-5.0FSN2	60278035	RPC-5.0FSN2E	7E440008
				RPC-6.0FSN2E	7E440009

Panels (Optional)			
			
P-N23DNA	60297211	P-N46DNA	60297212

NOTE

- *The RCD models must be used in combination with the panels indicated above.*

◆ RPI and RPIM indoor units

FSN(3/4)E indoor units					
RPI				RPIM	
					
Indoor ducted unit					
Unit	Code	Unit	Code	Unit	Code
RPI-1.5FSN4E	7E424015			RPIM-1.5FSN4E	7E430015
				RPIM-1.5FSN4E-DU	7E431015
RPI-2.0FSN4E	7E424016				
RPI-2.5FSN4E	7E424017				
RPI-3.0FSN4E	7E424018				
RPI-4.0FSN4E	7E424020				
RPI-5.0FSN4E	7E424021				
RPI-6.0FSN4E	7E424022				
		RPI-8.0FSN3E	7E424010		
		RPI-10.0FSN3E	7E424011		

◆ RPK, RPF and RPFI indoor units

FSN(H)(2/3)(E/M) indoor units ❄ ✺					
RPK		**RPF**		**RPFI**	
					
Wall type		Floor type		Floor concealed type	
Unit	Code	Unit	Code	Unit	Code
RPK-1.5FSN3M	60278148	RPF-1.5FSN2E	7E450002	RPFI-1.5FSN2E	7E460002
RPK-1.5FSNH3M	60278156				
RPK-2.0FSN3M	60278149	RPF-2.0FSN2E	7E450003	RPFI-2.0FSN2E	7E460003
RPK-2.5FSN3M	60278150	RPF-2.5FSN2E	7E450004	RPFI-2.5FSN2E	7E460004
RPK-3.0FSN3M	60278151				
RPK-4.0FSN3M	60278152				
EV-1.5N1(1)	60291791				

NOTE

- *(1) For RPK-1.5FSNH3M models only.*

1.3.6 Product guide: complementary systems

◆ KPI energy / heat recovery unit

Complementary systems			
KPI			
			
Energy recovery		Heat recovery	
Unit	Code	Unit	Code
KPI-252E3E	70602000		
KPI-502E3E	70602001	KPI-502H3E	70602101
KPI-802E3E	70602002	KPI-802H3E	70602102
KPI-1002E3E	70602003	KPI-1002H3E	70602103
KPI-1502E3E	70602004	KPI-1502H3E	70602104
KPI-2002E3E	70602005	KPI-2002H3E	70602105

◆ DX-Interface

Control box	Expansion valve box
	

DX-Interface	
Model	Code
EXV-2.0E1	7E610900
EXV-2.5E1	7E610901
EXV-3.0E1	7E610902
EXV-4.0E1	7E610903
EXV-5.0E1	7E610904
EXV-6.0E1	7E610905
EXV-8.0E1	7E610906
EXV-10.0E1	7E610907

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2. General data

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2.1 General information

2.1.1 Combination with indoor units

All of the outdoor units described in this manual are combined with indoor units as indicated in the following table:

Outdoor units	Indoor units	Complementary system
ES series	RCI	KPI DX-Interface
	RCIM	
	RCD	
	RPC	
	RPI	
	RPIM	
	RPK	
	RPF	
	RPFI	

2.1.2 Considerations

1 The nominal cooling and heating capacity is the combined capacity of the outdoor and indoor units system and is based on the EN14511, with the following operating conditions.

Operating conditions		Cooling	Heating
Indoor air inlet temperature	DB	27.0 °C	20.0 °C
	WB	19.0 °C	—
Outdoor air inlet temperature	DB	35.0 °C	7.0 °C
	WB	—	6.0 °C
DB: Dry Bulb; WB: Wet Bulb Piping length: 7.5 meters; Piping lift: 0 meters			

2 The tables show all possible single combinations with it each indoor unit.

3 The EER and COP are specified in the outdoor unit in combination with the above indoor unit.

4 The sound pressure level were measured in an anechoic chamber, so reflected sound should be taken into consideration when installing the unit. Test were carried out under the following conditions.

- Measurement point located: 1 m from floor level and 1 m from the unit front surface.
- Units working with their nominal supply voltage.

5 Sound power levels were measured in a reverberant room, in accordance with the standard EN12102. Used environment conditions are the same that specified in EN14511 for performance test. (See in the table).

6 SEER and SCOP are according to EN 14825.

2.1.3 General specifications

◆ 1~ 230V 50Hz

Outdoor units		RAS-3HVRNS3	RAS-4HVRNS3E	RAS-5HVRNS2E	RAS-6HVRNS2E
Power supply	-	1~ 230V 50Hz	1~ 230V 50Hz	1~ 230V 50Hz	1~ 230V 50Hz
Nominal cooling capacity (min-max)	kW	7.1 (3.2-8.0)	10.0 (4.5-11.2)	12.5 (5.7-14.0)	14.0 (6.0-16.0)
Nominal heating capacity (min-max)	kW	8.0 (3.5-10.6)	11.2 (5.0-14.0)	14.0 (6.0-16.0)	16.0 (6.0-18.0)
EER (*)		3.05	3.69	2.91	2.45
COP (*)		3.88	4.16	3.24	2.88
Minimum - Maximum indoor units connectable	-	1 - 2	1 - 2	1 - 2	1 - 3
Noise level cooling (sound pressure) (night mode)	dB(A)	48(46)	50(48)	52(50)	55(53)
Noise level heating (sound pressure)	dB(A)	50	52	54	57
Noise level (sound power)	dB(A)	66	70	71	72
Air flow (cooling / heating)	m^3/min	44.7 / 44.7	62 / 62	68 / 68	80 / 80
Dimensions (H x W x D)	mm	600 x 792 x 300	800 x 950 x 370	800 x 950 x 370	800 x 950 x 370
Net weight	kg	44	67	83	83
Recommended circuit breaker	A	20	32	32	32
Starting current	A	Less than maximum current	Less than maximum current	Less than maximum current	Less than maximum current
Maximum current	A	16.0	28.0	26.0	26.0
Running current cooling	A	10.0	11.3	18.4	24.6
Running current heating	A	8.8	11.3	18.5	23.8
Power cable size (according to EN 60335-1)	quantity x mm^2	3 x 4.0	3 x 6.0	3 x 6.0	3 x 6.0
Transmitting cable size between indoor unit and outdoor unit	quantity x mm^2	2 x 0.75	2 x 0.75	2 x 0.75	2 x 0.75
Piping diameter (liquid / gas)	mm (inch)	Ø9.52 (3/8) / Ø15.88 (5/8)	Ø9.52 (3/8) / Ø15.88 (5/8)	Ø9.52 (3/8) / Ø15.88 (5/8)	Ø9.52 (3/8) / Ø15.88 (5/8)
Minimum piping length	m	5	5	5	5
Maximum piping length chargeless	m	30	30	30	30
Maximum piping length (additional refrigerant charge needed)	m (g/m)	50 (30)	50 (40)	50 (60)	50 (60)
Height difference (O.U. higher / O.U. lower)	m	30 / 20	30 / 20	30 / 20	30 / 20
Working range (cooling // heating)	°C	-5 / +43 (DB) // -20 / +15(WB)	-5 / +43 (DB) // -20 / +15(WB)	-5 / +43 (DB) // -10 / +15(WB)	-5 / +43 (DB) // -10 / +15(WB)
Refrigerant	-	R410A	R410A	R410A	R410A
Refrigerant charge before shipment	kg	1.9	2.9	2.9	2.9
Compressor type	-	Scroll DC Inverter driven	Rotary DC Inverter driven	Scroll DC Inverter driven	Scroll DC Inverter driven
Remote control model (Optional)		PC-ART / PC-ARF	PC-ART / PC-ARF	PC-ART / PC-ARF	PC-ART / PC-ARF

(*) COP and EER for 3 and 4 HP data are specified for RCI-FSN3 indoor units combination. For 5 and 6 HP are specified for RCI-FSN3Ei indoor units combination.

◆ 3N~ 400V 50Hz

Outdoor unit		RAS-4HRNS3E	RAS-5HRNS2E	RAS-6HRNS2E
Power supply	-	3N~ 400V 50Hz	3N~ 400V 50Hz	3N~ 400V 50Hz
Nominal cooling capacity (min-max)	kW	10.0 (4.5-11.2)	12.5 (5.7-14.0)	14.0 (6.0-16.0)
Nominal heating capacity (min-max)	kW	11.2 (5.0-14.0)	14.0 (6.0-16.0)	16.0 (6.0-18.0)
EER (*)		3.69	2.91	2.45
COP (*)		4.16	3.24	2.88
Minimum - Maximum indoor units connectable	-	1 - 2	1 - 2	1 - 3
Noise level cooling (sound pressure) (night mode)	dB(A)	50(48)	52(50)	55(53)
Noise level heating (sound pressure)	dB(A)	52	54	57
Noise level (sound power)	dB(A)	70	71	72
Air flow (cooling / heating)	m^3/min	62 / 62	68 / 68	80 / 80
Dimensions (H x W x D)	mm	800 x 950 x 370	800 x 950 x 370	800 x 950 x 370
Net weight	kg	67	83	83
Recommended circuit breaker	A	20	20	20
Starting current	A	Less than maximum current	Less than maximum current	Less than maximum current
Maximum current	A	15.0	13.0	13.0
Running current cooling	A	4.1	6.5	8.7
Running current heating	A	4.1	6.6	8.4
Power cable size (according to EN 60335-1)	quantity x mm^2	5 x 4.0	5 x 4.0	5 x 4.0
Transmitting cable size between indoor unit and outdoor unit	quantity x mm^2	2 x 0.75	2 x 0.75	2 x 0.75
Piping diameter (liquid / gas)	mm (inch)	Ø9.52 (3/8) / Ø15.88 (5/8)	Ø9.52 (3/8) / Ø15.88 (5/8)	Ø9.52 (3/8) / Ø15.88 (5/8)
Minimum piping length	m	5	5	5
Maximum piping length chargeless	m	30	30	30
Maximum piping length (additional refrigerant charge needed)	m (g/m)	50 (40)	50 (60)	50 (60)
Height difference (OU higher / OU lower)	m	30 / 20	30 / 20	30 / 20
Working range (cooling // heating)	°C	-5 / +43 (DB) // -20 / +15(WB)	-5 / +43 (DB) // -10 / +15(WB)	-5 / +43 (DB) // -10 / +15(WB)
Refrigerant	-	R410A	R410A	R410A
Refrigerant charge before shipment	kg	2.9	2.9	2.9
Compressor type	-	Rotary DC Inverter driven	Scroll DC Inverter driven	Scroll DC Inverter driven
Remote control model (Optional)		PC-ART / PC-ARF	PC-ART / PC-ARF	PC-ART / PC-ARF

(*) COP and EER for 4 HP data are specified for RCI-FSN3 indoor units combination. For 5 and 6 HP are specified for RCI-FSN3Ei indoor units combination.

Outdoor unit		RAS-8HRNSE	RAS-10HRNSE
Power supply	-	3N~ 400V 50Hz	3N~ 400V 50Hz
Nominal cooling capacity (min-max)	kW	20.0 (9.0-22.4)	25.0 (11.2-28.0)
Nominal heating capacity (min-max)	kW	22.4 (8.3-25.0)	28.0 (9.0-31.5)
EER (*)		3.01	2.81
COP (*)		3.42	3.21
Minimum - Maximum indoor units connectable	-	1 - 4	1 - 4 (Not possible 3)
Noise level cooling (sound pressure) (night mode)	dB(A)	53(51)	60(56)
Noise level heating (sound pressure)	dB(A)	55	62
Noise level (sound power)	dB(A)	71	78
Air flow (cooling / heating)	m^3/min	127 / 127	146 / 146
Dimensions (H x W x D)	mm	1380 x 950 x 370	1380 x 950 x 370
Net weight	kg	135	141
Recommended circuit breaker	A	32	32
Starting current	A	Less than maximum current	Less than maximum current
Maximum current	A	20.0	23.0
Running current cooling	A	10.7	14.6
Running current heating	A	9.9	13.5
Power cable size (according to EN 60335-1)	quantity x mm^2	5 x 6.0	5 x 6.0
Transmitting cable size between indoor unit and outdoor unit	quantity x mm^2	2 x 0.75	2 x 0.75
Piping diameter (liquid / gas)	mm (inch)	Ø9.52 (3/8) / Ø25.4 (1)	Ø9.52 (1/2) (A) / Ø25.4 (1)
Minimum piping length	m	5	5
Maximum piping length chargeless	m	30	30
Maximum piping length (additional refrigerant charge needed)	m (g/m)	50 (65)	50 (120)
Height difference (OU higher / OU lower)	m	30 / 20	30 / 20
Working range (cooling // heating)	°C	-5 / +43 (DB) // -10 / +15(WB)	-5 / +43 (DB) // -10 / +15(WB)
Refrigerant	-	R410A	R410A
Refrigerant charge before shipment	kg	6.0	6.2
Compressor type	-	Scroll DC Inverter driven	Scroll DC Inverter driven
Remote control model (Optinal)		PC-ART / PC-ARF	PC-ART / PC-ARF

(*) COP and EER data are specified for RCI-FSN3Ei (x2) indoor units combination.

(A) When the piping length is over 30 m, Ø12.7 (1/2) pipe is required.

2.1.4 Seasonal cooling/heating performance and EER/COP (3 and 4 HP)

System combination		Cooling				Heating			
Outdoor unit	Indoor unit	SEER	EER	Energy Class	P Design (35ºC)	SCOP	COP	Energy Class	P Desing (-10ºC)
		-		-	kW				kW
RAS-3HVRNS3	RCI-3.0FSN3	5.14	3.05	A	7.1	3.88	3.88	A	5.6
	RCI-3.0FSN3Ei	4.70	3.01	B	7.1	3.81	3.65	A	5.6
	RCD-3.0FSN2	4.07	2.57	D	7.1	3.59	3.12	A	5.6
	RPC-3.0FSN2E	3.78	2.57	D	7.1	3.40	3.07	A	5.6
	RPI-3.0FSN4E	4.70	2.81	B	7.1	3.81	3.58	A	5.6
	RPK-3.0FSN3M	4.66	2.61	B	7.1	3.59	2.93	A	5.6
RAS-4HVRNS3E	RCI-4.0FSN3	4.95	3.69	B	10.0	3.85	4.16	A	8.0
	RCI-4.0FSN3Ei	4.70	3.30	B	10.0	3.81	3.65	A	8.0
	RCD-4.0FSN2	3.98	3.28	D	10.0	3.40	3.23	A	6.8
	RPC-4.0FSN2E	4.27	2.96	C	10.0	3.40	3.13	A	6.8
	RPI-4.0FSN4E	4.70	3.40	B	10.0	3.83	3.65	A	8.0
	RPK-4.0FSN3M	4.75	2.41	B	10.0	3.40	2.96	A	6.8
RAS-4HRNS3E	RCI-4.0FSN3	4.85	3.69	B	10.0	3.85	4.16	A	8.0
	RCI-4.0FSN3Ei	4.70	3.30	B	10.0	3.81	3.65	A	8.0
	RCD-4.0FSN2	3.98	3.28	D	10.0	3.40	3.23	A	6.8
	RPC-4.0FSN2E	4.17	2.96	C	10.0	3.40	3.13	A	6.8
	RPI-4.0FSN4E	4.70	3.40	B	10.0	3.83	3.65	A	8.0
	RPK-4.0FSN3M	4.66	2.41	B	10.0	3.40	2.96	A	6.8

2.1.5 EER/COP (5 and 6 HP)

System combination		Cooling		Heating	
Outdoor unit	Indoor unit	EER	Energy Class	COP	Energy Class
RAS-5HVRNS2E	RCI-5.0FSN3i	2.91	C	3.24	C
	RCD-5.0FSN2	3.03	B	3.31	C
	RPC-5.0FSN2E	2.80	D	3.09	D
	RPI-5.0FSN4E	2.93	C	3.33	C
RAS-5HRNS2E	RCI-5.0FSN3Ei	2.91	C	3.24	C
	RCD-5.0FSN2	3.03	B	3.31	C
	RPC-5.0FSN2E	2.80	D	3.09	D
	RPI-5.0FSN4E	2.93	C	3.33	C
RAS-6HVRNS2E	RCI-6.0FSN3Ei	2.45	E	2.88	D
	RPC-6.0FSN2E	2.41	E	2.83	D
	RPI-6.0FSN4E	2.75	D	3.23	C
RAS-6HRNS2E	RCI-6.0FSN3Ei	2.45	E	2.88	D
	RPC-6.0FSN2E	2.41	E	2.83	D
	RPI-6.0FSN4E	2.75	D	3.23	C

2.1.6 EER/COP (8 and 10 HP)

System combination		Cooling		Heating	
Outdoor unit	Indoor unit	EER	Energy Class	COP	Energy Class
RAS-8HRNSE	RPI-8.0FSN3E	2.57	E	3.07	D
	2 x RCI-4.0FSN3Ei	3.01	B	3.42	B
	2 x RCD-4.0FSN2	2.80	D	3.17	D
	2 x RPC-4.0FSN2E	2.66	D	2.96	D
	2 x RPI-4.0FSN4E	2.50	E	3.07	D
	2 x RPK-4.0FSN3M	2.62	D	2.84	D
RAS-10HRNSE	RPI-10.0FSN3E	2.41	E	3.03	D
	2 x RCI-5.0FSN3Ei	2.81	C	3.21	C
	2 x RCD-5.0FSN2	2.61	D	3.13	D
	2 x RPC-5.0FSN2E	2.48	E	2.93	D
	2 x RPI-5.0FSN4E	2.42	E	3.03	D

2.2 Component data

2.2.1 RAS-3HVRNS3

MODEL			RAS-3HVRNS3
Heat exchanger	Type		Multi-pass cross-finned tube
	Pipe material		Copper
	Outer diameter	mm	8
	Rows of tubes		2
	Number of tubes in the Heat exchanger		44
	Fin material		Aluminium
	Fin pitch		1.45
	Maximum operating pressure	MPa	4.15
	Total front area	m^2	0.47
	Number of Heat exchanger per unit		1
Fan	Fan type		Direct drive propeller fan
	Fans per unit		1
	Outer diameter	mm	449
	Revolutions	rpm	850
	Nominal air flow	m^3/min	45
Motor	Shell		Drip-proof type enclosure
	Starting		Direct current control
	Power	W	40
	Quantity		1
	Insulation class		E
Compressor			EU-180XA1

2.2.2 RAS-(4-6)HVRNS(2/3)E

MODEL			RAS-4HVRNS3E	RAS-5HVRNS2E	RAS-6HVRNS2E
Heat exchanger	Type		Multi-pass cross-finned tube		
	Pipe material		Copper		
	Outer diameter	mm	7	7	7
	Rows of tubes		2	3	3
	Number of tubes in the Heat exchanger		132	114	114
	Fin material		Aluminium		
	Fin pitch		1.4	1.9	1.9
	Maximum operating pressure	MPa	4.15	4.15	4.15
	Total front area	m^2	0.77	0.77	0.77
	Number of Heat exchanger per unit		1	1	1
Fan	Fan type		Direct drive propeller fan	Multi-blade centrifugal fan	
	Fans per unit		1	1	1
	Outer diameter	mm	544	465	465
	Revolutions	rpm	690	700	750
	Nominal air flow	m^3/min	68	68	80
Motor	Shell		Drip-proof type enclosure		
	Starting		Direct current control		
	Power	W	190	138	138
	Quantity		1	1	1
	Insulation class		E	E	E
Compressor			2YC63FXD	E-400HHD-36A2	

2.2.3 RAS-(4-6)HRNS(2/3)E

MODEL			RAS-4HRNS3E	RAS-5HRNS2E	RAS-6HRNS2E
Heat exchanger	Type		Multi-pass cross-finned tube		
	Pipe material		Copper		
	Outer diameter	mm	7	7	7
	Rows of tubes		2	3	3
	Number of tubes in the Heat exchanger		132	114	114
	Fin material		Aluminium		
	Fin pitch		1.4	1.9	1.9
	Maximum operating pressure	MPa	4.15	4.15	4.15
	Total front area	m^2	0.77	0.77	0.77
	Number of Heat exchanger per unit		1	1	1
Fan	Fan type		Direct drive propeller fan	Multi-blade centrifugal fan	
	Fans per unit		1	1	1
	Outer diameter	mm	544	465	465
	Revolutions	rpm	690	700	750
	Nominal air flow	m^3/min	68	68	80
Motor	Shell		Drip-proof type enclosure		
	Starting		Direct current control		
	Power	W	190	138	138
	Quantity		1	1	1
	Insulation class		E	E	E
Compressor			2YC63RXD	E-400HHD-36D2	

2.2.4 RAS-(8-10)HRNSE

MODEL			RAS-8HRNSE	RAS-10HRNSE
Heat exchanger	Type		Multi-pass corss-finned tube	
	Pipe material		Copper	
	Outer diameter	mm	7	7
	Rows of tubes		2	3
	Number of tubes in the Heat exchanger		132	198
	Fin material		Aluminium	
	Fin pitch		1.9	1.9
	Maximum operating pressure	MPa	4.15	4.15
	Total front area	m^2	1.36	1.36
	Number of Heat exchanger per unit		1	1
Fan	Fan type		Propeller fan	
	Fans per unit		2	2
	Outer diameter	mm	544	544
	Revolutions	rpm	561+740	664+850
	Nominal air flow	m^3/min	127	146
Motor	Shell		Drip-proof type enclosure	
	Starting		Direct current control	
	Power	W	138+120	138+170
	Quantity		2	2
	Insulation class		E	E
Compressor			E655DHD-65D2	

2.3 Electrical data

2.3.1 Considerations

Keywords:

- U: Power supply.
- PH: Phase.
- f: Frequency.
- STC: Starting current: Less than maximum current.
- IPT: Total input power.
- RNC: Running current.
- MC: Maximum current.
- CB: Circuit breaker (A).
- ELB: Earth leakage breaker (Number of poles/A/mA).

NOTE

- *Specifications in these tables are subject to change without notice in order that HITACHI may bring the latest innovations to their customers.*
- *Cooling conditions: Indoor air inlet: 20 ºC DB; Outdoor air inlet: 7/6 ºC (DB/WB).*
- *Heating conditions: Indoor air inlet: 27/19 ºC (DB/WB); Outdoor air inlet: 35 ºC DB.*

2.3.2 Outdoor Unit electrical data

Outdoor unit	Main unit power			Applicable voltage		Compressor and fan motor						CB (A)	ELB
							Cooling		Heating		Max. IPT (kW)	MC (A)		
	U (V)	PH	f (Hz)	U max (V)	U min (V)	STC (A)	IPT (kW)	RNC (A)	IPT (kW)	RNC (A)				
RAS-3HVRNS3	230	1	50	253	207	-	2.27	10.0	2.00	8.8	3.64	16.0	20	2/40/30
RAS-4HVRNS3E							2.58	11.3	2.56	11.3	6.38	28.0	32	
RAS-5HVRNS2E							4.16	18.4	4.18	18.5	5.86	26.0	32	
RAS-6HVRNS2E							5.53	24.6	5.38	23.8	5.86	26.0	32	
RAS-4HRNS3E	400	3	50	440	360	-	2.58	4.1	2.56	4.1	9.35	15.0	20	4/40/30
RAS-5HRNS2E							4.16	6.5	4.18	6.6	8.29	13.0	20	
RAS-6HRNS2E							5.53	8.7	5.38	8.4	8.29	13.0	20	
RAS-8HRNSE							6.42	10.1	6.33	9.9	12.75	20.0	40	
RAS-10HRNSE							8.62	13.5	8.44	13.2	14.66	23.0	40	

3. Capacities and selection data

Index

3.1 System selection procedure

The following procedure is an example of how to select the system units and indicates how to use all the parameters indicated in this chapter.

Considering the layout of the building, the possible position of the indoor units and the air flow distribution, select the unit features that provide the greatest efficiency and comfort. Decide a position for the outdoor unit that facilitates service and maintenance tasks.

Capacity adjustment by dip switch setting of the indoor units

In some, situations, it should be useful to adjust the capacity of the indoor units in order to adapt the unit to the actual installation requirements. This function is performed by dip switch setting and it's possible in some HP indoor unit models.

Following table contains the nominal capacity and the adjusted capacity by dip switch setting of the indoor units.

- Nominal capacity of indoor units

Horsepower (HP) / Capacity		1.5	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0
Cooling	kW	3.6	5.0	6.3	7.1	10.0	12.5	14.0	20.0	25.0
Heating	kW	4.0	5.6	7.0	8.0	11.2	14.0	16.0	22.4	28.0

NOTE

- *The nominal cooling and heating capacity is the combined capacity of the UTOPIA system, and is based on EN14511.*

Operation condition		Cooling	Heating
Indoor air inlet temperature	DB	27 °C	20 °C
	WB	19 °C	—
Outdoor air inlet temperature	DB	35 °C	7 °C
	WB	—	6 °C

Piping length: 7.5 meters.
Piping height: 0 meters.
DB: Dry Bulb.
WB: Wet Bulb.

- Adjusted capacities of indoor units.

Horsepower (HP)		1.3			1.8			2.3		
Variable capacity		1.3	←	1.5	1.8	←	2.0	2.3	←	2.5
Cooling	kW	3.2			4.5			5.6		
Heating	kW	3.6			5.0			6.3		
Applicable model		RPI(M), RCI(M), RCD, RPK, RPF, RPFI			RPI, RCI, RCD, RPK, RPC			RPI, RCI, RCD, RPC		
Indoor unit dip switch setting (DSW3)		1.3 HP	←	1.5 HP	1.8 HP	←	2.0 HP	2.3 HP	←	2.5 HP
										
		Lowered		Standard	Lowered		Standard	Lowered		Standard

NOTE

The maximum indoor unit capacity combined with the capacity of the outdoor unit should be carefully considered to ensure the correct distribution of the indoor units in each building.

3.1.1 Selecting unit features

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

Available models	Maximum cooling and heating capacities
General information of the units	COP and EER
Operation space possibilities	Different correction factors
Working range	Sound data for the different units

In case of an installation with ducts (outdoor unit with RPI indoor unit) the fan performance for duct calculations should be considered. The RPI units are designed with different static pressure ranges in order to fulfil all installation necessities.

3.1.2 Selection procedure

The system selection procedure is as follows:

Firstly, the outdoor unit is pre-selected according to the design conditions. Secondly, the combination with indoor units and their respective models is chosen. Finally, the theoretical capacity values taken from the different tables are corrected to take account of the various correction factors that exist.

This procedure is divided in two parts: cooling and heating.

◆ Cooling mode

a) Initial pre-selection

This example is based on an ambient with the following characteristics:

Design conditions

Outdoor air inlet	Dry bulb: 35 ºC
Indoor air inlet	Dry bulb: 25 ºC Wet bulb: 17 ºC
Required cooling load	13.5 kW
Required sensible heat load	10 kW

It has been assumed that this ambient will require a cooling load of 13.5 kW, of which the client has set a minimum sensible heat load condition of 10 kW.

The outdoor ambient temperature (air inlet at the outdoor unit) is 35 ºC DB and the air inlet temperature for the indoor unit is 25.0/17 ºC (DB/WB).

Installation characteristics

Total piping length	30 m
Height difference between indoor and outdoor units.	10 m

It is also considered that the outdoor unit is located in a higher position than the indoor units. Therefore, when necessary refer to the section *Piping length correction factor, see on page 35*it will be used the correction factor value at positive height difference between indoor and outdoor units (+H).

b) Selecting the combination of the outdoor unit and the indoor unit

In section *Maximum cooling capacities, see on page 33*should be seen once the characteristics of the space to be conditioned have been studied in order to find the unit that will provide the appropriate cooling capacity for these ambient conditions. The maximum capacities are not guaranteed constantly out of the standard conditions.

As can be seen in the table, the outdoor unit that covers the installation's cooling requirements is the RAS-6HVRNS2E. Therefore, this will be the pre-selected unit.

Outdoor unit	Cooling capacity of the outdoor unit (kW) (35 ºC DB / 17 ºC (24 ºC) WB (DB))
RAS-5HVRNS2E	13.00
RAS-6HVRNS2E	15.20

NOTE

- *If the air inlet temperature for the indoor unit or outdoor unit is not contained in the capacity table in section standard cooling and heating capacities, an interpolation should be carried out using the values above and below those of the air inlet temperature.*
- *Taking into account UTOPIA system possibilities mentioned above, it has been ajusted the indoor unit capacities by dip-switch.*

For this theoretical ambient, it is assumed that the most appropriate combination would be an outdoor unit with 3 indoor units, taking into account the design of the room and the possible position of the indoor units and their subsequent air distribution.

For this example it is assumed three different indoor units (RCI-2.0FSN3Ei, RPI- 2.0FSN3E and RPC-2.0FSN2E) in order to show how the choice of indoor unit can affect the different factors presented in this chapter.

c) Cooling capacity correction

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

$$Q_C = Q_{MC} \times f_{LC}$$

Q_C: Actual cooling capacity of the outdoor unit (kW).

Q_{MC}: Maximum cooling capacity of the outdoor unit (kW).

f_{LC}: Cooling piping length correction factor.

The maximum cooling capacity (Q_{MC}) of the RAS-6HVRNS2E unit is 15.2 kW (35 ºC DB / 17 ºC (24 ºC) WB (DB)).

Calculation of f_{LC}

Both the length of the refrigerant piping used and the height difference between the outdoor unit and the indoor units directly affect the performance of the unit. This concept is quantified in the piping length correction factor.

To determine this value it is necessary refer to section *Piping length correction factor, see on page 35*where it can be seen that for the characteristics of our example (piping length of 30 metres and a height difference between the outdoor unit and the indoor units of 10 metres) the piping length correction factor for cooling mode is **0.92**.

Calculation of Q_C

Once the correction factors to be applied have been determined, the formula for actual cooling capacity of the unit RAS-6HVRNS2E can be applied:

$$Q_C = 15.2\ kW \times 0.92 = \mathbf{13.98\ kW}$$

As can be seen, the actual cooling capacity of the RAS-6HVRNS2E (13.98 kW) unit is greater than the cooling load required by the ambient to be conditioned (13.5 kW), but before deciding that the unit is valid, it must be verified that the unit complies with the requirement for the minimum sensible heat capacity set by the client (10 kW).

NOTE

If the actual cooling capacity calculated is less than that provided by the pre-selected unit, the calculation must be done again with the unit immediately higher.

d) Sensible heat capacity (SHC)

The system requirements specify a minimum sensible heat capacity of 10 kW. Once the real cooling capacity of the RAS-6HVRNS2E unit has been determined, its sensible heat capacity in combination with the three indoor units (RCI-2.0FSN3Ei, RPI-2.0FSN3E and RPC-2.0FSN2E), can be calculated.

Firstly, the real cooling capacity of each indoor unit must be calculated. This is done using the following formula:

$$Q_{CI} = Q_C \times (Q_{MCI} / Q_{MCC})$$

Q_{CI}: Actual cooling capacity of the indoor unit (kW).

Q_C: Actual cooling capacity of the outdoor unit (kW).

Q_{MCI}: Maximum cooling capacity of the indoor unit (kW). See section *Maximum cooling capacities*.

Q_{MCC}: Maximum cooling capacity of the combination (kW). See section *Maximum cooling capacities*.

Applying this we obtain:

$$Q_C = 13.98\ kW \times (5.33\ kW / 16.0\ kW) = \mathbf{4.66\ kW} = Q_{RCI\text{-}2.0} = Q_{RPI\text{-}2.0} = Q_{RPC\text{-}2.0}$$

Once the calculation of the indoor units cooling capacity has been completed, the sensible heat capacity can be calculated using the following formula:

$$SHC = Q_{CI} \times SHF$$

SHC: Sensible heat capacity (kW).

Q_{CI}: Actual cooling capacity of the indoor unit (kW).

SHF: Sensible heat factor.

Calculation of SHF

To determine the sensible heat factor (ratio of sensible heat relative to the total) the table in section “Sensible heat factor (SHF)” in Indoor units Technical Catalogue has to be seen, in which the different SHF values are shown for the different indoor units for each of the three possible fan speeds (High, Medium, Low). The value used is “that relating” to the high fan speed.

Doing this we obtain:

$SHF_{RPI\text{-}2.0} = 0.76$

$SHF_{RCI\text{-}2.0} = 0.78$

$SHF_{RPC\text{-}2.0} = 0.72$

Initinally, once the sensible heat factors have been obtained, the sensible heat capacity of each indoor unit can be calculated by applying the previous formula.

$$SHC^{RPI\text{-}2.0} = 4.66\ kW \times 0.76 = \mathbf{3.54\ kW}$$

$$SHC^{RCI\text{-}2.0} = 4.66\ kW \times 0.78 = \mathbf{3.63\ kW}$$

$$SHC^{RPC\text{-}2.0} = 4.66\ kW \times 0.72 = \mathbf{3.36\ kW}$$

The cooling capacity data for the RAS-6HVRNS2E unit taken from the table in section *Maximum cooling capacities, see on page 33* is calculated on the basis of a relative humidity of 50% which means that an indoor air inlet temperature of 17 ºC WB corresponds to a temperature of 24 ºC DB.

However, the difference between the indoor air inlet dry bulb temperature required by the system (25 ºC) and the indoor air inlet dry bulb temperature recorded in the cooling capacity data (24 ºC) requires an adjustment of the sensible heat capacity for each indoor unit.

e) Sensible heat capacity correction (SHCc)

The following formula should be used to carry out the sensible heat correction for each indoor unit:

$$SHC_C = SHC + (CR \times (DB_R - DB))$$

SHC_C: Corrected sensible heat capacity (kW).

SHC: Sensible heat capacity (kW).

CR: Correction ratio due to humidity.

DB_R: Real Dry Bulb evaporator temperature (ºC).

DB: Dry Bulb evaporator temperature (ºC) for each wet bulb temperature from the table (HR = 50 %).

Calculation of CR

The correction ratio due to humidity is shown in the table contained in section *Maximum cooling capacities*.

This coefficient corrects the sensible heat capacity of a unit according to the relative humidity of the air entering the indoor unit. The greater the relative humidity the lower will be the sensible heat capacity and vice versa.

The correction ratio CR for the RAS-6HVRNS2E unit is **0.59**.

Once the CR has been identified for the RAS-6HVRNS2E unit the corrected sensible heat capacity SHC_C of the indoor unit can be calculated:

$SHC_{C\_RPI-2.0}$ = *3.54 kW* + (*0.59* x (*25* - *24*)) = 4.13 kW
$SHC_{C\_RCI-2.0}$ = *3.63 kW* + (*0.59* x (*25* - *24*)) = 4.22 kW
$SHC_{C\_RPC-2.0}$ = *3.36 kW*+ (*0.59* x (*25* - *24*)) = 3.95 kW

Calculation of SHC_C

The sensible heat capacity for the combination will be:

$SHC_C = SHC_{C\_RPI-2.0} + SHC_{C\_RCI-2.0} + SHC_{C\_RPC-2.0}$
SHC_C =4.13 kW +4.22 kW +3.95 kW = 12.30 kW

As can be seen, the corrected sensible heat capacity of the system (12.30 kW) is greater than the sensible heat capacity required by the ambient to be conditioned (10 kW). Therefore, it can be said that the RAS-6HVRNS2E unit meets the minimum cooling requirements set for the system.

f) Results of cooling mode

Item			Total
Estimated load	Total	kW	13.5
	Sensible		10.0
Actual capacity	Total		13.98
	Sensible		12.3

In order to validate the pre-selection of the RAS-6HVRNS2E unit, its compliance with the minimum cooling requirements and the minimum heating requirements must be checked.

◆ Heating mode

a) Initial pre-selection

The heating requirements for the previous example are shown below.

Ambient conditions

The cooling ambient studied has the following heating characteristics:

Outdoor air inlet	Dry bulb: 3 ºC Wet bulb: 0 ºC
Indoor air inlet	Dry bulb: 20 ºC
Required heating load	13 kW

The outdoor ambient temperature (air inlet at the outdoor unit) is 3/0 ºC (DB/WB) and temperature of the indoor air inlet is 20 ºC DB.

In the section *Maximum heating capacities,* should be seen once the characteristics of the space to be conditioned have been studied in order to verify that the unit pre-selected for cooling provides an appropriate heating capacity for these conditions. In this case for RAS-6HVRNS2E the maximum heating capacity is 15.50 kW. The maximum capacities are not guaranteed constantly out of the standard conditions.

As can be seen in the table, the RAS-6HVRNS2E unit provides a theoretical heating capacity greater than the heating demand required by the environment. Therefore, the calculation process can continue.

Outdoor unit	Heating capacity of the outdoor unit (kW)
RAS-6HVRNS2E	15.50

NOTE

If the unit pre-selected for cooling does not provide the heating load required by the environment the pre-selection should be changed and the next unit should be chosen.

b) Heating capacity correction

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

$$Q_H = Q_{MH} \times f_{LH} \times f_d$$

Q_H: Actual heating capacity of the outdoor unit (kW).

Q_{MH}: Maximum heating capacity of the outdoor unit (kW).

f_{LH}: Heating piping length correction factor.

f_d: Defrost correction factor.

The maximum heating capacity (Q_{MH}) of the RAS-6HVRNS2E unit is 15.50 kW.

Calculation of f_{LH}

Consulting *Piping length correction factor, see on page 35*it can be seen that for the characteristics of our example (piping length of 30 metres and a height difference between the outdoor unit and the indoor units of 10 metres) the piping length correction factor for heating mode is **0.985**.

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 this case, the heating capacity for the unit may be reduced because of the time spent by the unit in removing the frost up.

The defrost correction factor takes this time into account to apply the heating capacity correction.

To calculate the correction factor, please see section *Defrost correction factor, see on page 38* **which shows a table with different values of f_d depending on the ambient temperature (º DB). If the correction factor at an ambient temperature of 3 º DB does not appear on the table, an interpolation will be needed.**

Finally, the resulting defrosting correction factor is **0.87**.

Calculation of Q_H

Once the correction factors to be applied have been determined, the formula for actual heating capacity of the unit RAS-6HVRNS2E can be applied:

$$Q_H = 15.50\ kW \times 0.985 \times 0.87 = \mathbf{13.28\ kW}$$

As can be seen, the actual heating capacity of the unit RAS-6HVRNS2E (13.28 kW) is greater than the heating load required by the ambient to be conditioned (13 kW).

Therefore, the pre-selection will be considered valid for both heating and cooling.

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 higher.

c) Results of Heating mode

Item		Total
Estimated load	kW	13.00
Actual capacity		13.28

The corrected heating capacity is greater than the estimated heating load. Therefore, it can be said that the selection is valid for both heating and cooling

3.2 Combinability

The following table shows the possible combinations for ES series, as well as the maximum capacity of the 1 outdoor unit for each system of combination of the indoor units, at a rated temperature and with a 7.5 m piping length.

RAS-3HVRNS2					Nominal Cooling Capacity: 7.1 kW Nominal Heating Capacity: 8.0 kW							
Combination	Indoor Unit Combination (HP)				Maximum Capacity (kW)							
				Total	Cooling				Heating			
								Total				Total
Single	3.0	-	-	3.0	8.0	-	-	8.0	10.6	-	-	10.6
Twin	1.5	1.5	-	3.0	4.0	4.0	-	8.0	5.3	5.3	-	10.6

RAS-4H(V)RNS2E					Nominal Cooling Capacity: 10.0 kW Nominal Heating Capacity: 11.2 kW							
Combination	Indoor Unit Combination (HP)				Maximum Capacity (kW)							
				Total	Cooling				Heating			
								Total				Total
Single	4.0	-	-	4.0	11.2	-	-	11.2	14.0	-	-	14.0
Twin	2.0	2.0	-	4.0	5.6	5.6	-	11.2	7,0	7,0	-	14.0
	(2.3)	(1.8)	-	4.1	6.3	4.9	-	11.2	7,9	6,1	-	14.0
	(2.3)	2.0	-	4.3	6.0	5.2	-	11.2	7,5	6,5	-	14.0
	2.5	(1.8)	-	4.3	6.5	4.7	-	11.2	8,1	5,9	-	14.0
	2.5	2.0	-	4.5	6.2	5.0	-	11.2	7,8	6,2	-	14.0

RAS-5H(V)RNS2E					Nominal Cooling Capacity: 12.5 kW Nominal Heating Capacity: 14.0 kW							
Combination	Indoor Unit Combination (HP)				Maximum Capacity (kW)							
				Total	Cooling				Heating			
								Total				Total
Single	5.0	-	-	5.0	14.0	-	-	14.0	16.0	-	-	16.0
Twin	2.5	2.5	-	5.0	7.0	7.0	-	14.0	8.0	8.0	-	16.0
	3.0	(2.3)	-	5.3	7.9	6.1	-	14.0	9.1	6.9	-	16.0
	3.0	(1.8)	-	4.8	8.8	5.3	-	14.0	10.0	6.0	-	16.0
	3.0	2.0	-	5.0	8.4	5.6	-	14.0	9.6	6.4	-	16.0

RAS-6H(V)RNS2E					Nominal Cooling Capacity: 14.0 kW Nominal Heating Capacity: 16.0 kW							
Combination	Indoor Unit Combination (HP)				Maximum Capacity (kW)							
				Total	Cooling				Heating			
								Total				Total
Single	6.0	-	-	6.0	16.0	-	-	16.0	18.0	-	-	18.0
Twin	3.0	3.0	-	6.0	8.0	8.0	-	16.0	9.0	9.0	-	18.0
	3.0	2.5	-	5.5	8.7	7.3	-	16.0	9.8	8.2	-	18.0
Triple	(1.8)	(1.8)	(1.8)	5.4	5.3	5.3	5.3	16.0	6.0	6.0	6.0	18.0
	2.0	2.0	2.0	6.0	5.3	5.3	5.3	16.0	6.0	6.0	6.0	18.0
	2.0	2.0	(1.8)	5.8	5.5	5.5	5.0	16.0	6.2	6.2	5.6	18.0
	(1.8)	(1.8)	2.0	5.6	5.1	5.1	5.7	16.0	5.8	5.8	6.4	18.0
	1.5	1.5	2.5	5.5	4.4	4.4	7.3	16.0	4.9	4.9	8.2	18.0

RAS-8HRNSE						Nominal Cooling Capacity: 20.0 kW Nominal Heating Capacity: 22.4 kW									
Combination	Indoor Unit Combination (HP)					Maximum Capacity (kW)									
					Total	Cooling					Heating				
										Total					Total
Single	8.0				8.0	22.4				22.4	25.0				25.0
Twin	4.0	4.0			8.0	11.2	11.2			22.4	12.5	12.5			25.0
Triple	3.0	3.0	3.0		9.0	7.4	7.4	7.4		22.2	8.3	8.3	8.3		25.0
Quad	2.0	2.0	2.0	2.0	8.0	5.6	5.6	5.6	5.6	22.4	6.2	6.2	6.2	6.2	25.0

RAS-10HRNSE						Nominal Cooling Capacity: 25.0 kW Nominal Heating Capacity: 28.0 kW									
Combination	Indoor Unit Combination (HP)					Maximum Capacity (kW)									
					Total	Cooling					Heating				
										Total					Total
Single	10.0				10.0	28.0				28.0	31.5				31.5
Twin	5.0	5.0			10.0	14.0	14.0			28.0	15.7	15.7			31.5
Quad	2.5	2.5	2.5	2.5	10.0	7.0	7.0	7.0	7.0	28.0	7.8	7.8	7.8	7.8	31.5

NOTE

- *The RPF(I) unit cannot be connected with another unit in a twin or triple combination due to lift restriction between indoor units.*
- *UTOPIA ES series is only for simultaneous operation at twin, triple and quad combinations.*
- *The triple combination is not available for RAS-10HRNSE.*
- *In brackets ( ): Adjusted capacity.*

3.3 Standard cooling and heating capacities

Outdoor unit	Indoor unit	Cooling				Heating			
		Capacity (kW)	OU+IU input (kW)	EER	Cooling per-formance	Capacity (kW)	OU+IU input (kW)	COP	Heating per-formance
RAS-3HVRNS3	RCI-3.0FSN3	7.1	2,33	3.05	A	8.0	2,06	3.88	A
	RCI-3.0FSN3Ei	7.1	2,36	3.01	B	8.0	2,19	3.65	A
	RCD-3.0FSN2	7.1	2,76	2.57	D	8.0	2,56	3.12	A
	RPC-3.0FSN2E	7.1	2,76	2.57	D	8.0	2,61	3.07	A
	RPI-3.0FSN4E	7.1	2,53	2.81	B	8.0	2,23	3.58	A
	RPK-3.0FSN3M	7.1	2,72	2.61	B	8.0	2,73	2.93	A
RAS-4HVRNS3E	RCI-4.0FSN3	10.0	2,71	3.69	B	11.2	2,69	4.16	A
	RCI-4.0FSN3Ei	10.0	3,03	3.30	B	11.2	3,07	3.65	A
	RCD-4.0FSN2	10.0	3,05	3.28	D	11.2	3,47	3.23	A
	RPC-4.0FSN2E	10.0	3,38	2.96	C	11.2	3,58	3.13	A
	RPI-4.0FSN4E	10.0	2,94	3.40	B	11.2	3,07	3.65	A
	RPK-4.0FSN3M	10.0	4,15	2.41	B	11.2	3,78	2.96	A
RAS-5HVRNS2E	RCI-5.0FSN3Ei	12.5	4.30	2.91	C	14.0	4.32	3.24	C
	RCD-5.0FSN2	12.5	4.13	3.03	B	14.0	4.23	3.31	C
	RPC-5.0FSN2E	12.5	4.46	2.80	D	14.0	4.53	3.09	D
	RPI-5.0FSN4E	12.5	4.27	2.93	C	14.0	4.20	3.33	D
	RCI-2.5FSN3E (x2)	12.5	4.28	2.92	C	14.0	4.30	3.26	C
	RCD-2.5FSN2 (x2)	12.5	4.14	3.02	B	14.0	4.24	3.30	C
	RPC-2.5FSN2E (x2)	12.5	4.49	2.78	D	14.0	4.56	3.07	D
	RPI-2.5FSN4E (x2)	12.5	4.25	2.94	C	14.0	4.18	3.35	C
	RPK-2.5FSN2M (x2)	12.5	4.46	2.80	D	14.0	4.53	3.09	D
	RPF-2.5FSN2E (x2)	12.5	4.48	2.79	D	14.0	4.59	3.05	D
	RPFI-2.5FSN2E (x2)	12.5	4.48	2.79	D	14.0	4.59	3.05	D
RAS-6HVRNS2E	RCI-6.0FSN3Ei	14.0	5.71	2.45	E	16.0	5.56	2.88	D
	RPC-6.0FSN2E	14.0	5.81	2.41	E	16.0	5.65	2.83	D
	RPI-6.0FSN4E	14.0	5.09	2.75	D	16.0	4.95	3.23	C
	RCI-3.0FSN3E (x2)	14.0	5.71	2.45	E	16.0	5.56	2.88	D
	RCD-3.0FSN2 (x2)	14.0	5.05	2.77	D	16.0	5.00	3.20	D
	RPC-3.0FSN2E (x2)	14.0	5.92	2.36	F	16.0	5.76	2.78	E
	RPI-3.0FSN4E (x2)	14.0	5.16	2.71	D	16.0	5.02	3.19	D
	RPK-3.0FSN2M (x2)	14.0	5.84	2.40	F	16.0	5.69	2.81	D

Outdoor unit	Indoor unit	Cooling				Heating			
		Capacity (kW)	OU+IU input (kW)	EER	Cooling per-formance	Capacity (kW)	OU+IU input (kW)	COP	Heating per-formance
RAS-4HRNS3E	RCI-4.0FSN3	10.0	2,71	3.69	B	11.2	2,69	4.16	A
	RCI-4.0FSN3Ei	10.0	3,03	3.30	B	11.2	3,07	3.65	A
	RCD-4.0FSN2	10.0	3,05	3.28	D	11.2	3,47	3.23	A
	RPC-4.0FSN2E	10.0	3,38	2.96	C	11.2	3,58	3.13	A
	RPI-4.0FSN4E	10.0	2,94	3.40	B	11.2	3,07	3.65	A
	RPK-4.0FSN3M	10.0	4,15	2.41	B	11.2	3,78	2.96	A
RAS-5HRNS2E	RCI-5.0FSN3Ei	12.5	4.30	2.91	C	14.0	4.32	3.24	C
	RCD-5.0FSN2	12.5	4.13	3.03	B	14.0	4.23	3.31	C
	RPC-5.0FSN2E	12.5	4.46	2.80	D	14.0	4.53	3.09	D
	RPI-5.0FSN4E	12.5	4.27	2.93	C	14.0	4.20	3.33	D
	RCI-2.5FSN3E (x2)	12.5	4.28	2.92	C	14.0	4.30	3.26	C
	RCD-2.5FSN2 (x2)	12.5	4.14	3.02	B	14.0	4.24	3.30	C
	RPC-2.5FSN2E (x2)	12.5	4.49	2.78	D	14.0	4.56	3.07	D
	RPI-2.5FSN4E (x2)	12.5	4.25	2.94	C	14.0	4.18	3.35	C
	RPK-2.5FSN2M (x2)	12.5	4.46	2.80	D	14.0	4.53	3.09	D
	RPF-2.5FSN2E (x2)	12.5	4.48	2.79	D	14.0	4.59	3.05	D
	RPFI-2.5FSN2E (x2)	12.5	4.48	2.79	D	14.0	4.59	3.05	D
RAS-6HRNS2E	RCI-6.0FSN3Ei	14.0	5.71	2.45	E	16.0	5.56	2.88	D
	RPC-6.0FSN2E	14.0	5.81	2.41	E	16.0	5.65	2.83	D
	RPI-6.0FSN4E	14.0	5.09	2.75	D	16.0	4.95	3.23	C
	RCI-3.0FSN3E (x2)	14.0	5.71	2.45	E	16.0	5.56	2.88	D
	RCD-3.0FSN2 (x2)	14.0	5.05	2.77	D	16.0	5.00	3.20	D
	RPC-3.0FSN2E (x2)	14.0	5.92	2.36	F	16.0	5.76	2.78	E
	RPI-3.0FSN4E (x2)	14.0	5.16	2.71	D	16.0	5.02	3.19	D
	RPK-3.0FSN2M (x2)	14.0	5.84	2.40	F	16.0	5.69	2.81	D
RAS-8HRNSE	RPI-8.0FSN3E	20.0	7.79	2.57	E	22.4	7.30	3.07	D
	RCI-4.0FSN3Ei (x2)	20.0	6.64	3.01	B	22.4	6.55	3.42	B
	RCD-4.0FSN2E (x2)	20.0	7.15	2.80	D	22.4	7.07	3.17	D
	RPC-4.0FSN2E (x2)	20.0	7.52	2.66	D	22.4	7.57	2.96	D
	RPI-4.0FSN4E (x2)	20.0	7.99	2.50	E	22.4	7.30	3.07	D
	RPK-4.0FSN2M (x2)	20.0	7.64	2.62	D	22.4	7.89	2.84	D
RAS-10HRNSE	RPI-10.0FSN3E	25.0	10.37	2.41	E	28.0	9.24	3.03	D
	RCI-5.0FSN3Ei (x2)	25.0	8.90	2.81	C	28.0	8.72	3.21	C
	RCD-5.0FSN2E (x2)	25.0	9.58	2.61	D	28.0	8.94	3.13	D
	RPC-5.0FSN2E (x2)	25.0	10.08	2.48	E	28.0	9.57	2.93	D
	RPI-5.0FSN4E (x2)	25.0	10.33	2.42	E	28.0	9.23	3.03	D

3.4 Maximum cooling capacities

Values are based on the following conditions:

Piping Length/Height difference: 7.5 m / 0 m.

The values are based on High speed of indoor fan. To calculate the cooling capacity of medium or low speed of indoor fan, multiply cooling capacity of high speed by Correction value Factor.

All temperatures in ºC.

All cooling capacities in kW

Outdoor Unit	CR	Outdoor Air Inlet Temperature (DB) (ºC)	Indoor Air Inlet Temperature WB (ºC) / (DB (ºC))					
			15/(22)	17/(24)	18/(25)	19/(27)	21/(29)	23/(31)
			CAP max	CAP max	CAP max	CAP max	CAP max	CAP max
RAS-3HVRNS3	0.34	25	7.70	8.10	8.31	8.50	8.80	9.10
		30	7.42	7.84	8.04	8.23	8.55	8.80
		35	7.26	7.63	7.82	8.00	8.32	8.60
		40	6.78	7.00	7.16	7.32	7.64	7.95
RAS-4H(V)RNS3E	0.43	25	10.60	11.20	11.50	11.80	12.40	13.07
		30	10.30	10.90	11.20	11.50	12.13	12.79
		35	9.91	10.60	10.91	11.20	11.80	12.37
		40	9.60	10.30	10.62	10.90	11.40	11.90
RAS-5H(V)RNS2E	0.51	25	13.20	14.00	14.80	14.70	15.60	15.80
		30	12.75	13.50	14.00	14.40	14.80	15.45
		35	12.25	13.00	13.60	14.00	14.50	14.80
		40	11.50	12.30	12.70	13.00	13.50	14.00
RAS-6H(V)RNS2E	0.59	25	15.50	16.35	16.60	17.00	17.60	18.10
		30	15.20	16.00	16.30	16.60	17.45	17.70
		35	14.30	15.20	15.55	16.00	16.45	16.90
		40	13.55	14.45	14.75	15.20	15.65	16.45
RAS-8HRNSE	0.74	25	20.38	21.68	22.36	23.08	24.55	26.04
		30	20.09	21.42	22.12	22.85	24.31	25.84
		35	19.22	20.74	21.59	22.40	23.83	25.10
		40	18.21	19.71	20.56	21.45	23.04	24.33
RAS-10HRNSE	0.88	25	25.38	27.56	28.48	29.41	31.22	33.03
		30	24.92	27.00	27.90	28.73	30.46	31.89
		35	24.23	26.15	27.09	28.00	29.62	31.21
		40	23.14	24.96	25.87	26.79	28.56	30.05

NOTE

- *CAP max: Capacity at compressor maximum frequency (kW) (At 100% combination).*
- *CR: Correction ratio.*

3.5 Maximum heating capacities

Values are based on the following conditions:

Piping Length/Height difference: 7.5 m / 0 m.

The values are based on High speed of indoor fan. to calculate the cooling capacity of medium or low speed of indoor fan, multiply cooling capacity of high speed by correction value factor.

The values does not include decreasing capacity by defrosting operation.

All temperatures in ºC.

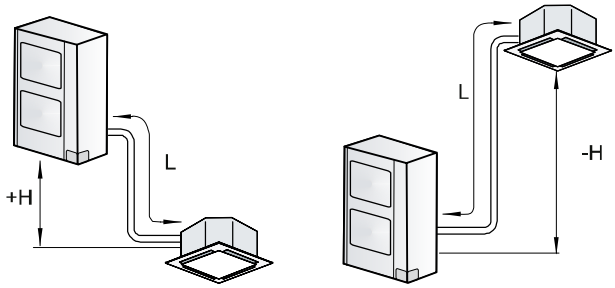
All heating capacities in kW

Outdoor Unit	Outdoor Air Inlet Temperature (WB) (ºC)	Indoor Air Inlet Temperature DB (ºC)						
		16	18	20	22	24	26	28
		CAP max	CAP max	CAP max	CAP max	CAP max	CAP max	CAP max
RAS-3HVRNS3	-10	6.02	5.96	5.95	5.85	5.80	5.75	5.70
	-5	6.82	6.75	6.69	6.63	6.57	6.52	6.46
	0	7.88	7.81	7.74	7.68	7.61	7.55	7.49
	5	8.95	8.87	8.79	8.72	8.65	8.58	8.51
	10	10.04	9.95	9.87	9.80	9.72	9.64	9.56
	15	11.16	11.07	10.96	10.88	10.78	10.68	10.59
RAS-4H(V)RNS2E	-10	10.48	10.32	10.14	9.94	9.73	9.52	9.32
	-5	11.67	11.53	11.38	11.20	11.00	10.80	10.61
	0	12.86	12.75	12.62	12.46	12.27	12.08	11.90
	5	13.96	13.88	13.77	13.62	13.45	13.27	13.10
	10	15.47	15.45	15.36	15.24	15.08	14.92	14.77
	15	17.09	17.07	17.05	16.93	16.78	16.63	16.47
RAS-5H(V)RNS2E	-10	10.75	10.60	10.45	10.35	10.30	10.25	10.20
	-5	12.30	12.20	12.15	12.10	12.05	12.00	11.95
	0	14.20	14.10	14.00	13.90	13.80	13.60	13.50
	5	15.90	15.80	15.70	15.60	15.30	15.20	15.10
	10	17.80	17.70	17.60	17.40	17.20	17.05	17.00
	15	19.75	19.65	19.50	19.35	19.10	19.00	18.40
RAS-6H(V)RNS2E	-10	11.40	11.30	11.25	11.20	11.20	11.15	11.10
	-5	13.60	13.45	13.40	13.30	13.20	13.15	13.10
	0	15.70	15.65	15.50	15.30	15.15	15.10	15.00
	5	17.85	17.80	17.60	17.45	17.15	17.10	17.00
	10	20.00	19.90	19.80	19.65	19.40	19.30	19.20
	15	22.20	22.10	22.00	21.85	21.75	21.55	21.40
RAS-8HRNSE	-10	15.78	15.73	15.67	15.62	15.59	15.58	15.55
	-5	18.73	18.66	18.59	18.54	18.48	18.45	18.39
	0	21.69	21.59	21.51	21.44	21.37	21.30	21.23
	5	24.64	24.52	24.42	24.33	24.24	24.15	24.06
	10	27.75	27.60	27.45	27.29	27.13	26.97	26.81
	15	30.97	30.73	30.49	30.27	30.04	29.82	29.60
RAS-10HRNSE	-10	19.99	19.85	19.73	19.62	19.51	19.40	19.29
	-5	23.64	23.52	23.41	23.32	23.21	23.11	23.01
	0	27.29	27.18	24.23	27.01	26.91	26.83	26.74
	5	30.95	30.88	30.81	30.74	30.65	30.54	30.45
	10	34.84	34.71	34.58	34.45	34.26	34.07	33.91
	15	38.74	38.59	38.39	38.17	37.96	37.75	37.55

NOTE

- *CAP max: Capacity at compressor maximum frequency (kW) (At 100% combination).*

3.6 Piping length correction factor



The correction factor is based on the equivalent piping length in meters (EL) and the height between outdoor and indoor units in meters (H).

H:

Height between indoor unit and outdoor unit (m).

- H>0: Position of outdoor unit is higher than position of indoor unit (m).
- H<0: Position of outdoor unit is lower than position of indoor unit (m).

L:

Actual one-way piping length between indoor unit and outdoor unit (m).

EL:

Equivalent one-way piping length between indoor unit and outdoor unit (m).

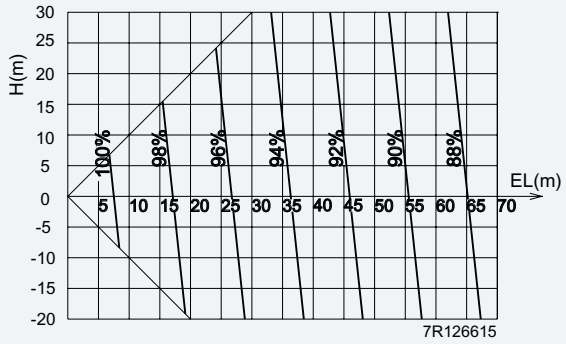
- One 90º elbow is 0.5 m.
- One 180º bend is 1.5 m.
- One Multi-kit is 0.5 m.

NOTE

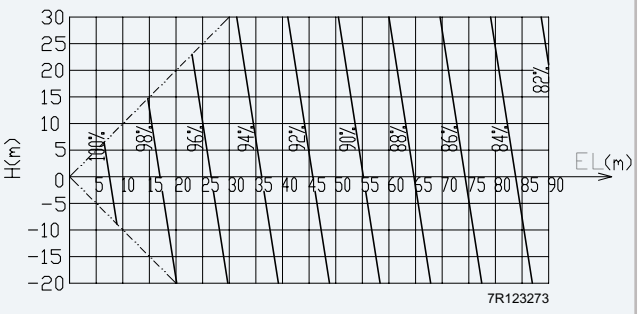
In order to ensure correct unit selection, consider the fartest indoor unit.

Cooling

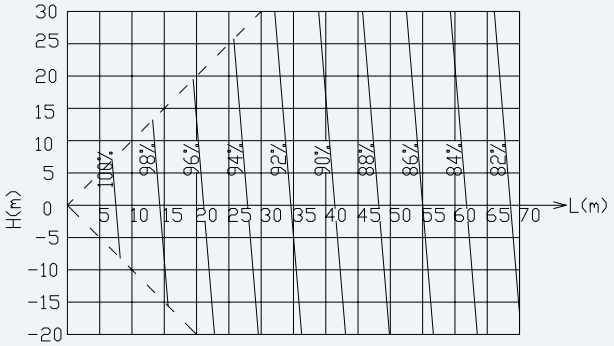
RAS-3HVRNS3



RAS-4H(V)RNS3E



RAS-5H(V)RNS2E



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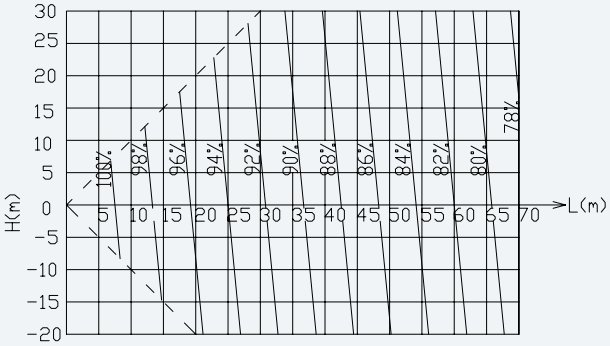
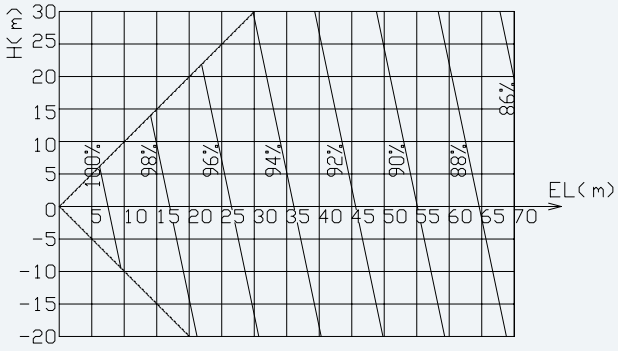
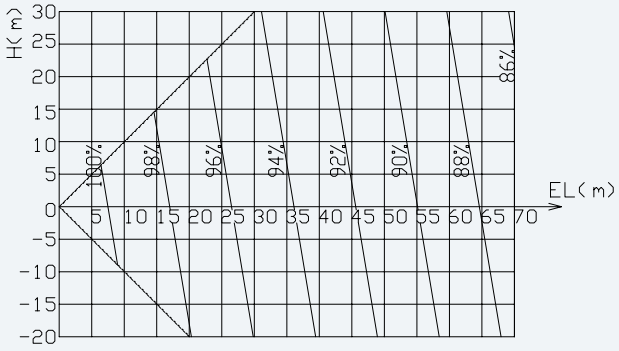


RAS-8HRNSE



RAS-10HRNSE



NOTE

Cooling capacity:

The cooling capacity should be corrected according to the following formula:

CCA = CC x F

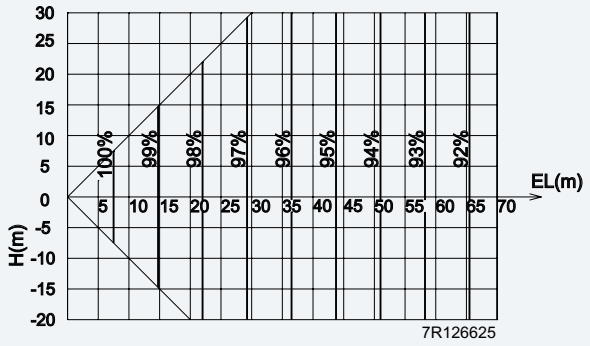
CCA: Actual corrected cooling capacity (kW).

CC: Cooling capacity from cooling capacity table (kW).

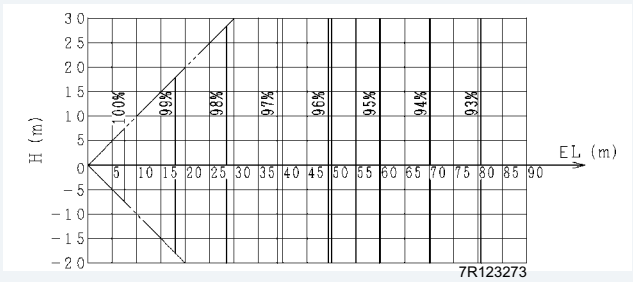
F: Correction factor based on the equivalent piping length (in %).

Heating

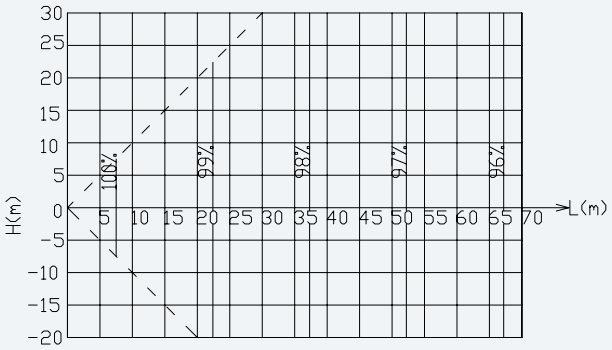
RAS-3HVRNS3



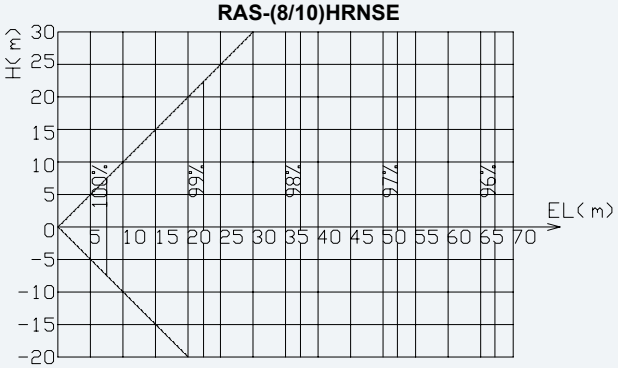
RAS-4H(V)RNS3E



RAS-(5/6)H(V)RNS2E



RAS-(8/10)HRNSE



3

NOTE

Heating capacity

The heating capacity should be corrected according to the following formula:

$$HCA = HC \times F$$

HCA: Actual corrected heating capacity (kW).

HC: Heating capacity from heating capacity table (kW).

FD: Correction factor based on the equivalent piping length (in %).

3.7 Correction ratio due to humidity (CR)

The cooling capacity data for the outdoor units is taken from the cooling capacity curves. The curves are calculated on the basis of a relative humidity of 50%.

In some situations, it's possible that the temperature condition of the ambient to be conditioned, specifies other different relative humidity, which affect at the Dry Bulb temperature. In this cases, it's necessary to calculate the difference between the indoor air inlet dry bulb temperature required by the system and the indoor air inlet dry bulb temperature shown in the cooling capacity data.

This temperature difference requires an adjustment of the cooling capacity of the system.

$$Q_{AC} = Q_C + (CR \times (DB_R - DB))$$

3.8 Fan speed correction value factor

The values are based on High speed of indoor fan. To calculate the cooling capacity of medium or low speed of indoor fan, multiply cooling capacity of high speed by correction value factor.

◆ **Cooling**

	Outdoor Unit HP
Indoor Unit fan speed	3/4
High	1.00
Medium	0.98
Low	0.95

◆ **Heating**

The values does not include decreasing capacity by defrosting operation.

	Outdoor Unit HP
Indoor Unit fan speed	3/4
High	1.00
Medium	0.98
Low	0.97

3.9 Defrost 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:

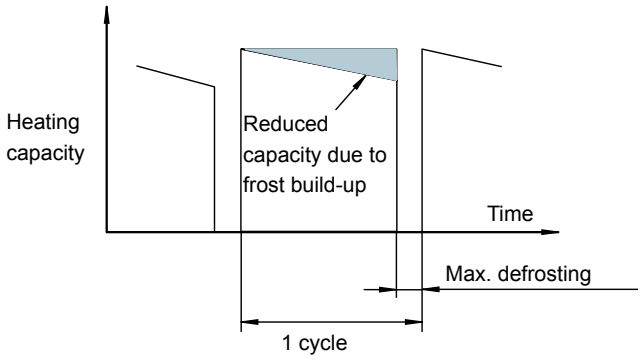
Correction heating capacity = Correction factor x heating capacity

NOTE

Defrost correction factor corresponds to a relative humidity of 85%. If the condition changes, the correction factor will be different.

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

Outdoor inlet air temp. (ºC DB)	-7	-5	-3	0	3	5	7
Correction factor	0.95	0.93	0.88	0.85	0.87	0.90	1.00



NOTE

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

4. Acoustic characteristic curves

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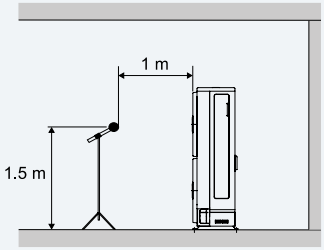
4.1 Overall sound level

The overall sound level has been measured in an anechoic chamber so reflected sound should be taken into consideration when installing the unit.

Test Conditions:

1 Distance of the unit from the measuring point: 1 meter from the unit's front surface; 1.5 meter from floor level:

Overall sound level measuring position



2 Power supply:

a. Single phase units: 1~ 230V 50Hz.

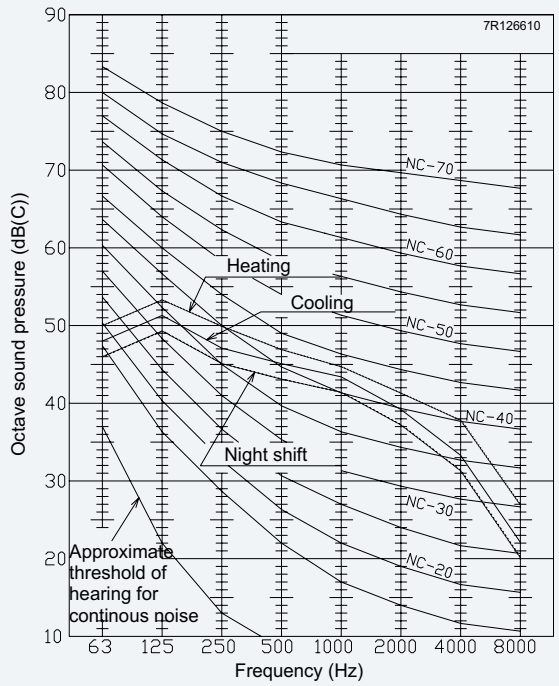
b. Three phase units: 3N~ 400V 50Hz.

NOTE

- *The sound data is measured in an anechoic chamber, so reflected sound should be taken into consideration when installing the unit.*

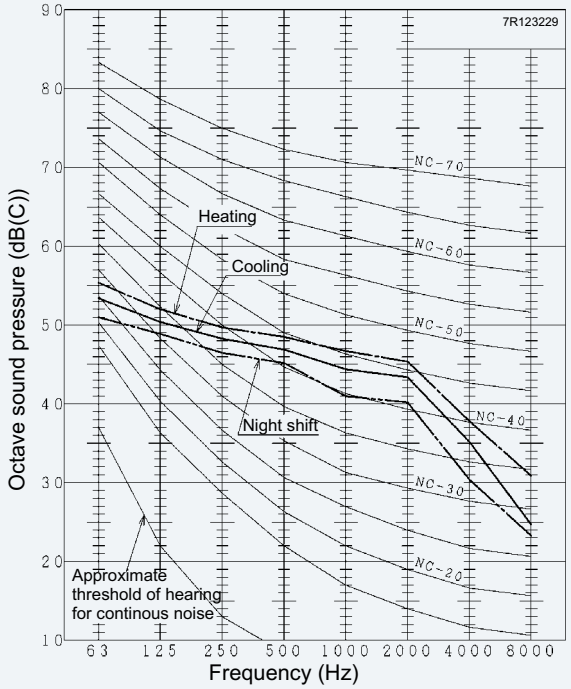
4.2 Sound data

RAS-3HVRNS3



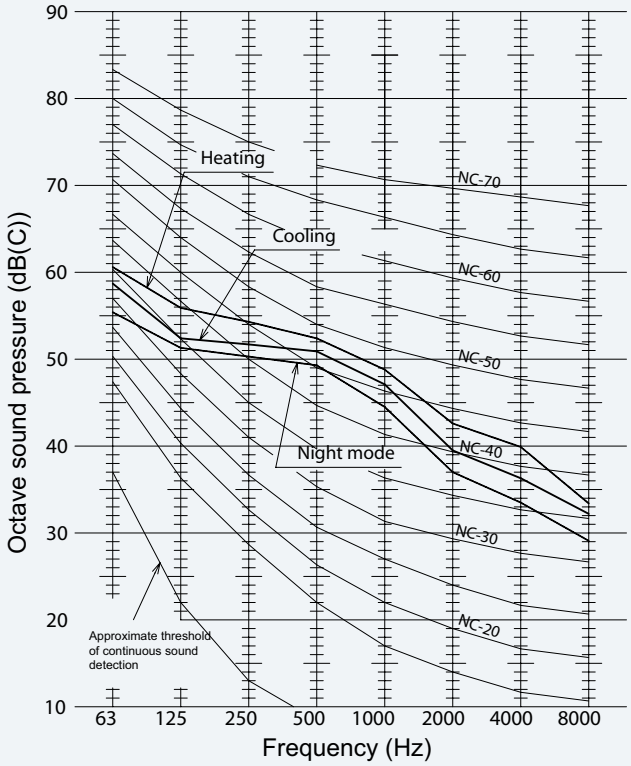
Cooling/Heating/Night mode: 48/50/46 dB(A)

RAS-4HVRNS3E



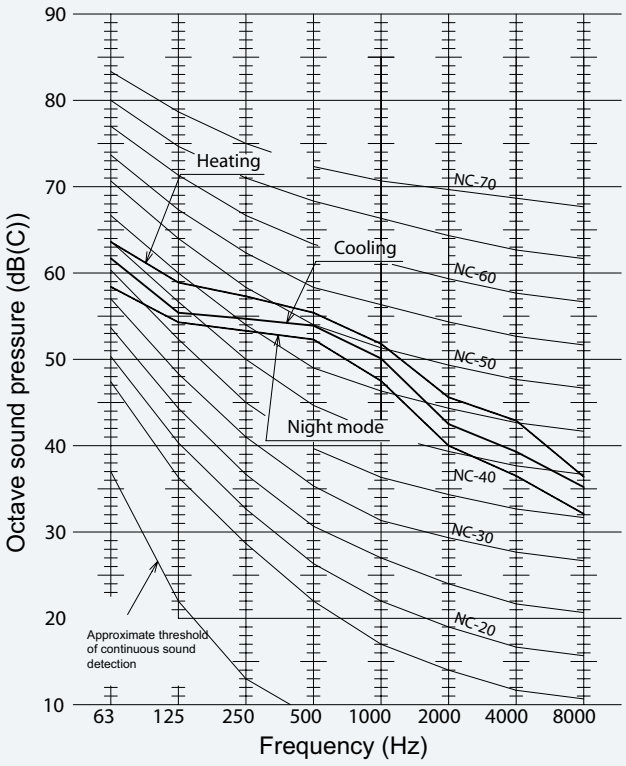
Cooling/Heating/Night mode: 50/52/48 dB(A)

RAS-5HVRNS2E



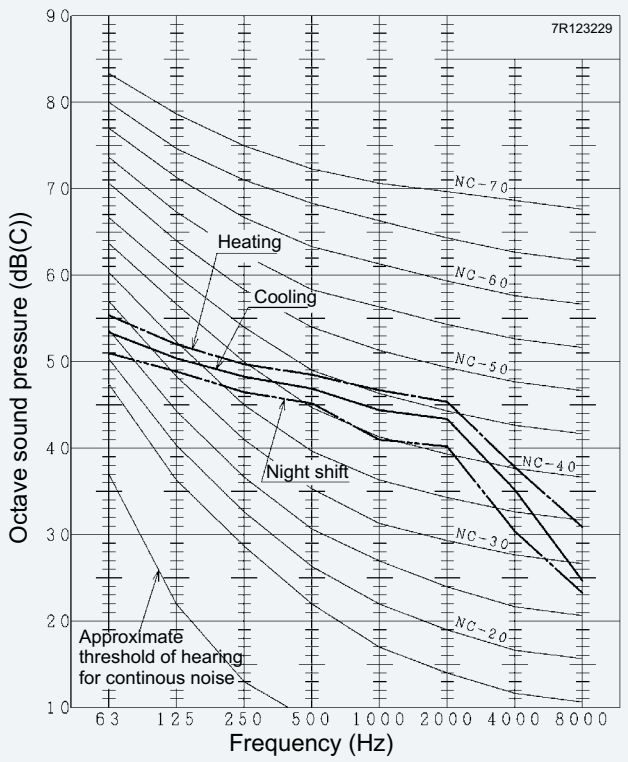
Cooling/Heating/Night mode: 52/54/50 dB(A)

RAS-6HVRNS2E



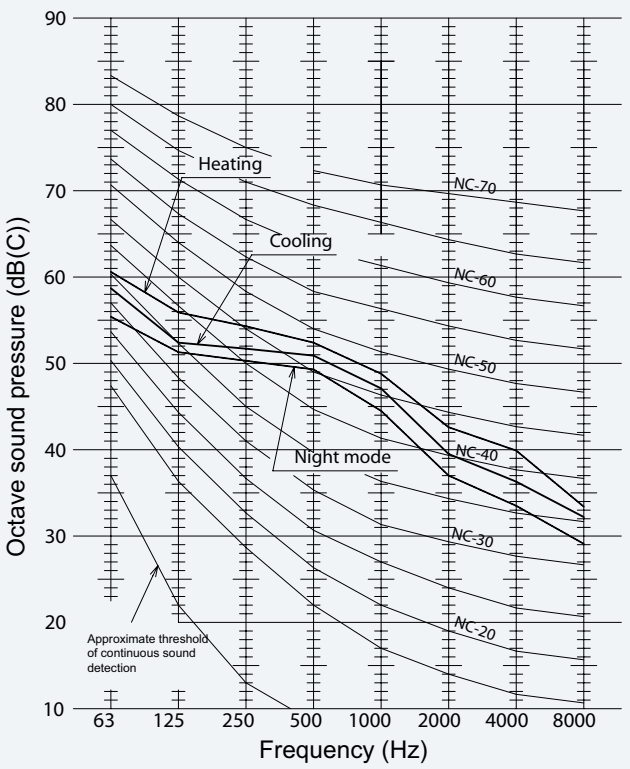
Cooling/Heating/Night mode: 55/57/53 dB(A)

RAS-4HRNS3E



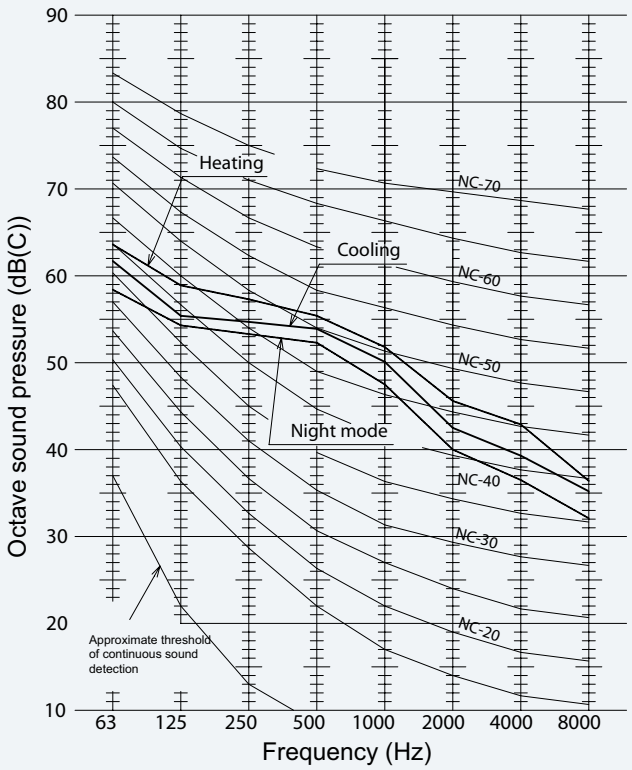
Cooling/Heating/Night mode: 50/52/48 dB(A)

RAS-5HRNS2E



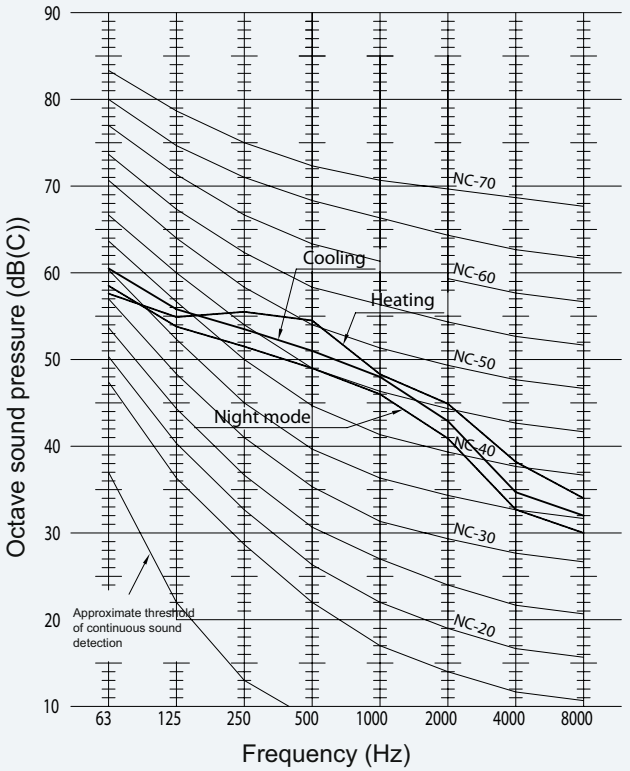
Cooling/Heating/Night mode: 52/54/50 dB(A)

RAS-6HRNS2E



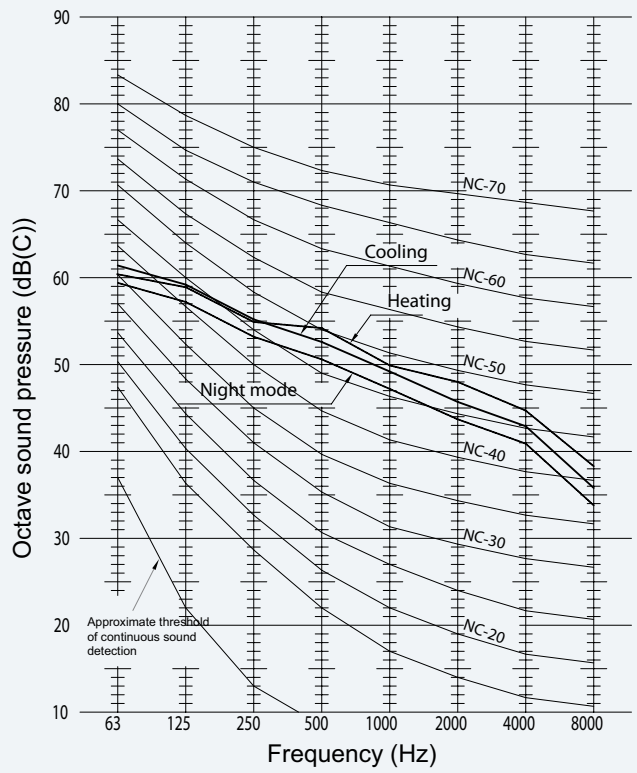
Cooling/Heating/Night mode: 55/57/53 dB(A)

RAS-8HRNSE



Cooling/Heating/Night mode: 53/55/51 dB(A)

RAS-10HRNSE



Cooling/Heating/Night mode: 60/62/56 dB(A)

HITACHI
Inspire the Next

5. Working range

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5.1 Working range

5.1.1 Power supply

Operating voltage

Between 90 and 110% of the nominal voltage.

Voltage imbalance (3N~ 400V 50Hz)

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

Starting voltage

Always higher than 85% of the nominal voltage.

5.1.2 Temperature range

The temperature range is indicated in the following table:

		Cooling mode	Heating mode
Indoor air inlet temperature	Minimum	21 °C DB / 15 °C WB	15 °C DB
	Maximum	32 °C DB / 23 °C WB	27 °C DB
Outdoor air inlet temperature	Minimum	-5 °C DB	-10 °C WB
	Maximum	43 °C DB	15 °C WB

NOTE

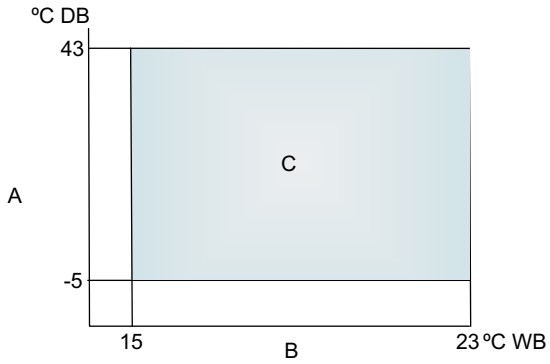
- *DB: Dry Bulb; WB: Wet Bulb.*

Cooling mode

A. Outdoor air inlet temperature.

B. Indoor air inlet temperature.

C. Working range.

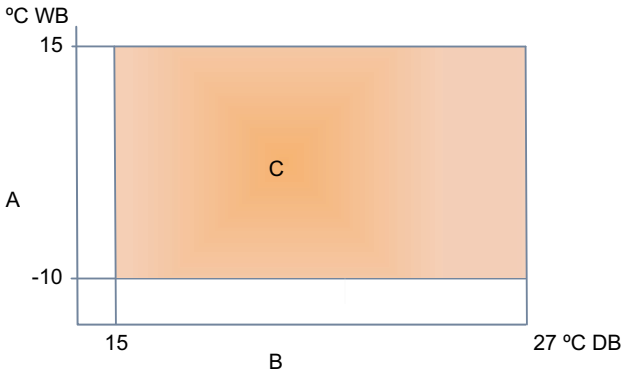


Heating mode

A. Outdoor air inlet temperature.

B. Indoor air inlet temperature.

C. Working range.



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6. General dimensions

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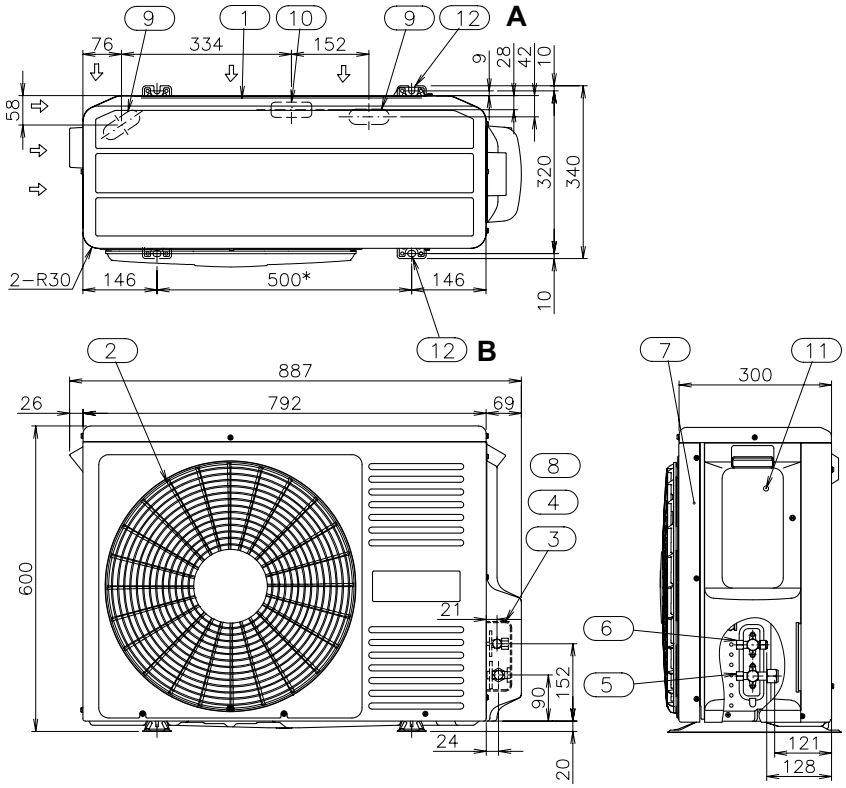
6.1 Dimensions

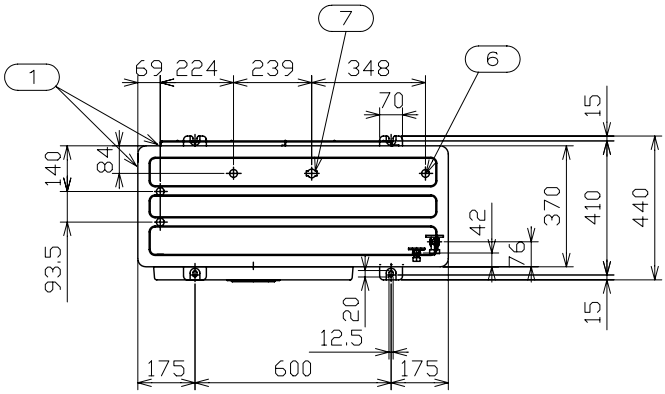
6.1.1 RAS-3HVRNS3

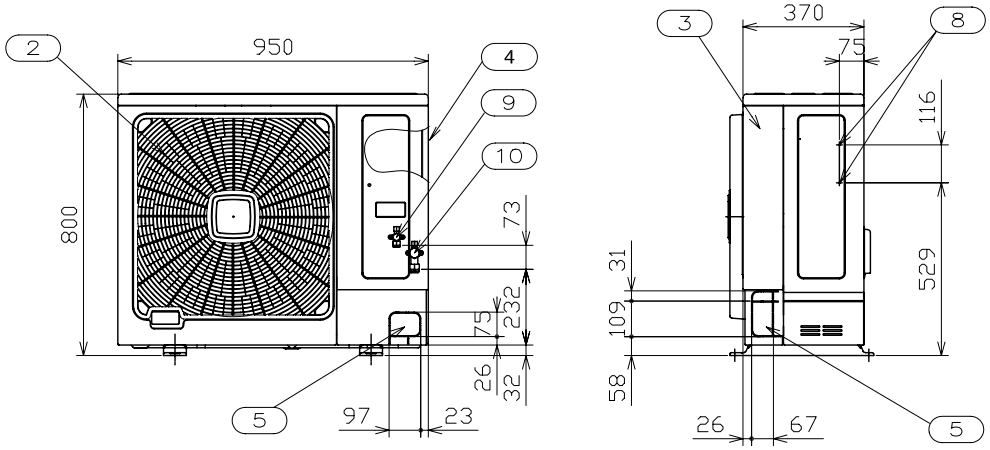


Units in mm.

No.	Description	Remarks
1	Air inlet	—
2	Air outlet	—
3	Holes for power supply wiring	—
4	Holes for control line wiring	—
5	Gas piping connection	—
6	Liquid piping connection	—
7	Service panel	—
8	Refrigerant piping hole	—
9	Drain hole	—
10	Drain hole	—
11	Earth terminal wiring	(M5)
12	Holes for fixing machine to wall	A: 2-U cut holes / B: 2 - holes

6.1.2 RAS-(4-6)H(V)RNS(2/3)E

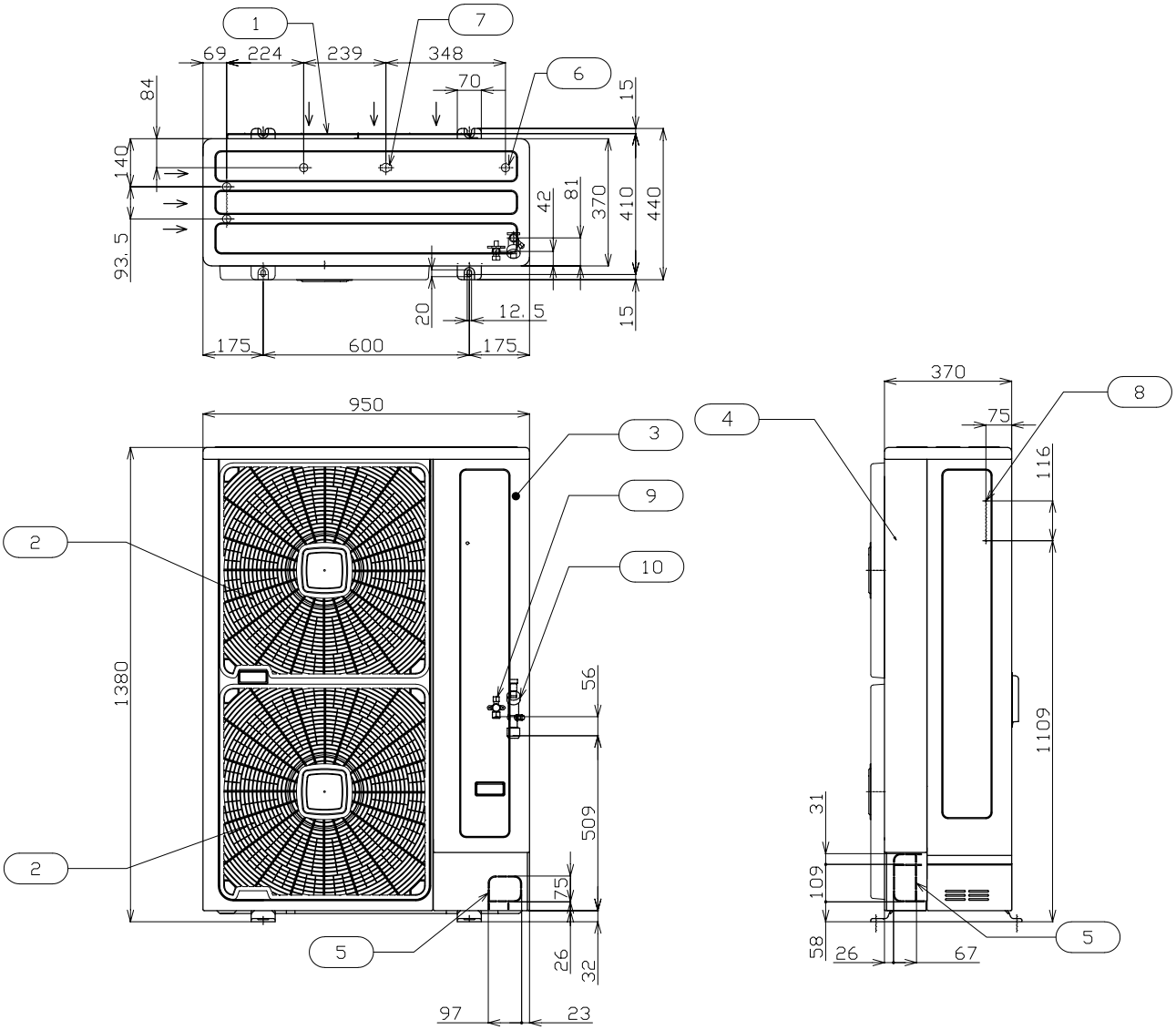




Units in mm.

No.	Description	Remarks
1	Air inlet	—
2	Air outlet	—
3	Service cover	—
4	Electrical switch box	—
5	Holes for refrigerant piping and electrical wiring piping	—
6	Drain holes	4-Ø24
7	Drain holes	1-Ø26
8	Holes for fixing machine to wall	4-(M5)
9	Refrigerant liquid pipe	Flare nut: Ø9.52 (3/8”)
10	Refrigerant gas pipe	Flare nut: Ø15.88 (5/8”)

6.1.3 RAS-(8-10)HRNSE

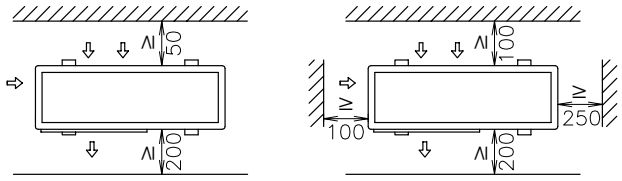


Units in mm.

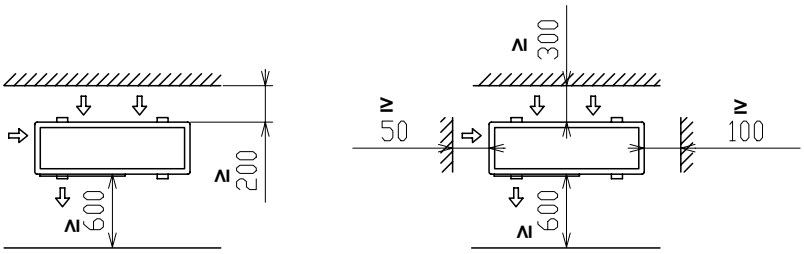
No.	Description	Remarks
1	Air inlet	—
2	Air outlet	—
3	Service cover	—
4	Electrical switch box	—
5	Holes for refrigerant piping and electrical wiring piping	—
6	Drain holes	4-Ø24
7	Drain holes	1-Ø26
8	Holes for fixing machine to wall	4-(M5)
9	Refrigerant liquid pipe	Flare nut: Ø9.52 (3/8”)
10	Refrigerant gas pipe	Flare nut: Ø25.4 (1”)

6.2 Service space

6.2.1 RAS-3HVRNS3



6.2.2 RAS-(4-10)H(V)RNS(2/3)E



Units in mm.

NOTE

- *For the specific information, please refer to the Service Manual.*

7. Refrigerant cycle

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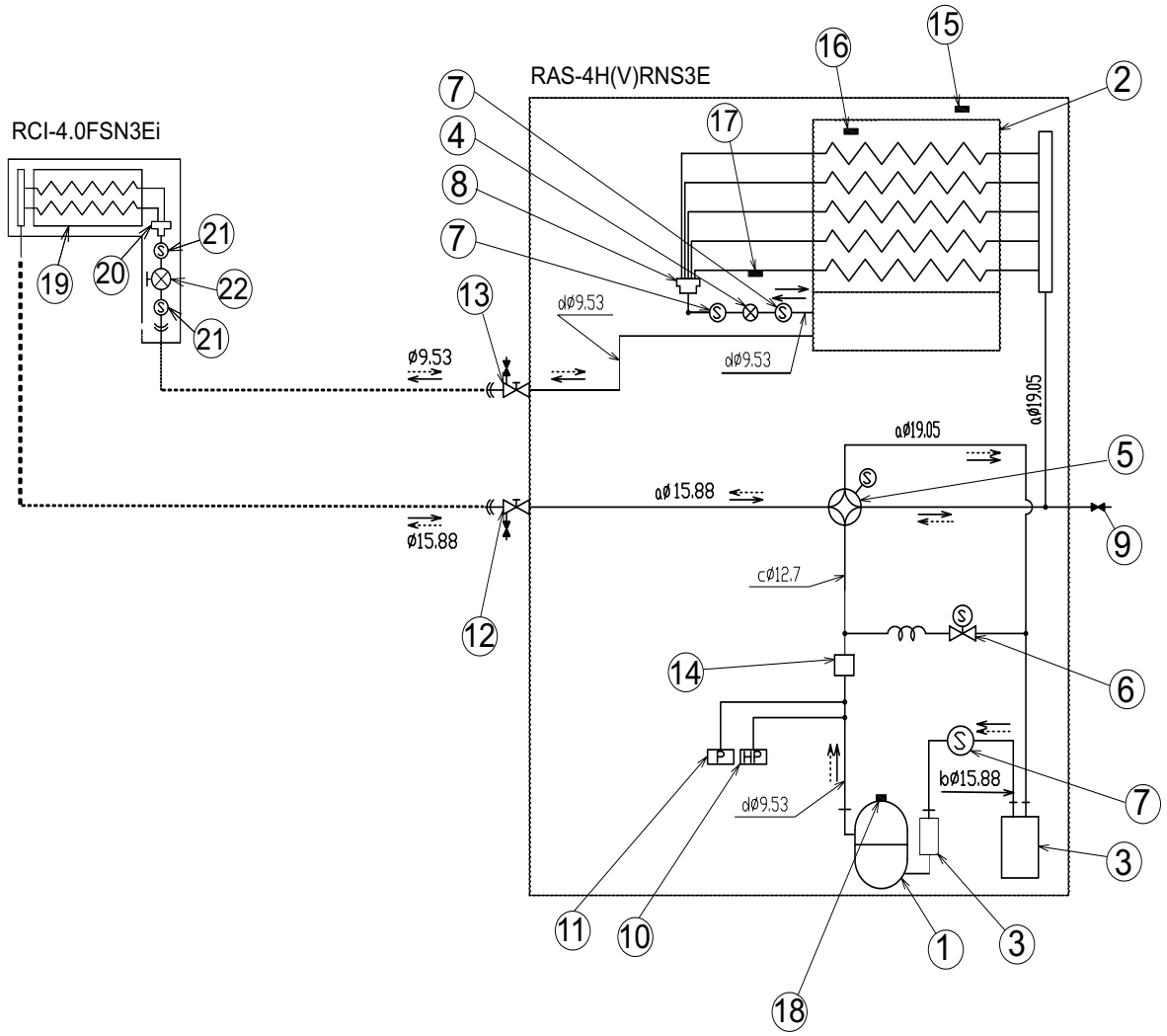
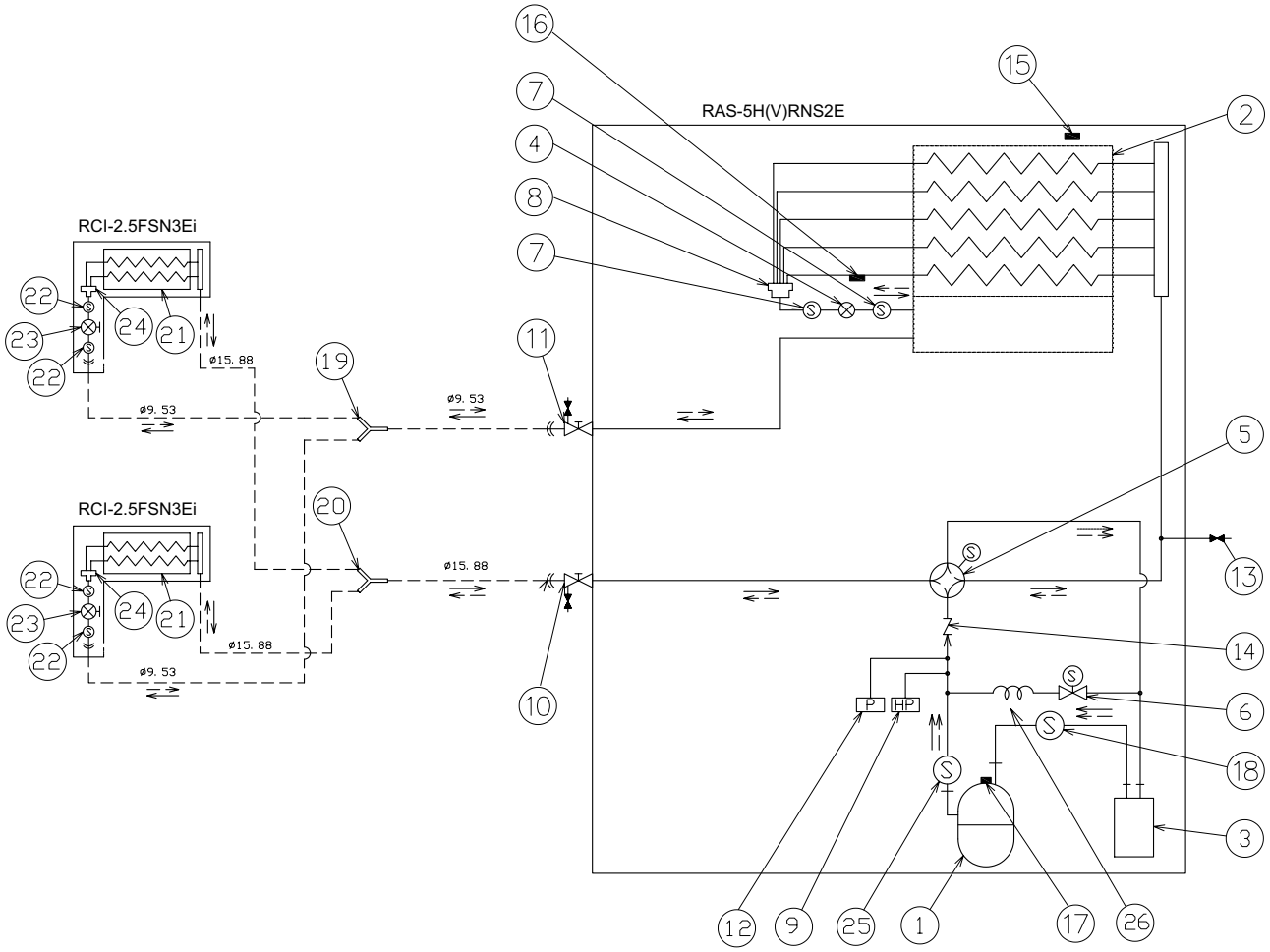
7.1 Example of single combination



Refrigerant flow for cooling	Refrigerant flow for heating	Installation refrigeration pipe	Connection by flare nut	Connection by welding	R410A Gas refrigerant	4.15 MPa Leakage test pressure

No.	Part name	No.	Part name	No.	Part name
1	Compressor	9	Check joint	17	Evaporator pipe thermistor
2	Outdoor unit Heat exchanger	10	High pressure switch (protection)	18	Gas discharge thermistor
3	Accumulator	11	Pressure switch (control)	19	Indoor unit Heat exchanger
4	Micro-computer control expansion valve	12	Stop valve for gas line	20	Distributor
5	Reversing valve	13	Stop valve for liquid line	21	Strainer
6	Solenoid valve for gas bypass	14	Silencer	22	Expansion valve
7	Strainer	15	Ambient thermistor		
8	Distributor	16	Thermistor		

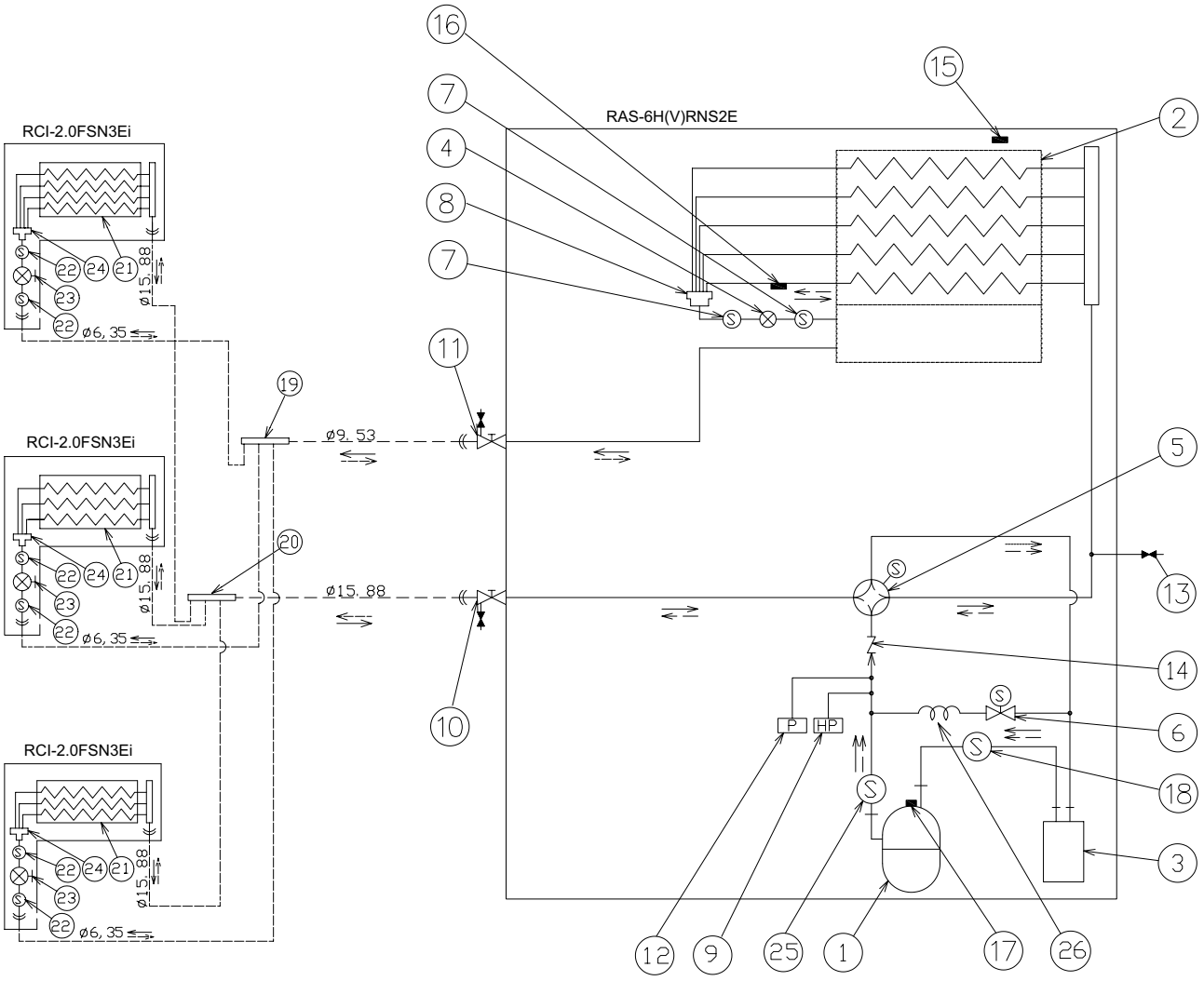
7.2 Example of twin combination



Refrigerant flow for cooling	Refrigerant flow for heating	Installation refrigeration pipe	Connection by flare nut	Connection by welding	R410A Gas refrigerant	4.15 MPa Leakage test pressure

No.	Part name	No.	Part name	No.	Part name
1	Compressor	10	Gas pipe stop valve	19	Branch pipe (liquid)
2	Outdoor unit Heat exchanger	11	Liquid pipe stop valve	20	Branch pipe (gas)
3	Accumulator	12	Pressure switch (control)	21	Indoor unit Heat exchanger
4	Expansion valve	13	Check joint	22	Strainer
5	Reversing valve	14	Check valve	23	Expansion valve
6	Solenoid valve	15	Ambient thermistor	24	Distributor
7	Strainer	16	Evaporator pipe thermistor	25	Silencer
8	Distributor	17	Gas discharge thermistor	26	Capillary tube
9	High pressure switch (protection)	18	Strainer		

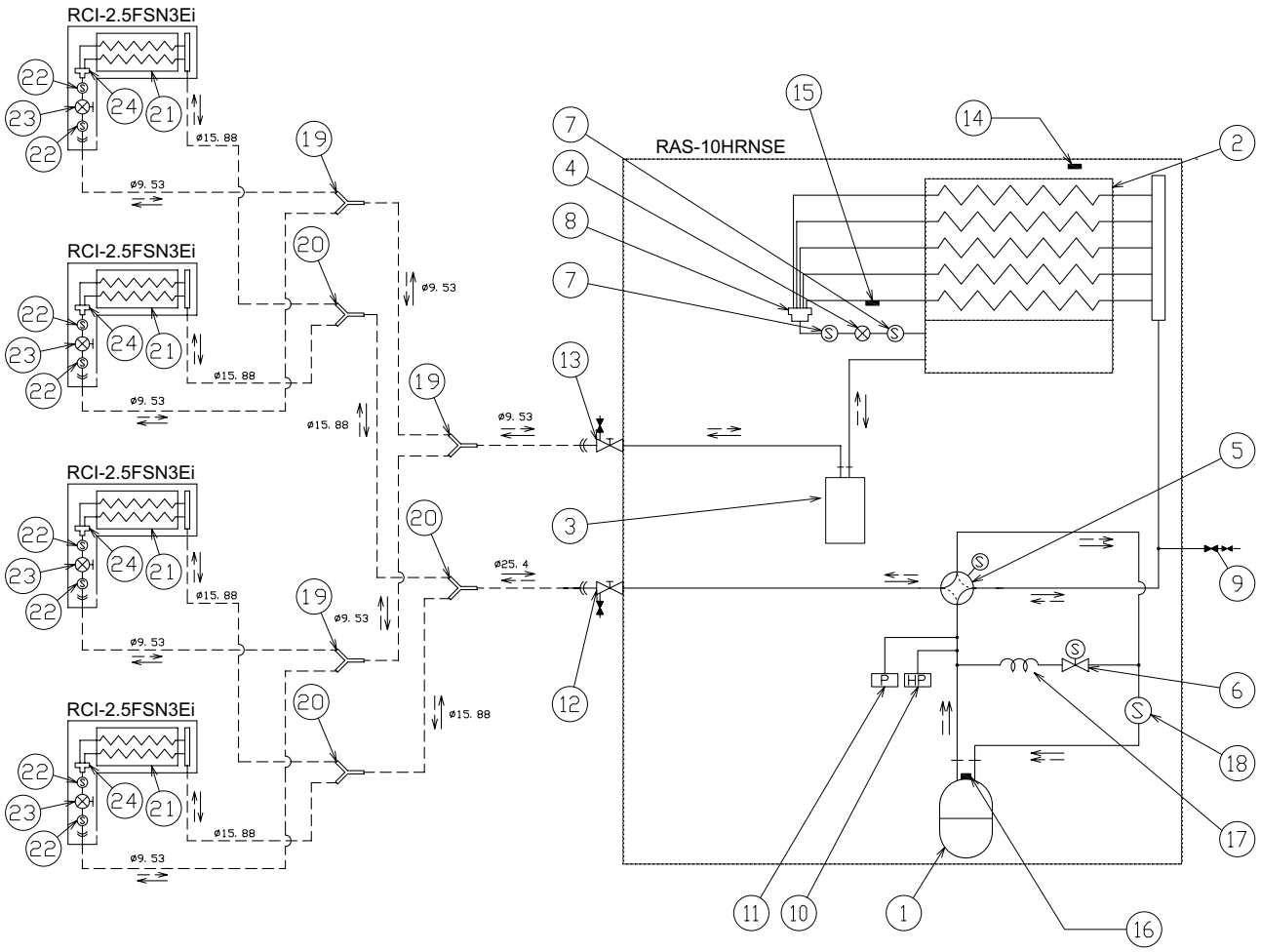
7.3 Example of triple combination (only 6 and 8 HP)



Refrigerant flow for cooling	Refrigerant flow for heating	Installation refrigeration pipe	Connection by flare nut	Connection by welding	R410A Gas refrigerant	4.15 MPa Leakage test pressure

No.	Part name	No.	Part name	No.	Part name
1	Compressor	10	Gas pipe stop valve	19	Branch pipe (liquid)
2	Outdoor unit Heat exchanger	11	Liquid pipe stop valve	20	Branch pipe (gas)
3	Accumulator	12	Pressure switch (control)	21	Indoor unit Heat exchanger
4	Expansion valve	13	Check joint	22	Silencer
5	Reversing valve	14	Check valve	23	Expansion valve
6	Solenoid valve	15	Ambient thermistor	24	Distributor
7	Strainer	16	Evaporator pipe thermistor	25	Silencer
8	Distributor	17	Gas discharge thermistor	26	Capillary tube
9	High pressure switch for protection	18	Strainer		

7.4 Example of quad combination (only 8 and 10 HP)



Refrigerant flow for cooling	Refrigerant flow for heating	Installation refrigeration pipe	Connection by flare nut	Connection by welding	R410A Gas refrigerant	4.15 MPa Leakage test pressure

No.	Part name	No.	Part name	No.	Part name
1	Compressor	9	Check joint	17	Capillary tube
2	Outdoor unit Heat exchanger	10	High pressure switch for protection	18	Strainer
3	Liquid tank	11	Pressure switch (control)	19	Branch pipe (liquid)
4	Expansion valve	12	Gas pipe stop valve	20	Branch pipe (gas)
5	Reversing valve	13	Liquid pipe stop valve	21	Indoor unit Heat exchanger
6	Solenoid valve	14	Ambient thermistor	22	Strainer
7	Strainer	15	Evaporator pipe thermistor	23	Expansion valve
8	Distributor	16	Gas discharge thermistor	24	Distributor

8. Piping work and refrigerant charge

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8.1 Refrigerant pipe selection

8.1.1 Pipe size selection

Select the pipe size in line with the following instructions:

1 Between the outdoor unit and the branch pipe (multikit): select the same pipe connection size as for the outdoor unit.
2 Between the branch pipe (multikit) and the indoor unit: select the same pipe connection size as for the indoor unit.

CAUTION

- *Do not use refrigerant pipe sizes other than those indicated in this Technical Catalogue. The diameter of the refrigerant pipes depends directly on the outdoor unit capacity.*
- *If larger diameter gas refrigerant pipes are used, the circuit lubrication oil tends to separate from the gas carrying it. The compressor will be seriously damaged due to a lack of lubrication.*
- *If smaller diameter gas refrigerant pipes are used, the gas or liquid refrigerant will have serious difficulties in circulating. System performance will be affected. The compressor will run under more severe conditions than foreseen and will be damaged in a short space of time.*

8.1.2 Multikit or distributor selection

NOTE

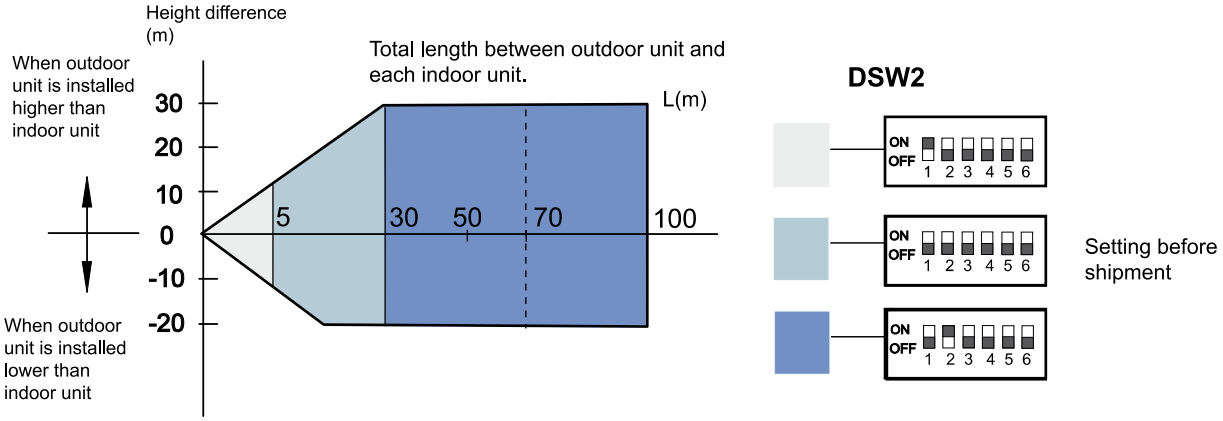
- *Pipe connection size on outdoor units, indoor units and the multikit or distributor vary according to the system. For the specific information, please refer to Service Manual.*
- *The sizes of the indoor and outdoor units could be different. Adjust the flare adapter (accessory) to the indoor pipe connection in these cases.*

8.2 Refrigerant piping range

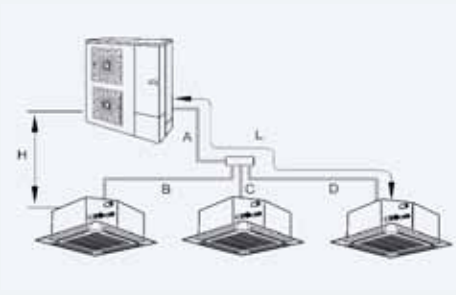
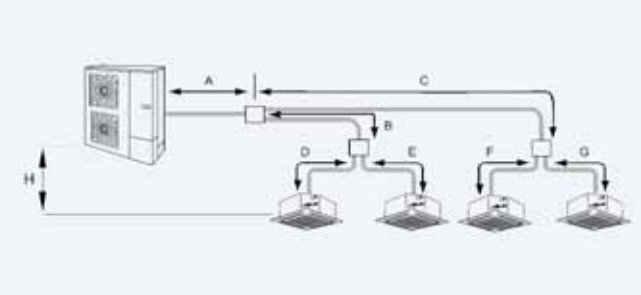
8.2.1 Refrigerant piping length

The refrigerant piping between the indoor unit and the outdoor unit should be designed using the following chart.

Keep the design point within the area of the chart, which is showing the applicable height difference according to piping length.



Piping system (illustration as examples)

Single system (O.U. from 3 to 10 HP)	Twin system (O.U. from 3 to 10 HP)
	
	L= A + the longest of B & C
Triple system (O.U. 6 and 8 HP)	**Quad system (O.U. 8 and 10 HP)**
	
L= A + the longest of B, C & D	L= A + the longest of (B + the longest of D & E) & (C + the longest of F & G)

NOTE

L and H are the length and height indicated in the above chart. For twin, triple and quad systems, the length is the distance between the outdoor unit and the farthest indoor unit.

NOTE

- *The liquid piping and the gas piping must be of the same length and run along the same route.*
- *Multikits for multiple connections (optional accessory as system parts) must be used to install the branch pipe to the indoor unit.*
- *Install Multikits at the same horizontal level.*

◆ Maximum refrigerant piping length

(m)

Item		3HP	4 HP	(5/6) HP	(8/10) HP
Maximum piping length between the outdoor unit and the farthest indoor unit	Actual piping length (L)	50	50	50	50
	Equivalent piping length	70	70	70	70 (*)
Maximum height difference between indoor and outdoor units (H)	Outdoor unit higher than the indoor unit	30	30	30	30
	Indoor unit higher than outdoor unit	20	20	20	20
	Height difference between indoor units	0.5	0.5	0.5	0.5
Maximum total piping length	Twin (A + B + C)	60	60	60	60
	Triple (A + B + C + D)	–	–	70	70
	Quad (A + B + C + D + E + F + G)	–	–	–	80

NOTE

(*) Quad: 75 m.

The refrigerant piping length from the outdoor unit to the first branch must be higher than the piping length from the first branch to the farthest indoor unit.

◆ Piping length after branches (only 5, 6, 8 and 10 HP)

Piping length after branch pipe (B, C, D, E, F or G):

1 After branch pipe, the pipe length should be shorter than the values shown in the following table:

(m)

		3, 4 and 5 HP	6 HP	(8-10) HP
Twin	B, C	10	10	10
Triple	B, C, D	–	10	10
Quad	B + D, B + E, C + F, C + G	–	–	10

2 All branch piping should be balanced, and the difference between these sections cannot be greater than indicated in the tables below:

(m)

		3, 4 and 5 HP	6 HP	(8/10) HP
Twin	Difference between B and C	8	8	8
Triple	Difference between B, C and D	–	8	8
Quad	Difference between B + (D/E) and C + (F/G); Between D and E; Between F and G	–	–	8

◆ Piping length specifications

Performance capacity	Liquid	Ø6.35				Ø9.52				
	Gas	Ø9.52	Ø12.7	Ø15.88	Ø19.05	Ø12.7	Ø15.88	Ø19.05	Ø22.2	Ø25.4
RAS-3HVRNS3		—	30[1*2*]	30[2*]	—	30[1*]	**50**	—	—	—
RAS-4H(V)RNS3E		—	—	5[2*]	5[2*]	40[1*]	**50**	50[4*]	—	—
RAS-5H(V)RNS2E		—	—	5[2*]	5[2*]	40[1*]	**50**	50[4*]	—	—
RAS-6H(V)RNS2E		—	—	5[2*]	5[2*]	40[1*]	**50**	50[4*]	—	—
RAS-8HRNSE		—	—	—	—	—	—	30[1*4*]	30[1*]	**50**
RAS-10HRNSE		—	—	—	—	—	—	—	—	**30[5*]**

Performance Capacity	Liquid	Ø12.7					Ø15.88[5*]	
	Gas	Ø15.88	Ø19.05	Ø22.2	Ø25.4	Ø28.6	Ø25.4	Ø28.6
RAS-3HVRNS3		—	—	—	—	—	—	—
RAS-4H(V)RNS3E		30[3*]	30[3*4*]	—	—	—	—	—
RAS-5H(V)RNS2E		30[3*]	30[3*4*]	—	—	—	—	—
RAS-6H(V)RNS2E		30[3*]	30[3*4*]	—	—	—	—	—
RAS-8HRNSE		—	30[1*3*4*]	30[1*3*]	30[3*]	—	—	—
RAS-10HRNSE		—	—	30[1*3*]	**50[3*5*]**	50[3*]	20[3*]	20[3*]

NOTE

- *(1*) If the gas pipe is smaller, the cooling performance drops, and the operating range is reduced because the pressure loss in the gas pipe increases.*
- *(2*) If the liquid pipe is smaller the expansion valve capacity of the indoor unit is reduced.*
- *(3*) If the liquid pipe is larger refrigerant has to be added.*
- *(4*) If the gas line is Ø19,05:*
  Switch ON DSW2-4# in the outdoor unit PCB (for RAS-3HVRNS3 and RAS-4H(V)RNS3E).
  Cut the JP6 jumper of the outdoor unit PCB (For RAS-(5/6)H(V)RNS2E and RAS-(8/10)HRNSE).
- *(5*) If the liquid pipe is larger (Ø12,70), 120 g/m of refrigerant should be added.*

Standard specification.

8.2.2 Refrigerant piping size

Select the piping connection sizes according to the following procedures:

- Between outdoor unit and branch pipe: Select the same pipe connection size as the pipe size of the outdoor unit.
- Between first and second branch pipe (for RAS-(8/10)HRNSE), see table below.
- Between branch pipe and indoor unit: Select the same pipe connection size as the pipe size of the indoor unit.

◆ Piping connection size of outdoor units and multikit/distributor

(mm)

Outdoor Unit	Pipe Size (*1)		Multikit & Distributor		
	Liquid Piping	Gas Piping	Twin	Triple	Quad
RAS-3HVRNS3	Ø9.52	Ø15.88	—	—	—
RAS-4H(V)RNS3E	Ø9.52	Ø15.88	—	—	—
RAS-5H(V)RNS2E	Ø9.52	Ø15.88	TE-56N1	—	—
RAS-6H(V)RNS2E	Ø9.52	Ø15.88	TE-56N1	TRE-46N1	—
RAS-8HRNSE	Ø9.52	Ø25.4	TE-08N	TRE-810N	TE-08N + TE-04N1 + TE-04N1
RAS-10HRNSE	Ø9.52(1)	Ø25.4	TE-08N	—	TE-08N + TE-56N1 + TE-56N1

NOTE

- *(*1): The sizes of the indoor and outdoor units are different. Adjust the flare adapter (accessories) to the joint part of the indoor piping.*
- *(1): Select the piping size ø12.7 when the length is over 30 m (only for RAS-10HRNSE).*

◆ Piping connection size between first and second branch pipe (For RAS-(8/10)HRNSE)

Total Indoor unit Capacity after connecting Second Branch Pipe	Pipe Size (Ø mm) (First ~ Second Branch Pipe)	
	Gas	Liquid
≤ 2.3 HP	Ø12.7	Ø6.35
≤ 6.0 HP	Ø15.88	Ø9.52

◆ Piping connection size of indoor units

Indoor unit	Gas piping size	Liquid piping size
1.5 HP	Ø12.7	Ø6.35
2 HP	Ø15.88	Ø6.35
2.5 - 6 HP	Ø15.88	Ø9.52
8 HP	Ø19.05 → Ø25.4 (*1)	Ø9.52
10 HP	Ø22.2 → Ø25.4 (*1)	Ø9.52 (*2)

NOTE

- *If using different piping from the standard values, piping reducers will be supplied by the installer.*
- *(*1) Ø19.05 → Ø25.4 and Ø22.2 → Ø25.4 indoor pipe adapters are factory supplied with the indoor unit.*
- *(*2) Change the liquid piping size to Ø12.7 when the piping length is more than 30 m. Indoor unit pipe adapter is factory supplied with the indoor unit.*

8.3 Copper pipes, sizes and connection

8.3.1 Copper pipes and sizes

1 Prepare locally-supplied copper pipes.
2 Select the pipe size of a suitable thickness and material. Use the table below to select the required piping.

Nominal diameter		Thickness (mm)	Copper type
(mm)	(in.)		
Ø6.35	1/4	0.80	Roll
Ø9.52	3/8	0.80	Roll
Ø12.70	1/2	0.80	Pipe/Roll
Ø15.88	5/8	1.00	Roll
Ø19.05	3/4	1.00	Pipe/Roll
Ø22.23	7/8	1.00	Pipe/Roll
Ø25.40	1	1.00	Pipe
Ø28.60	1+1/8	1.25	Pipe

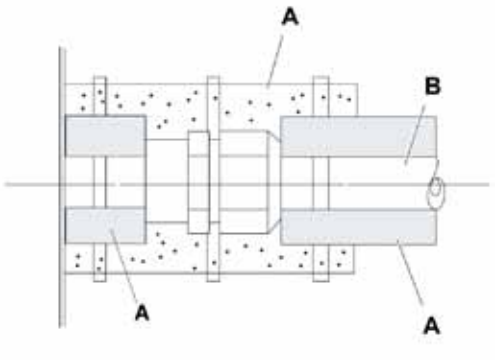
NOTE

If copper pipe is used for piping bigger than Ø19.05, flaring work can not be performed. If necessary, use a joint adapter.

3 Select clean copper pipes. Make sure there is no dust and moisture inside. Blow the inside of the pipes through with oxygen-free nitrogen to remove any dust and foreign materials before connecting pipes.
4 After connecting the refrigerant piping, seal the open space between the knockout hole and refrigerant pipes by using insulation material as shown below:

A. Insulation.

B. Field-supplied refrigeration piping.



NOTE

Do not use saws, grindstone or other tools which might create copper dust.

When cutting pipes, secure the part to be soldered as shown in chapter 2 of the Service Manual.

- *Strictly follow national or local regulations regarding occupational health and safety.*
- *Wear appropriate means of protection during cutting or brazing operations and installation (gloves, eye protection, etc).*

8.3.2 Pipe connection

Fix the connecting pipe as shown in the figure below. Use the insulation attached to the indoor unit.

A. Use the flare nut of the indoor unit.

B. Insulate this part with the insulation material supplied.

C. Fix this part with the bracket supplied or with tape.

D. Refrigerant piping in the installation.

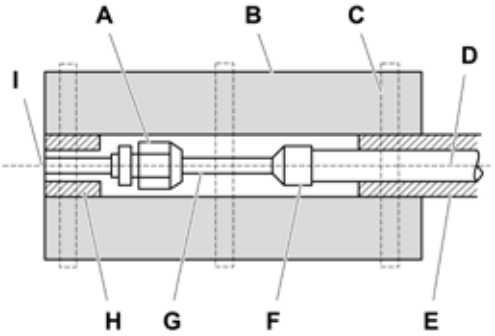
E. Field-supplied insulation.

F. Brazing.

G. Make flares after attaching flare nut to the connecting pipe in the Multikit package.

H. Insulation attached to indoor unit.

I. Indoor unit.



NOTE

- *A system with no moisture or oil contamination will give maximum performance and life-cycle as compared with a poorly prepared system. Take particular care to ensure that all copper piping is clean and dry internally.*
- *To ensure this, blow oxygen free nitrogen through the pipes.*

CAUTION

- *Cap the end of the pipe when the pipe is to be inserted through a hole.*
- *Do not place pipes directly on the ground without a cap or vinyl tape covering the end, as it shown in the figure.*

- *If piping installation cannot be completed until the following day or longer, solder the ends of the piping to close them and load with oxygen-free nitrogen using an access device such as a Schrader valve to avoid moisture and contamination by extraneous particles.*
- *Do not use insulation material containing NH3 as it can damage the copper piping material and may be a source of future leakage.*

8.3.3 Insulation

Attach insulation package with the Multikit to each branch using vinyl tape. Also attach insulation to field-supplied piping to prevent capacity decrease due to ambient air conditions and dewing on pipe surface caused by low pressure.

NOTE

- *When polyethylene foam is applied, a thickness of 10 mm for the liquid piping and from 15 mm to 20 mm for the gas piping is recommended.*

CAUTION

Perform insulation work after the surface temperature decreases to the room temperature, If not, the insulation material may melt. If the ends of the piping system are open after finishing the installation work, securely attach caps or vinyl bags to the ends of the piping to prevent moisture or dust entering.

8.4 Refrigerant charge amount

Although refrigerant has been charged into this unit, additional refrigerant charge is required according to piping length.

- The additional refrigerant quantity should be determined and charged into the system according to the following procedure.
- Record the additional refrigerant quantity in order to facilitate maintenance and servicing activities.

8.4.1 Refrigerant charge before shipment (W_0 (kg))

W_0 is the outdoor unit refrigerant charge before shipment explained before, and it's shown in the following table:

Outdoor unit	Refrigerant charge before shipment (W_0 (kg))
RAS-3HVRNS3	1.9
RAS-4H(V)RNS3E	2.9
RAS-(5/6)H(V)RNS2E	2.9
RAS-8HRNSE	6.0
RAS-10HRNSE	6.2

CAUTION

- *When charging refrigerant, measure the amount precisely.*
- *Overloading or underloading of refrigerant may cause compressor problems.*
- *If the actual piping length is less than 5 m consult your dealer.*

8.4.2 Additional refrigerant charge calculation method

Calculate the additional refrigerant charge amount according to the following steps:

◆ Step 1: Additional refrigerant charge calculation for liquid piping (W_1 (kg))

Outdoor units has been charged with refrigerant for 30 m (*) of actual piping length. An additional refrigerant charged is required in systems with actual piping length longer than 30 m (*).

Use the following formula:

$$W_1 = (L-30) \times P \ (*)$$

L: Total piping length (m)

P: Additional refrigerant charge (kg/m) (Refer to the following table)

Model	Additional refrigerant charge (P) (kg/m)
RAS-3HVRNS3	0.03
RAS-4H(V)RNS3E	0.04
RAS-(5/6)H(V)RNS2E	0.06
RAS-8HRNSE	0.065
RAS-10HRNSE	0.12

◆ Step 2: Additional refrigerant charge calculation for indoor unit (W_2 (kg))

When the outdoor unit is combined with indoor units RPI-(8/10)HP, it´s necessary an additional refrigerant charge (W_2) = 1 kg/unit. For indoor units lower than 8 HP, an additional refrigerant charge it's not needed.

Indoor unit capacity	Additional refrigerant charge (W_2 (kg))
≥ 8 HP	1
< 8 HP	0

◆ Step 3: Calculation of total additional refrigerant charge (W (kg))

Put weight W_1 and W_2 calculated in step 1 and step 2 into the following formula:

$$W = W_1 + W_2$$

System example (W) = [ ] + [ ] = [ ] kg

◆ Step 4: Charging work

Charge refrigerant (R410A) into the system according to the instructions in the Service Manual.

◆ Step 5: Total refrigerant charge of the system (W_{TOT} (kg))

The total refrigerant charge of this system is calculated by the following formula:

$$W_{TOT} = W + W_0$$

System example (W_{TOT}) = [ ] + [ ] = [ ] kg

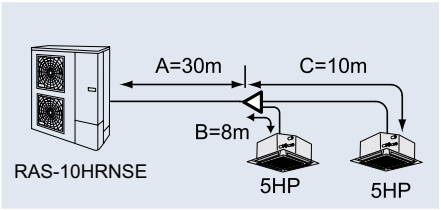
W_0 is the outdoor unit refrigerant charge before shipment explained before, and it's shown in its specific table.

Finally, record the refrigerant charge quantity in order to facilitate maintenance and servicing activities.

Total additional charge W	[ ] kg
Total ref. charge of this system	[ ] kg
Date of ref. charge work	
Year [ ] Month [ ] Day [ ]	

8.4.3 Additional refrigerant charge calculation example

Example of twin system for RAS-10HRNSE



◆ Step 1: Additional refrigerant charge calculation for liquid piping (W_1 (kg))

Use the following formula:

$$W_1 = (L-30) \times P$$

Total piping length (L) = A+B+C = 30+8+10 = 48 m

Additional refrigerant charge (P) = 12 m (Refer to its specific table)

$$W_1 = (48-30) \times 0.12 = 2.16 \text{ kg}$$

◆ Step 2: Additional refrigerant charge calculation for indoor unit (W_2 (kg))

The additional refrigerant charge needed for indoor units it's only for (8-10)HP, so in this case it's not needed (W_2 = 0 kg).

◆ Step 3: Calculation of total additional refrigerant charge (W (kg))

Use the formula shown below:

$$W = W_1 + W_2 = 2.16 + 0 = 2.16 \text{ kg}$$

◆ Step 4: Total refrigerant charge of the system (W_{TOT} (kg))

The total refrigerant charge of this system is calculated by the following formula:

$$W_{TOT} = W + W_0$$

Refrigerant charge before shipment (W_0) = 6.2 kg (Refer to its specific table)

$$W_{TOT} = 6.2 + 2.16 = 8.16 \text{ kg}$$

8.5 Caution in case of refrigerant leakage

The installers and those responsible for drafting the specifications are obliged to comply with local safety codes and regulations in the case of refrigerant leakage.

8.5.1 Maximum permitted concentration of hydrofluorocarbon (HFC)

The refrigerant R410A, charged in the UTOPIA series system, is an incombustible and non-toxic gas. However, if leakage occurs and gas fills a room, it may cause suffocation.The maximum permissible concentration of HFC gas, R410A in air is 0.44 kg/m^3, according to EN378-1.

Therefore, some effective measure must be taken to lower the R410A concentration in air below 0.44 kg/m^3, in case of leakage.

8.5.2 Calculation of refrigerant concentration

The room must have the following characteristics should there be a gas refrigerant leak:

1. Calculate the total quantity of refrigerant R (kg) charged in the system by connecting all the indoor units in the rooms to be air-conditioned.
2. Calculate the room volume V (m^3) of each room.
3. Calculate the refrigerant concentration C (kg/m^3) of the room according to the following equation:

C = R / V
R: Total quantity of refrigerant charged (kg).
V: Room volume (m^3).
C: Refrigerant concentration (≤ 0.44 kg/m^3 for R410A).

8.5.3 Countermeasure for refrigerant leakage

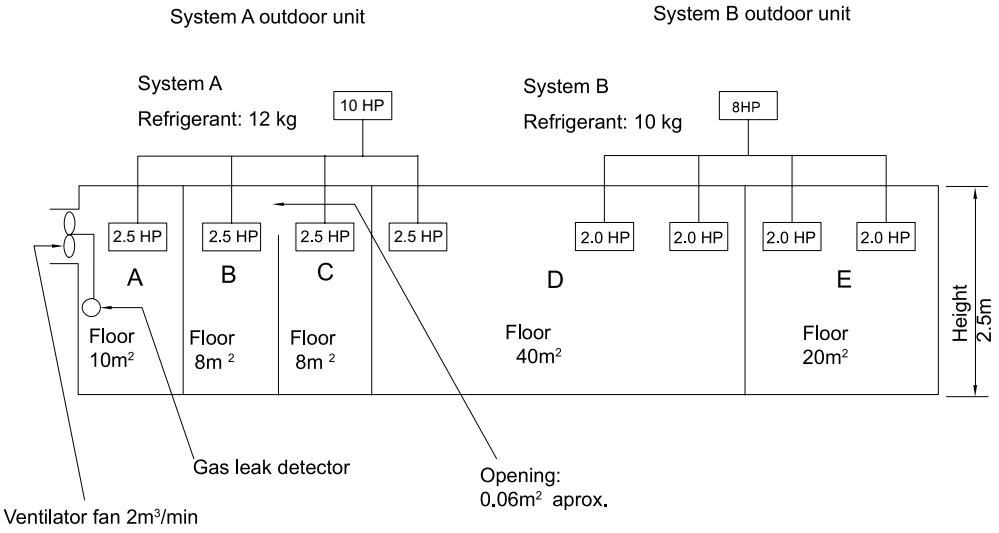
The facility must have the following features in case of a refrigerant leakage occurs:

1. Provide a shutterless opening which will allow fresh air to circulate into the room.
2. Provide a doorless opening of 0.15% or more size to the floor area.
3. There must be a ventilator fan connected to a gas leak detector, with a ventilator capacity of 0.4 m³/min or higher per Japanese refrigeration ton (= compressor displacement volume / 5.7 m³/h) of the air conditioning system using the refrigerant.

Model	Tonnes
RAS-3HVRNS3	1.35
RAS-4H(V)RNS3E	1.64
RAS-(5/6)H(V)RNS2E	2.27
RAS-(8/10)HRNSE	4.11

4. Pay a special attention to the place, such as a basement, etc., where refrigerant can stay, since refrigerant is heavier than air.

◆ Example of application



Room	R (kg)	V (m³)	C (kg/m³)	Countermeasure
A	12	25	0.48	2 m³/min fan linked with gas leak detector
B	12	20	0.60	0.06 m² aprox. opening
C	12	20	0.60	0.06 m² aprox. opening
B + C	12	40	0.30	—
D	22	100	0.22	—
E	10	50	0.20	—

9. Electrical wiring

Index

9.1 General information

9.1.1 General notes

CAUTION

- *Before any electrical wiring work or regular inspections, switch off the main power supply switches of the indoor and outdoor units. Wait three minutes before starting installation or maintenance work.*
- *Make sure that the indoor and outdoor are completely stopped before starting work on the electrical wiring or regular inspections.*
- *Protect cables, drain hose, electric parts, etc. from rodents and insects; otherwise these might damage unprotected components and, in the worst case, cause a fire.*
- *Do not allow cables to come into contact with the refrigerant pipes, metal edges, printed circuit boards (PCB) or the electric parts inside the unit; the cables may be damaged and, in the worst case, cause a fire.*
- *Firmly secure the cables inside the indoor unit with plastic flanges.*

DANGER

- ***Use an earth leakage breaker with medium sensitivity, and an activation speed of 0.1 sec or less. If this is not fitted, there is a risk of electric shock and/or fire.***
- ***Install an earth leakage breaker, fuse and circuit breaker for each outdoor unit power line. Not fitting it may cause an electric shock or fire.***

NOTE

- *Fix the rubber bushes with adhesive when the outdoor unit ducts are not used.*

9.1.2 General verifications

1 Make sure the electric components supplied by the installer (main power switches, circuit breakers, wires, connectors and connection terminals) have been selected correctly in line with the electrical data given.

   a. The electricity supply to the unit should be via an exclusive power control switch and protective circuit breaker, certified and installed in accordance with local or national safety regulations.

   b. The electricity supply for the outdoor and indoor units should be separate. Connect the voltage supply wiring for each group of indoor units to the same outdoor unit.

2 Check that the supply voltage is between 90 and 110% of the rated voltage. Where the voltage capacity is too low, it will not be possible to start the system due to the drop in voltage.

3 During the preliminary preparation work of the electricity supply line for the unit, the provisions in local and national legislation must never be violated.

4 Check that the earth cable is correctly connected.

Electromagnetic compatibility

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	Z_{max} (Ω)	MODEL	Z_{max} (Ω)
RAS-3HVRNS3	—	RAS-6HVRNS2E	0.29
RAS-4HVRNS3E	0.27	RAS-6HRNS2E	—
RAS-4HRNS3E	—	RAS-8HRNSE	—
RAS-5HVRNS2E	0.29	RAS-10HRNSE	—
RAS-5HRNS2E	—		

Harmonics

Harmonics situation of each model regarding IEC 61000-3-2 and IEC 61000-3-12 is as follows:

MODELS SITUATION REGARDING IEC 61000-3-2 and IEC 61000-3-12	MODEL	Ssc “xx” (KVA)
Equipment complying with IEC 61000-3-2 (professional use(*))	RAS-3HVRNS3	—
	RAS-4HRNS3E (*)	—
	RAS-5HRNS2E (*)	—
	RAS-6HRNS2E (*)	—
Equipment complying with IEC 61000-3-12	RAS-4HVRNS3E	—
	RAS-5HVRNS2E	—
	RAS-6HVRNS2E	—
	RAS-8HRNSE	—
This equipment complies with IEC 61000-3-12 provided that the short-circuit power Ssc is greater than or equal to xx (see Ssc column) at the interface point between the user’s supply and the public system. It is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment is connected only to a supply with a short-circuit power Ssc greater than or equal to xx (see Ssc column)		
Installation restrictions may be applied by supply authorities in relation to harmonics	RAS-10HRNSE	—

DANGER

- ***Never connect the earth cable to the refrigerant pipes. The gas in the pipes could cause a fire.***
- ***Do not connect the earth cable to the lighting arrest system. The electrical potential of earth would increase abnormally.***

9.2 Setting of DIP switches and RSW switches

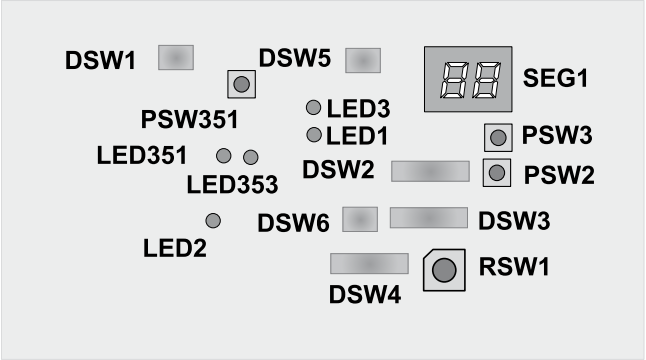
NOTE

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

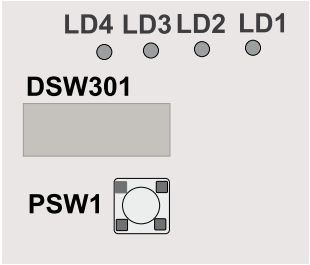
9.2.1 Quantity and Position of DIP Switches

◆ **RAS-3HVRNS3**

PCB1

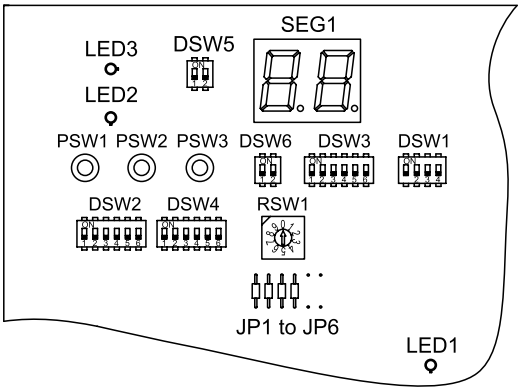


PCB2

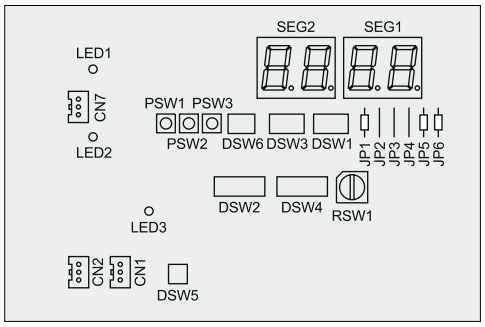


◆ **RAS-4H(V)RNS3E**

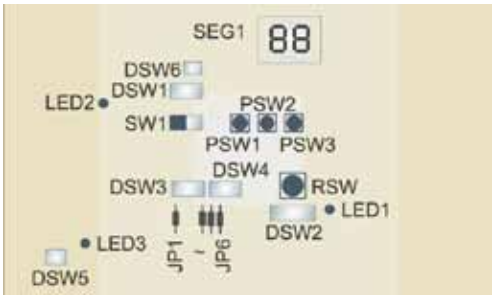
PCB



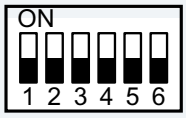
◆ **RAS-(5/6)HVRNS2E**



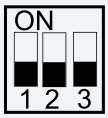
◆ **RAS-(8/10)HRNSE**



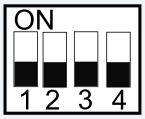
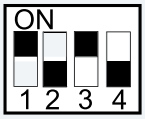
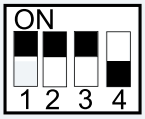
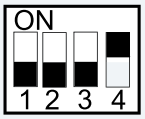
◆ DSW301: Test run mode (only RAS-3HVRNS3)

• Before shipment.	

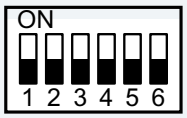
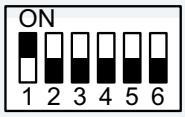
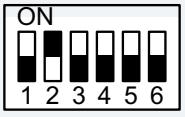
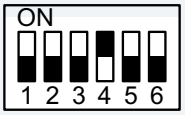
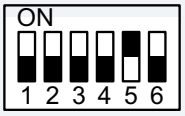
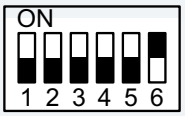
◆ DSW1: No setting is required (only RAS-3HVRNS3)

• When set pin number 1 to ON, the electric current detection is cancelled. Pin number 1 should be set back to OFF after electrical work.	

◆ DSW1: Test run mode (only RAS-4H(V)RNS3E, RAS-(5/6)H(V)RNS2E and RAS-(8/10)HRNSE)

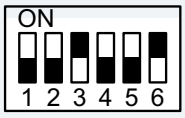
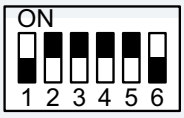
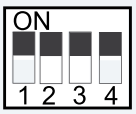
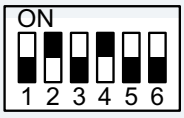
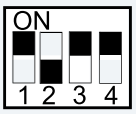
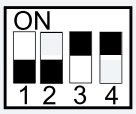
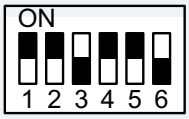
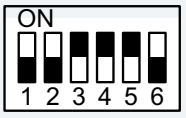
• Factory setting	
• Cooling	
• Heating	
• Cooling for intermediate season	
• Heating for intermediate season	
• Forced stop of compressor	

◆ DSW2: Optional function setting and piping lenght

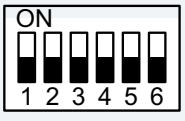
• Pipe length setting should be performed as follows according to the on-site pipe length.	Setting before shipment  Pipe length (≤5m)  Pipe length (≥30m) 
• Optional piping setting	
• Optional function setting	
• External input/output setting mode	

◆ DSW3: Capacity setting (No setting is required)

Factory setting

RAS-3HVRNS3	RAS-4HVRNS3E	RAS-5HVRNS2E	RAS-6HVRNS2E		
					
	RAS-4HRNS3E	RAS-5HRNS2E	RAS-6HRNS2E	RAS-8HRNSE	RAS-10HRNSE
					

◆ DSW4 and RSW1: Refrigerant cycle number setting (Setting is required)

• Setting for the ten digit (Factory setting)	

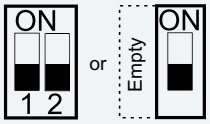
• Setting position Set by inserting slotted screwdriver into the groove (setting for the last digit)	

◆ DSW5: End terminal resistance (No setting is required)

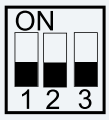
To ensure the impedance corresponds, set the DSW5 according to the number of outdoor units of the H-LINK system.

• Factory setting	
• Cancellation	

◆ DSW6: No setting is required (Only RAS-3HVRNS3 and RAS-4(H)VRNS3E)

• Factory setting	

◆ DSW6: Power supply and series setting (No setting is required) (Only RAS-(5/6)H(V)RNS2E and RAS-(8/10)HRNSE)

	5/6 HP	8/10 HP
• Factory setting		

◆ JP4-6 cables: Jumper cable (RAS-3HVRNS3)

- JP4 cut: Fixing cooling mode.
- JP5 cut: Selfdiagnosis.
- JP6 cut: Phase detection release.

◆ JP1-6 cables: Jumper cable (RAS-4H(V)RNS3E)

- JP1 cut: 230V power source voltage.
- JP3 cut: 380V power source voltage.
- JP4 cut: Fixing cooling mode.
- JP5 cut: Selfdiagnosis.
- JP6 cut: Phase detection release.

◆ JP4-6 cables: Jumper cable (RAS-(5/6)H(V)RNS2E and RAS-(8/10)HRNSE)

- JP4 cut: Fixing cooling mode.
- JP5 cut: Alternative defrost mode.
- JP6 cut: High-pressure control based on R407C piping.

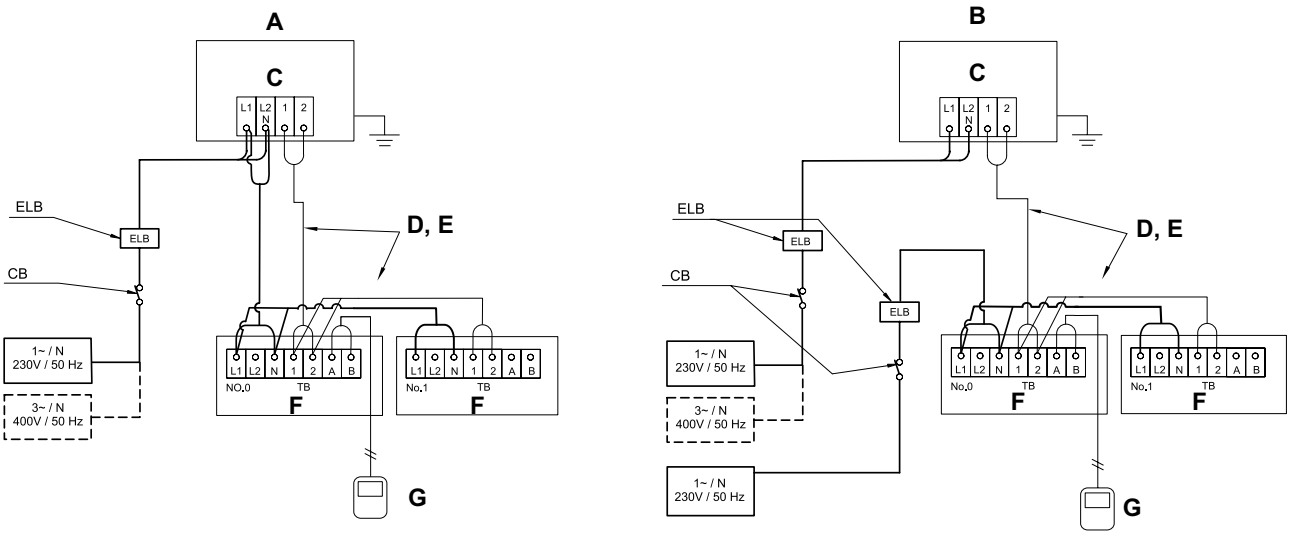
9.3 Common wiring

9.3.1 Electrical wiring between outdoor and indoor unit

- Connect the electrical wires between the indoor unit and the outdoor unit as show in the figure.
- When installing the electrical wiring, follow local codes and regulations.
- The refrigerant piping and the control wiring are connected to the units in the same refrigerant cycle.
- Use twist pair wire (more than 0.75 mm^2) for operation wiring between the outdoor unit and indoor unit, and operation wiring between indoor unit and indoor unit.
- Use a 2-core wire for the operating line (do not use wire with more than 3 cores).
- Use shielded wires for intermediate wiring to protect the units from noise interference at lengths of less than 300 m. The size must comply with local code.
- Open a hole near the connection hole of power source wiring when multiple outdoor units are connected from a single power source line.
- The recommended circuit-breaker sizes are shown in the table of electrical data and recommended wiring and breaker sizes / 1 O.U.
- If a duct for field-supplied wiring is not used, fix rubber bushes with adhesive on the panel.
- All field wiring and equipment must comply with local and international codes.
- H-LINK twist pair shielded cable must be grounded in the outdoor unit side.

NOTE

- *Take care with the connection of the operating line. Incorrect connection may cause a failure of the PCB.*



TB: Terminal board.

CB: Circuit breaker (field supplied).

ELB: Earthleakage breaker (field supplied).

A: Power source from the outdoor unit to the indoor unit.

B: Independent power source of outdoor unit and indoor unit.

C: System outdoor unit.

D: Operating line (Twisted shielded pair cable or shielded pair cable).

E: DC5V (non-pole transmission, H-LINK system).

F: Indoor unit.

G: Remote control switch (optional accessory).

9.3.2 Wiring size

◆ Connection wiring

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

Model	Power supply	Maximum current (A)	Power supply cable size EN60 335-1	Transmitting cable size EN60 335-1
RAS-3HVRNS3	1~ 230V 50Hz	16.0	4.0 mm²	0.75 mm²
RAS-4HVRNS3E		28.0	6.0 mm²	
RAS-5HVRNS2E		26.0	6.0 mm²	
RAS-6HVRNS2E		26.0	6.0 mm²	
RAS-4HRNS3E	3N~ 400V 50Hz	15.0	4.0 mm²	
RAS-5HRNS2E		13.0	4.0 mm²	
RAS-6HRNS2E		13.0	4.0 mm²	
RAS-8HRNSE		20.0	6.0 mm²	
RAS-10HRNSE		23.0	6.0 mm²	

NOTE

- *Follow local codes and regulation when selecting field wires.*
- *Use the wires which are not lighter than the ordinary polychloroprene sheathers flexible cord (code designation H05RN-F).*

9.3.3 Main switch protection

Select the main switches according to the following tables:

Model	Power supply	Maximum current (A)	CB (A)	ELB N°. of poles/A/mA
RAS-3HVRNS3	1~ 230V 50Hz	16.0	20	2/40/30
RAS-4HVRNS3E		28.0	32	
RAS-5HVRNS2E		26.0	32	
RAS-6HVRNS2E		26.0	32	
RAS-4HRNS3E	3N~ 400V 50Hz	15.0	20	4/40/30
RAS-5HRNS2E		13.0	20	
RAS-6HRNS2E		13.0	20	
RAS-8HRNSE		20.0	40	
RAS-10HRNSE		23.0	40	

NOTE

CB: Circuit breaker.

ELB: Earth leakage breaker.

9.4 H-LINK II system

The H-LINK II is the wiring connection system between units.

The H-LINK II wiring system only needs:

- Two transmission wires connecting each indoor and outdoor unit for a total of 64 refrigerant cycles.
- Connection wiring for all indoor and outdoor units in series.

CAUTION

The H-LINK II system cannot be applied to the models with the old cycle, nor to units with an old transmission.

9.4.1 Features

- The total wiring length is considerably reduced compared to traditional connections.
- Only one connection is required for the wiring between the indoor and outdoor units.
- The wiring connection of the complementary central control devices is easy.

NOTE

- *CSNET WEB is centralized control system which allows the installation to be controlled remotely. It can be connected at any point of the local corporate network, or even via the Internet.*

9.4.2 Specifications

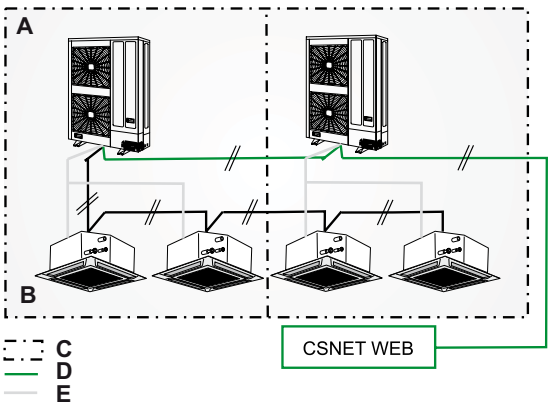
A: outdoor unit.

B: indoor unit.

C: a refrigerant cycle.

D: transmission cables.

E: refrigerant piping.



- Transmission cable: 2-wire.
- Polarity of transmission cable: non-polar wire.
- Maximum number of indoor units that can be connected: 4 units per cycle and 160 units per H-LINK II system.
- Maximum wiring length: total 1000 m (including CSNET WEB).
- It is possible to increase the maximum wiring length up to 5000 m by using up to four PSC-5HR units.
- Recommended cable: shielded twisted pair cable, over 0.75 mm^2 (Equivalent to KPEV-S).
- Voltage: 5 V DC.

CAUTION

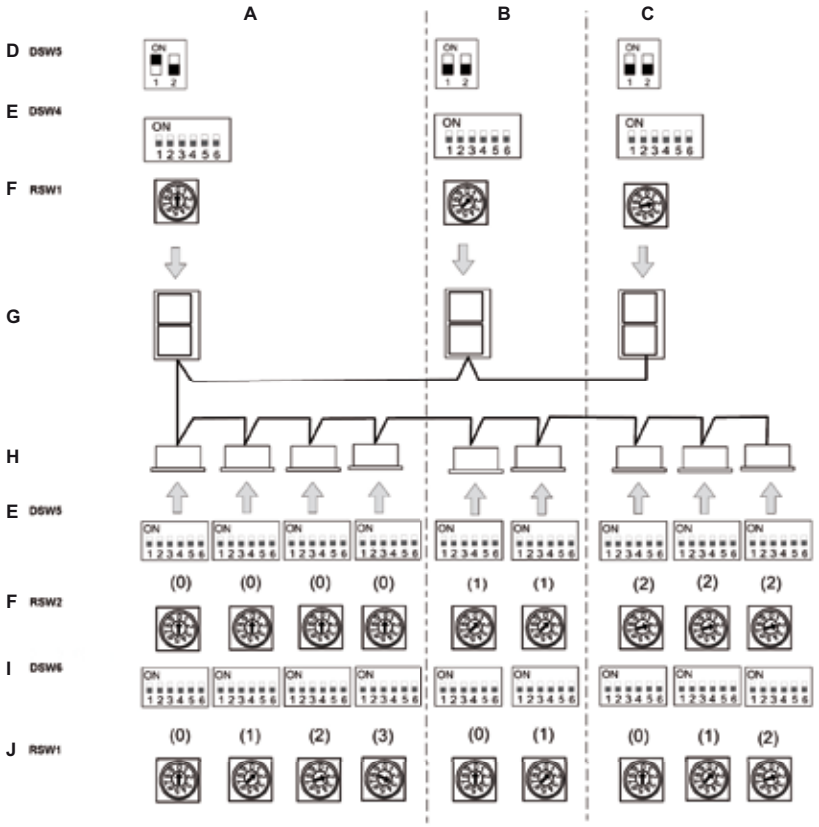
- *For the H-LINK II system must use twisted shielded pair cable or shielded pair cable.*

9.4.3 DIP Switch setting for twin, triple and quad systems

Dip switch of indoor PCB and outdoor H-LINK II

The DIP switches of all the indoor and outdoor units have to be set and the impedance of the transmission circuit adapted.

- Example of the setting of the DIP switches.



A: Cycle No. 0.

B: Cycle No. 1.

C: Cycle No. 2.

D: Terminal resistance.

E: No. of refrigerant cycle (setting for the tenth digit).

F: No. of refrigerant cycle (setting for the last digit).

G: Outdoor units.

H: Indoor units.

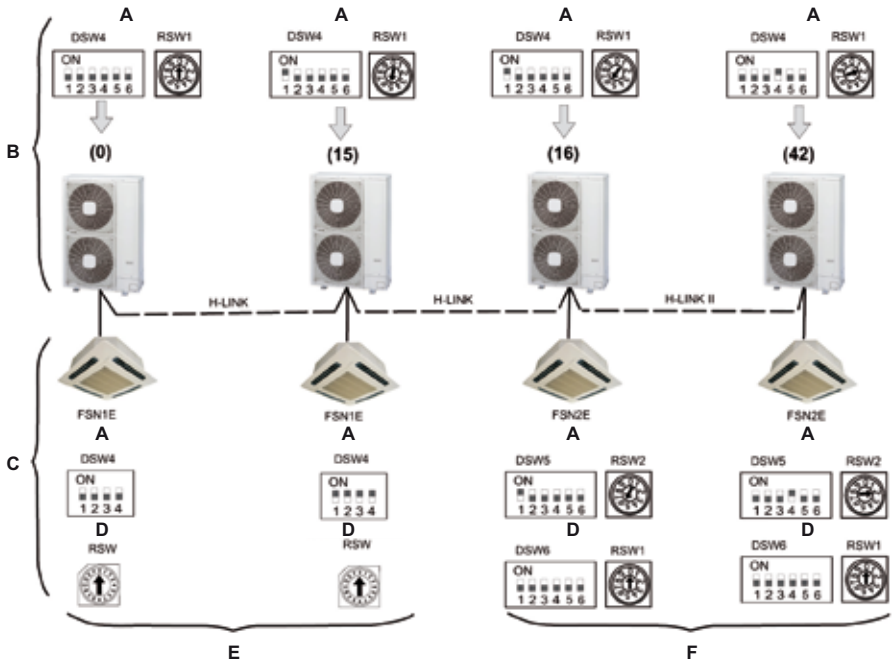
I: Address of the indoor unit (setting for the tenth digit).

J: Address of the indoor unit (setting for the tenth digit).

Unit	Name of DIP switch	Mark	Setting before the Shipment	Function
Outdoor Unit	Refrigerant cycle	DSW4 RSW1		For setting the refrigerant cycle address of the outdoor unit. Set the DSW4 and RSW1 to overlap the setting of other outdoor units in the same H-LINK system.
	Resistance of terminal	DSW5		To adapt the impedance of the transmission circuit, adjust DSW5 according to the number of outdoor units of the H-LINK system.
Indoor Unit	Refrigerant cycle	DSW5 RSW2		For setting the refrigerant cycle address of the indoor unit. Set the DSW5 and RSW2 corresponding to the address of outdoor unit in the same refrigerant cycle.
	Address of the indoor unit	DSW6 RSW1		Setting indoor unit address. Set the DSW6 and RSW1 not to overlap the setting of other indoor units in the same refrigerant cycle. (If no set, the automatic address function is performed.)

9.4.4 Examples of the system of connection between H-LINK and H-LINK II units

In the case of mixed systems with H-LINK and H-LINK II, set the H-LINK units in the first 16 position of the system, as in the following example where 42 systems are connected, 16 with indoor FSN1E units and 26 with indoor FSN2E units.



A: Refrigerant cycle.

B: Outdoor unit.

C: Indoor unit.

D: Indoor unit address.

E: Either the current remote control switch (H-LINK) or the new one (H-LINK II) can be used.

F: Only the new remote control switch (H-LINK II) can be used.

NOTE

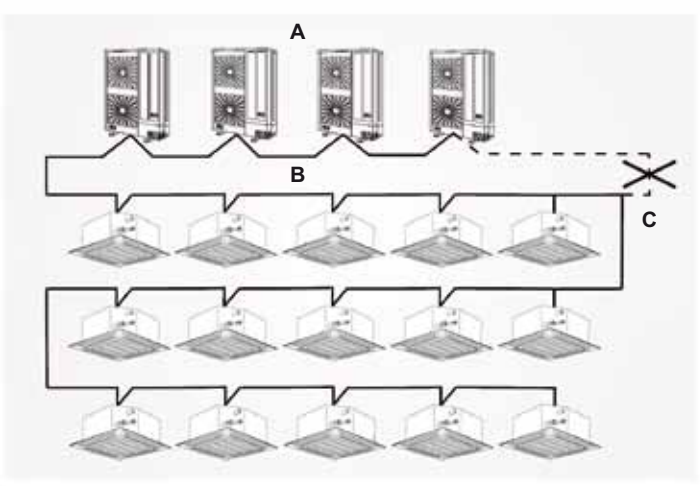
- *The maximum number of indoor units than an H-LINK II can control is 160.*
- *If you use PSC-5S and the CSNET WEB 2.0 (systems only compatible with H-LINK) bear in mind that it will only recognize 16 indoor and 16 outdoor units.*

9.4.5 Examples of H-LINK II system

Two cases:

1. Using H-LINK II system for air conditioning systems without a central control device (CSNET WEB or PSC-A64S).

- Line connection with all units (including Utopia and/or Set Free, Mini Set Free and DC Inverter).

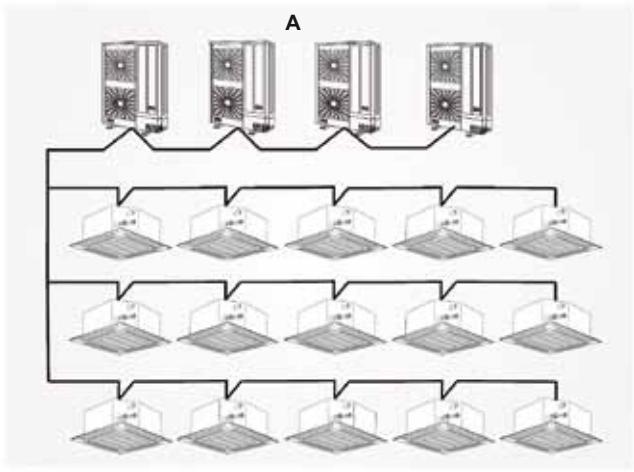


A: Outdoor units.

B: Indoor units.

C: Do not install wiring in a loop.

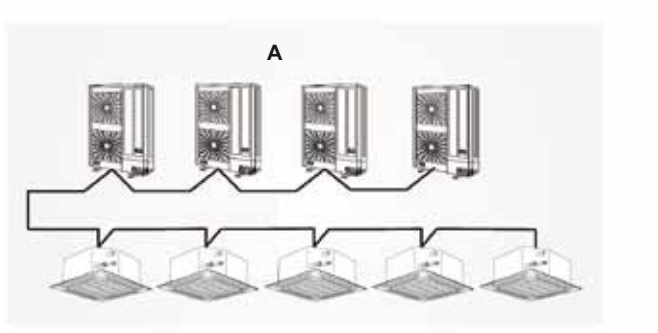
- Line connection for each floor.



A: Outdoor units.

B: Indoor units.

- Connection with one main line and with the branch lines for the units.



A: Outdoor units.

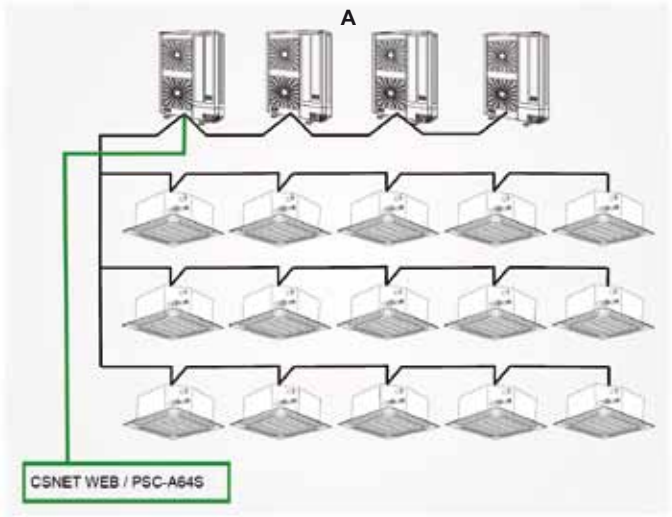
B: Indoor units.

CAUTION

- *The maximum number of units than can be connected is 64 outdoor units and 160 indoor units (including Utopia and/ or Set Free, Mini Set-free).*
- *Do not install the wiring in a loop.*
- *If the H-LINK II system is not used when carrying out the electrical wiring as shown above, it must be used once the wiring of the instrument is completed. The DIP switches must therefore be set as specified in the DIP switches on the PCB.*

2. Using the H-LINK II system for air conditioning systems with a central control device (CSNET WEB or PSC-A64S)

- If the central control device is used when carrying out electrical wiring, the CS-NET WEB can be connected at any point of the H-LINK II wiring.



A: Outdoor units.

B: Indoor units.

- If the central control device is not used when electrical wiring is carried out, you must connect the H-LINK II wiring to all the systems. The easiest method is usually to connect the outdoor units.

NOTE

- *For CSNET WEB 2.0 the limitations are those corresponding to H-LINK.*

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10. Optional functions

Index

10.1 Optional signals

External input function setting	
Optional function	**Explanation**
Fixing Operation Mode (Heating/Cooling)	This function fixes the operation mode, heating or cooling. If indoor unit is set on Heating (Cooling) mode when Cooling (Heating) mode is fixed, the indoor unit will be Thermo-OFF.
Demand stoppage.	When this function is enabled, the compressor is stopped and the indoor units are put under Thermo-OFF condition.
Forced stoppage	This function produces an emergency stoppage. The compressor and indoor fans do not operate.
Demand Current Control.	This function regulates Outdoor running current (60%, 80%, 100% for 3 HP / 60%, 70%, 80%, 100% for 4 HP / 50%, 75% 100% for 5, 6, 8 and 10 HP), if demanded current is above set, the indoor unit capacity is reduced still thermo off if needs.

External output function setting	
Optional function	**Explanation**
Operation signal	The operation signal is sent to output terminals when the indoor units (or a single indoor unit) are operating. This function can be used for the circulation or humidification operation.
Alarm signal	This function is used to receive the alarm signal. The alarm signal will be sent to output terminals when the indoor units (or a single indoor unit) are operating and an alarm occurs in the system.
Compressor ON signal	This function is used to receive the compressor operation signal.
Defrosting signal	This function is used to receive the defrosting signal.

10.2 Optional functions

for RAS-3HVRNS3 and RAS-4H(V)RNS3E units

Optional function	Explanation
Indoor unit fan control during the Thermo-OFF in heating mode	Normally, the fan speed is changed to “LOW” at heating Thermo-OFF. However, the indoor fan motor is operated at “LOW” and stopped repeatedly by setting this function.
Night-shift (low noise)	The night shift operation shall be applied in case the cooling capacity has the allowed range to decrease the capacity and the low noise level operation is required especially at night.
Cancellation of the outdoor ambient temperature limit.	The heating operation is continued under a high outdoor temperature or the cooling operation is continued under a low temperature.
Defrost for cold area (change in the defrost condition)	This function changes the defrosting operation conditions. It is particularly useful in cold areas.
SLo (fan speed) Defrost setting	When this function is enabled, the indoor fan speed in defrost mode switches to slow instead of stopping the fan.
Cancellation of the hot start	
Low noise setting (in the case of low noise setting, the working range in cooling/heating will be restricted)	This setting reduce the compressor frequency and the outdoor fan motor rotation frequency.
Demand function setting	Demand control setting is adapting the self-demand function, which causes the power consumption to drop drastically for the purpose of saving energy.
Wave function setting	This function sets the outdoor flow. If the flow demanded is above the flow set, the capacity of the indoor unit is reduced and the thermostat may even be disabled if necessary. Control of the operation flow is not a set value and may vary within a range.
Cold draft protection	The discharge air temperature of the indoor unit is also low, the outdoor unit is switching operation mode to prevent this low discharge air temperature.

Optional functions for RAS-(5/6)H(V)RNS2E and RAS-(8/10)HRNSE units

Optional function	Explanation
Setting for the energy saving request function.	This function regulates the outdoor unit consumption to 50%, 70% or 100%. If the required power is above the set value, the capacity of the indoor unit will be reduced proportionally to the power consumption of the outdoor unit. It can even come to a thermostatic stop if necessary. This function can be configured using an external or internal signal, depending on the needs of the installation. Configuration by external signal is very useful for setting up groups of outdoor units. The internal signal is useful for setting up a single outdoor unit.
Thermo stop order	When this function is activated the compressor is stopped and the indoor units are on thermo OFF.
Low speed defrost adjustment.	When this function is activated the indoor fan speed at defrost mode changes to slow instead of stopping the fan.
Low noise setting	This function decreases the sound levels of the outdoor units by reducing the maximum working frequency of the compressor (Cooling/Heating).
Night mode (low noise) operation	This function reduces the sound level of the outdoor units by decreasing the maximum working frequency of the compressor and the fan airflow according to the outside temperature (only for cooling mode).
Change of defrost operation conditions	This function changes the defrosting operation conditions. It is especially useful in cold areas.
Protection against cold air discharge (1)	When the air discharge temperature of the indoor unit is less than or equal to 10 ºC in cooling mode, the fans stop and the frequency of the outdoor unit is reduced, thereby preventing any discomfort to the occupants of the room.
Protection against cold air discharge (2)	When the discharge temperature of the air in the indoor unit is less than or equal to 10 ºC in cooling mode, the compressor stops and alarm no. 24 appears.
Wave function setting	This function controls the outdoor unit consumption in the following way: It allows a consumption of 100% for 20 minutes. The following 10 minutes it goes down to 70% and then alternates between 100% and 70%.
Indoor unit energy-saving temperature setting	This function reduces the power consumption of the indoor unit according to the temperature.
Piping for the R407C	If you use conventional R407C piping instead of the R410A, the piping pressure will increase. This function is activated in order to avoid this pressure increase.
Alternation of the defrost mode activation	This function is useful in an installation consisting of various outdoor units placed in the same H-LINK. The defrost mode is activated alternately in each outdoor unit.
New temperature margin in cooling mode.	This function sets the cooling mode: the indoor unit will only start when the system is on COOL or DRY.
Setting the cooling mode	This function sets the heating mode: the indoor unit will only start when the system is on HEAT or DRY/FAN.

10.3 Optional functions for operation with CS-NET WEB

Optional function	Explanation
Historical data	CS-NET WEB generates a file with this information so the data can be consulted.
Power consumption	
Automatic COOL/HEAT operation	This function changes automatically from Cool to Heat operation.
Setting the operation mode	This function eliminates the possibility of changing the operation mode from the remote controller.
Setting set temperature	This function eliminates the possibility of changing the set temperature from the remote controller.
Setting air volume	This function eliminates the possibility of changing the fan speed from the remote controller.

11. Troubleshooting

Index

11.1 On-screen displays during abnormal operation

Abnormal operation can be produced due to the following reasons:

- Malfunction

The RUN (red) indicator flashes.

The ALARM indicator appears on the liquid crystal display.

The screen also displays the following items:

- A: indoor unit address.
- B: Refrigerant cycle number.
- C: Alarm code.
- D: Model code.
- E: If there are various indoor units connected, the above mentioned information is shown for each one of them.

Write down the indications and contact your HITACHI service supplier.

- Power supply failure.

All displays disappear.

If the unit stops due to a power shortage, it will not start again, even though the power comes back on. Carry out the start-up operations again.

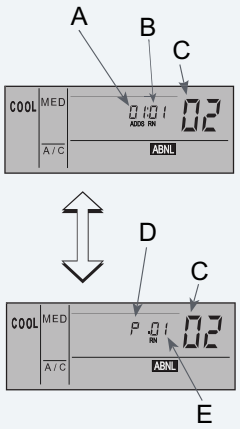
If the power failure lasts less than 2 seconds, the unit will start again automatically.

- Electrical noise.

The displays can disappear from the screen and the unit can stop. This is because the microcomputer has been activated to protect the unit from electrical noise.

NOTE

If the wireless remote control is used for the wall-type indoor unit, remove the connectors (CN25) that are connected to the indoor PCB. Otherwise the unit will not work. The stored data cannot be erased unless the remote control is initialised.



(PC-ART example)

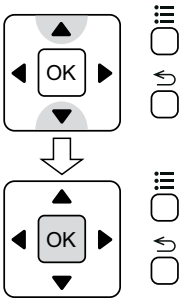
Model code	
Indication	**Model**
H	Heat pump
P	Inverter
F	Multi (SET-FREE)
C	Cooling only
E	Other
b	IVX, individual operation
L	KPI

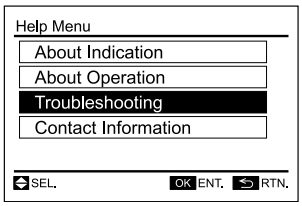
11.1.1 PC-ARF Troubleshooting help menu

PC-ARF remote controller have a Troubleshooting function in Help Menu.

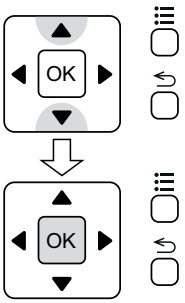
Make sure that the troubleshooting is read carefully before requesting for repairs.

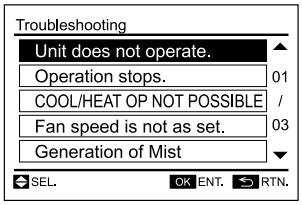
Select “Troubleshooting” from the help menu and press “OK”. The list of troubleshooting will be displayed.



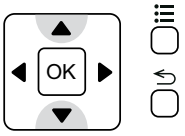


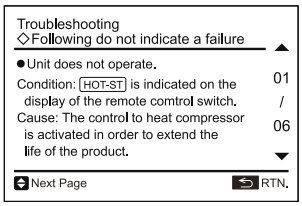
1 Select a problem from the list by pressing “△” or “▽” and press “OK”. The details of the selected problem will be displayed.



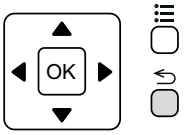


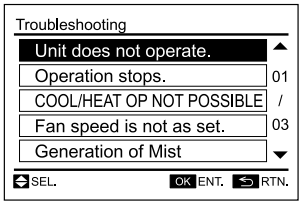
2 Press “△” or “▽” to scroll the text up and down.





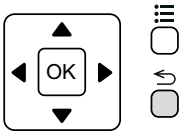
3 Press “⮌” (return). The screen will return to the list of troubleshooting.

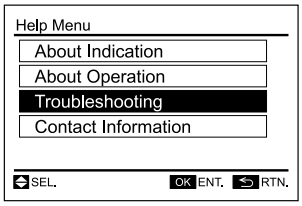




4 Press “⮌” (return). The screen will return to the help menu.

To return to the normal mode, press “⮌” (return) again.





11.2 Alarm codes

Code number	Category	Abnormality	Cause
1	Indoor unit	Activation of protection device	Failure of fan motor, drain discharge, PCB, relay, float switch activated.
2	Outdoor unit	Activation of protection device	Activation of PSH, locked motor, abnormal operation in the power supply phase. Failure of fan motor, drain discharge, PCB, relay, float switch activated.
3	Transmission	Abnormality between indoor and outdoor units	Incorrect wiring. Failure of PCB. Tripping of fuse. Power supply OFF.
4		Abnormal operation between inverter and control PCB	Transmission failure between PCBs.
5	Power supply	Abnormal power supply	Power source with abnormal wave pattern. Main power supply phase is reversely connected or one phase is not connected.
6	Voltage drop	Excessively low voltage or excessively high voltage in outdoor unit	Voltage drop in power supply. Incorrect wiring or insufficient capacity of power supply wiring.
7	Cycle	Drop in discharge gas overheating	Excessive refrigerant charge. Expansion valve lock open.
8		Increase in discharge gas temperature	Insufficient refrigerant charge, refrigerant leakage. Expansion valve closed or clogged.
11	Sensor in indoor unit	Air inlet thermistor	Failure of thermistor, sensor, connection.
12		Air outlet thermistor	
13		Anti-freeze thermistor	
14		Gas pipe thermistor	
16		Remote thermistor	Failure of thermistor
17		Thermistor of RCS	Failure of thermistor
19		Protection device for fan motor is triggered	Failure of fan motor.
20	Outdoor unit sensor	Compressor thermistor	Failure of thermistor, sensor, connection.
21		High pressure sensor	Incorrect wiring, disconnected wiring, broken cable, short circuit.
22		Thermistor for outdoor ambient temperature.	Failure of thermistor, sensor, connection.
23		Thermistor for discharge gas temperature.	Incorrect wiring, disconnected wiring, broken cable, short circuit.
24		Thermistor for evaporating temperature.	Failure of thermistor, sensor, connection.
29		Low pressure sensor	Incorrect wiring, disconnected wiring, broken cable, short circuit.
31	System	Incorrect setting of outdoor and indoor units	Incorrect setting of capacity code.
35		Incorrect setting of indoor unit number	Duplication of indoor unit number.
36		Incorrect indoor unit combination	R22 indoor unit
38		Abnormality of protective circuit in outdoor unit	Failure of indoor unit PCB; incorrect wiring; connection to indoor unit PCB.

Code number	Category	Abnormality	Cause
41	Pressure	Cooling overload (possible activation of high pressure device)	O.U. pipe thermistor temp. is higher than 55 ºC and the compressor top temp. is higher than 95 ºC, O.U. protection device is activated.
42		Heating overload (high-pressure device may be activated)	If I.U. freeze protection thermistor temp. is higher than 55 ºC and compressor top temp. is higher than 95 ºC, O.U. protection device is activated.
43		Activation of the safety device from compression ratio decrease	Abnormal compress (Compressor, Inverter damage)
44		Activation of the safety device from excessively high suction pressure	Overload during cooling, high temperature with heating, loked expansion valve
45		Activation of the safety device from excessively high discharge pressure	Overload (obstruction of HEX, short circuit) mixture of inert gas
47		Activation of protection device for low pressure drop (protection from vacuum operation)	Stoppage due to excessive decrease of evaporating temperature (Tem < -35 ºC) is activated 3 times in one hour, motor locked in heating mode.
48	Inverter	Activation of overload protection	Overload, overcurrent. Failure of DIP IPM, IPM or PCB2, heat exchanger clogged, locked compressor. EVI/EVO failure.
51		Abnormality in inverter current sensor	Incorrect wiring of current sensor. Failure of control PCB, DIP IPM, IPM or PCB2.
53		Activation for protection of DIP IPM, IPM or PCB2	Abnormality of DIP IPM or PCB2. Compressor failure, heat exchanger clogged.
54		Increase in inverter fin temperature	Abnormal inverter fin thermistor. Heat exchanger clogged. Abnormal outdoor fan.
55		Abnormality of DIP IPM, IPM or PCB2	Failure of DIP-IPM, IPM or PCB2.
57	Outdoor fan	Fan motor abnormality	Disconnected wire or incorrect wiring between control PCB and inverter PCB. Incorrect wiring or abnormality in fan motor.
b1	Setting	Incorrect setting address or refrigerant cycle	Address or refrigerant number over 64.
b5		Incorrect indoor unit connection number setting	There are more than 17 units not corresponding to H-Link II connected to one system
EE	Compressor	Compressor protection alarm	Compressor failure.
96	Sensor on KPI unit	Room temperature thermistor	Failure of thermistor, sensor, connection.
97		Outdoor temperature thermistor	

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TCGB0086 rev.0 - 04/2013

Printed in Spain