HITACHI
Inspire the Next

SET FREE SERIES
FSNM(E)

Technical Catalogue

Outdoor Units:8~12 HP

HITACHI
Inspire the Next

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

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

Contents (Cont.)

Contents (Cont.)

◆ Unit code list

NOTE:

MODEL CODIFICATION — Please check by model name your air conditioner type, its abbreviation and reference number in this technical catalogue.

FSN(2)(E) INDOOR UNITS

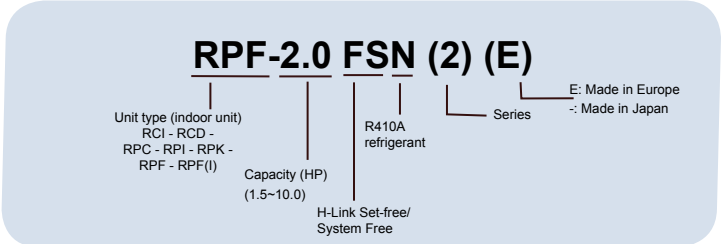
4-Way Cassette		4-Way Mini Cassette		2-Way Cassette		Ceiling	
Unit	Code	Unit	Code	Unit	Code	Unit	Code
RCI-1.0FSN2E	7E400001	RCIM-1.0FSN2	60278011	RCD-1.0FSN2	60278029		
RCI-1.5FSN2E	7E400002	RCIM-1.5FSN2	60278013	RCD-1.5FSN2	60278030		
RCI-2.0FSN2E	7E400003	RCIM-2.0FSN2	60278014	RCD-2.0FSN2	60278031	RPC-2.0FSNE	7E440003
RCI-2.5FSN2E	7E400004			RCD-2.5FSN2	60278032	RPC-2.5FSN2E	7E440004
RCI-3.0FSN2E	7E400005			RCD-3.0FSN2	60278033	RPC-3.0FSN2E	7E440005
RCI-4.0FSN2E	7E400007			RCD-4.0FSN2	60278034	RPC-4.0FSN2E	7E440007
RCI-5.0FSN2E	7E400008			RCD-5.0FSN2	60278035	RPC-5.0FSN2E	7E440008
RCI-6.0FSN2E	7E400009					RPC-6.0FSN2E	7E440009
							
RCI		RCIM		RCD		RPC	
☀ ❄ 1~							

RPI-3.0 FSN (2) (E)

- Unit type (indoor unit) RCI(M) - RCD - RPC - RPI - RPK - RPF - RPF(I)
- Capacity (HP) 1.0~6.0
- H-Link Set-free/ System Free
- R410A refrigerant
- Series
- E: Made in Europe
- -: Made in Japan

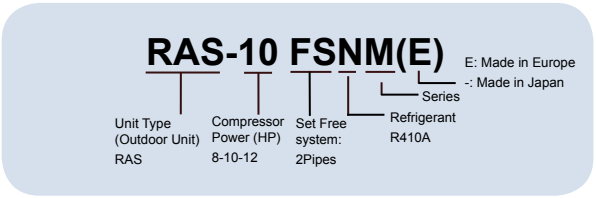
◆ Unit code list

FSN(2)(E) INDOOR UNITS									
Duct				Wall		Floor Enclosure		Floor Concealed Enclosure	
Unit	Code	Unit	Code	Unit	Code	Unit	Code	Unit	Code
				RPK-1.0FSNH2M	60277942				
RPI-0.8FSN2E	7E420000	RPIM-0.8FSN2E	7E430000	RPK-1.5FSNH2M	60277942				
RPI-1.0FSN2E	7E420001	RPIM-1.0FSN2E	7E430001	RPK-1.0FSN2M	60277941	RPF-1.0FSN2E	7E450001	RPFI-1.0FSN2E	7E460001
RPI-1.5FSN2E	7E420002	RPIM-1.5FSN2E	7E430002	RPK-1.5FSN2M	60277942	RPF-1.5FSN2E	7E450002	RPFI-1.5FSN2E	7E460002
RPI-2.0FSN2E	7E420003			RPK-2.0FSN2M	60277943	RPF-2.0FSN2E	7E450003	RPFI-2.0FSN2E	7E460003
RPI-2.5FSN2E	7E420004			RPK-2.5FSN2M	60277944	RPF-2.5FSN2E	7E450004	RPFI-2.5FSN2E	7E460004
RPI-3.0FSN2E	7E420005			RPK-3.0FSN2M	60277945	-	-	-	-
RPI-4.0FSN2E	7E420007			RPK-4.0FSN2M	60277946				
RPI-5.0FSN2E	7E420008								
RPI-6.0FSN2E	7E420009								
RPI-8.0FSN2E	7E420010								
RPI-10.0FSN2E	7E420011								
									
RPI		RPIM		RPK		RPF		RPFI	
❄1~									



◆ Unit code list for Outdoor Units

FSNM OUTDOOR UNITS (SET FREE SIDE FLOW TYPE)	
Unit	Code
RAS-8FSNM(E)	60288308
RAS-10FSNM(E)	60288309
RAS-12FSNM(E)	60288310
	
RAS	
❄ ✺ 3~	

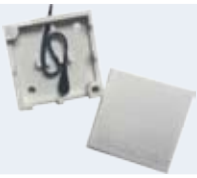


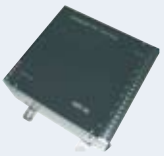
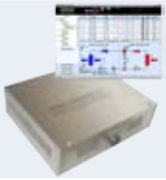
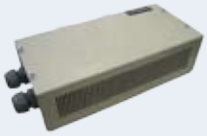
◆ Complementary systems

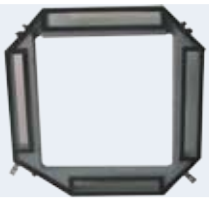
Name	Description	Code	Figure
KPI-502E1E	Energy recovery ventilation units	70600001	
KPI-802E1E		70600002	
KPI-1002E1E		70600003	
KPI-1502E1E		70600004	
KPI-2002E1E		70600005	
KPI-3002H1E		70600107	
EF-5NE	Econofresh kit	7E774148	

◆ List of accessories

Name	Description	Code	Figure
PC-ART	Remote control switch with timer	70510000	
PSC-A64S	Central control	60291479	
PSC-A16RS	Centralized ON/OFF controller	60291484	
PSC-A1T	Programmable timer	60291482	

Name	Description	Code	Figure
PC-LH3A	Wireless remote control switch	60291056	
PC-ARH	Optional remote controller	60291486	
PC-ALH	Receiver kit (for RCI-FSN2E -on the panel-)	60291464	
PC-ALHD	Receiver kit (for RCD-FSN2· -on the panel-)	60291467	
PC-ALHZ	Receiver kit (for RCI, RCD, RPC, RPI, RPK, RPF(I) - (FSN2(E)) -on the wall-)	60291473	
PC-ALHC	Receiver kit (for RCIM-FSN2 -on the panel-)	60291476	Image not available
PSC-5HR	H-LINK relay	60291105	
PCC-1A	Optional function connector	60199286	
PRC-10E1	2-pin extension cord	7E790211	
PRC-15E1	2-pin extension cord	7E790212	
PRC-20E1	2-pin extension cord	7E790213	
PRC-30E1	2-pin extension cord	7E790214	
THM-R2AE	Remote temperature sensor (THM4)	7E299907	
HC-A32MB	Building Management System Gateway to MODBUS systems.	NEW 7E513200	
HC-A16KNX	Building Management System Gateway to KNX systems.	NEW 7E513300	

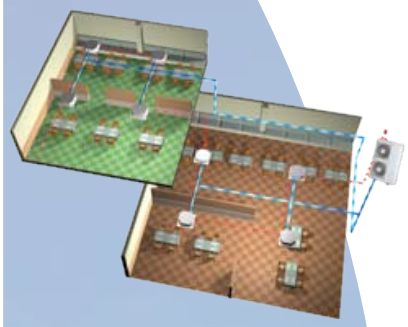
Name	Description	Code	Figure
HARC-BXE (A)	Buildin g Management System Gateway to LONWORKS systems. (max. 64 IU, 8 parameters)	60290874	
HARC-BXE (B)	Building Management System Gateway to LONWORKS systems. (max. 32 IU, 16 parameters)	60290875	
HC-A64BNP	Building Management System Gateway to BAC Net system.	60291569	
CSNET-WEB (v3)	Control System	7E891938	
TS001 WEB SCREEN	15-inch touch-screen display	7E891935	
PC-A-1I0	Integration of teams into H-LINK	7E519000	
HC-A160SMS	SMS alarm warning device	7E519100	
DBS-26	Drain discharge connection	60299192	
P-N23WA	Air panel for RCI-FSN2E	70530000	
P-N23WAM	Air panel for RCIM-FSN2E	60197160	
P-N23DWA	Air panel for RCD-FSN2E	60291574	
P-N46DWA	Air panel for RCD-FSN2E	60291575	

Name	Description	Code	Figure
B-23H4	Adapter for deodorant filter	60199790	
F-23L4-K	Antibacteria filter	60199791	
F-23L4-D	Deodorant filter	60199793	
F-46L4-D	Deodorant filter	60199794	
PDF-23C3	Duct connection flange	60199795	
PDF-46C3	Duct connection flange	60199796	
OACI-232	Fresh-air intake kit	60199797	
PD-75	Fresh-air intake kit	60199798	
PI-23LS5	3-way outlet parts	60199799	
TKCI-232	T-duct connecting kit	60199801	
MW-102AN	Branch pipe	70522001	
MW-162AN		70522002	
MH-84AN	Header	70522007	
MH-108AN		70522008	

Name	Description	Code	Figure
HR-500	Energy exchanger for KPI (heat recovery)	70550101	
HR-800		70550102	
HR-1000		70550103	
HR-1500		70550104	
HR-2000		70550105	
STL-30-200-L600	Sound attenuator (Heat/energy recovery)	70550200	
STL-30-250-L600		70550201	
STL-30-300-L600		70550202	
STL-30-355-L600		70550203	
STL-30-450-L600		70550204	

HITACHI
Inspire the Next

Introduction



SET FREE FSNM(E) Series

System description

- The SET FREE air conditioning system is a VRF (Variant Refrigerant Flow) type system that allows multiple indoor units, of different power and model, to be set up with independent control for each of them.
- The Hitachi SET FREE systems offer high efficiency, reliability and comfort, features that make the SET FREE system one of the best on the market.

Benefits of the system

- The SET FREE air-conditioning system incorporates a set of technical benefits that make it one of the most attractive on the market.
- Right from the selection of the ideal type of equipment in each case, up to its maintenance, and through installation, start up and operation, SET FREE always provides the best solution for every user, and greatly simplifies and eases the user's selection process.

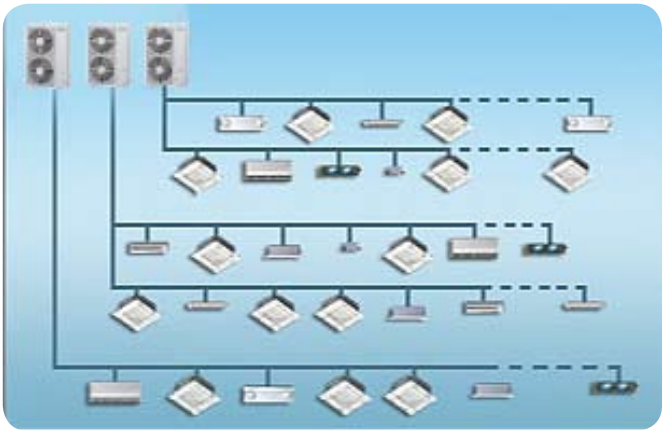


Diagram showing the multiple combinations of a SET FREE FSNM(E) System

- HITACHI offers the same type of indoor unit, the SYSTEM FREE system. Until now each range of outdoor units had its own indoor units. SYSTEM FREE allows users to design a system without having to think what kind of indoor units are needed for it.
- Another benefit of this system is that it allows better stock control and optimizes the number of references. Thanks to this, both installers and distributors obtain a significant reduction in stock and storage costs.
- HITACHI proudly introduces the new SET FREE FSNM(E) series, the highly-efficient and reliable air conditioning system. Recently increased numbers of buildings are requiring "intelligent" facilities communication networks, office automation, including a comfortable environment. Particularly, comfortable space is required all the day through the year in office buildings.
  This multi-split system air conditioner, SET-FREE FSNM(E) can meet these requirements. The proven combination of the scroll compressor and the inverter provides the best air conditioning for small/medium office buildings.
- The SET FREE FSNM(E) series intregrates the compactness and lightness of a multi-split air conditioning system (with multiple indoor units) and the user-friendliness of the SET FREE series.

Advantatges of SET FREE FSNM(E) Series

- Provided in a compact body, but allows installation conditions comparable with those of a high-performance muti-split air conditioning system.
- The compact and light body facilitates delivery and installation.
- The adoption of a slim body improves flexibility in mounting, enabling installation in a small space or a formerly dead space.

Refrigerant

◆ Environmentally-friendly

- A comfortable air-conditioned environment is essential in buildings which are part of a comfortable urban space. Air conditioning systems for buildings are required to meet various needs such as “consideration for the global environment”, “lower energy consumption”, “lighter installation work”, and “smaller footprint”. Hitachi’s new multi-split air conditioning system for buildings, the SET FREE FSNM(E), can meet such needs on a high level. Based on cutting edge technologies, a rich portfolio, a diversity of options and comprehensive services that only Hitachi can provide, we will offer a comfortable air-conditioned environment in accordance with the characteristics and functions of the building. The concept of the Hitachi SET FREE FSNM(E) series is to provide buildings with high-quality, high-value-added air conditioning systems.
- They use R410A refrigerant.
  Hitachi units are environmentally-friendly because they use R410A refrigerant, while the RoHS and green dot regulations are applied in their assembly process, showing Hitachi to be highly aware and respectful of the environment.

  R410A is totally environmentally-friendly since it does not contain any substances that are harmful to the ozone layer, ODP (Ozone Depleting Product) = 0.
- Environmental Design
  Simply replacing the current air conditioner by the HITACHI SET FREE FSNM(E) series high efficiency model is an environmentally friendly approach, and can form an effective part of a CO_2 emission reduction program in buildings and factories.

HITACHI
Inspire the Next

1. Features and Benefits of SET FREE FSNM(E)

This chapter describes the features and benefits of the SET FREE FSNM(E) series outdoor unit. The system's flexibility and modularity offer you the complete solution for your air conditioning requirements.

Contents

☛ Choice benefits:

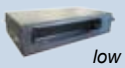
1.1. Choice benefits

1.1.1. Wide product range of units

The range of new FSNM(E) outdoor units includes 3 models, from 8 to 12 HP.

Outdoor units		Capacity (HP)		
		8	10	12
SET FREE FSNM(E)		●	●	●

The line-up of new SET FREE series indoor units has been extended up to 39 indoors units in 7 types to meet various building requirements (0.8HP to through 10HP)

	Indoor Units		Capacity (HP)									
			0.8	1.0	1.5	2	2.5	3	4	5	6	8	10
SYSTEM FREE	Duct	 *low*	●	●	●								
						●	●	●	●	●	●		
												●	●
	Duct for hotels		●	●	●								
	Cassette 4-way	 *mini*		●	●	●							
				●	●	●	●	●	●	●	●		
	Cassette 2-way			●	●	●	●	●	●	●			
	Wall			●	●	●	●	●	●				
	Ceiling					●	●	●	●	●	●		
	Floor With casing			●	●	●	●						
	Floor Without casing			●	●	●	●						

HITACHI
Indoor
System Free

NOTE:
If you connect the FSN2 with FSN1 units, you will lose the benefit of H-LINK II connection.

A Wide Range of Accessories

All the units have a large set of accessories that facilitate installation, operation and maintenance.

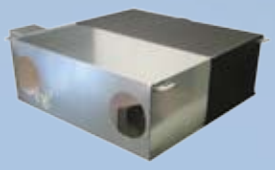
These accessories are designed to improve and adapt the unit to the type of installation the system needs, always keeping in mind the parameters of quality that the system requires.

These accessories are of type:

- Remote control switches
- Panels
- Filters
- Multikits

Wide Range of Complementary Systems

The complementary systems have been designed as elements attached to the installation. They improve its performance in terms of power consumption and the quality of the conditioned air.



KPI

Econofresh

◈ KPI

Energy recovery unit with two choice options, depending on the installation requirements:

- Heat recovery units, which recover the energy through the temperature.
- Energy recovery units, which recover the energy through the temperature and humidity.
- Wide range of capacities from 500m³/h to 3.000m³/h.

◈ Econofresh

Air renewal unit that also permits a saving in energy. Connected to the RPI-5.0FSN2E unit.
Allows different operating modes depending on the type of installation.

1.1.2. Complete Remote Control Range

HITACHI has three different remote control systems that can be used with DC INVERTER outdoor units.

- Individual control systems
- Centralized control systems
- Computer control systems

HITACHI also has interface equipment to integrate its machines in installations with intelligent control or BMS (Building Management System).

☛ Choice benefits:

PC-ART
Wall-mounted remote
control switch with timer

PC-LH3A
Wireless Remote
Control Switch

PC-ARH
Basic wired remote
control switch

PSC-A1T
Timer

◆ Individual Control Systems

◈ PC-ART

Remote control switch with timer:

- LCD display.
- 4 timer settings per week.
- Optional functions like locking, energy saving, and intelligent room temperature maintenance.
- Automatic testing to solve problems that provides information continually with an alarm code.
- Access to all function settings for the indoor units.
- Thermostat function available.
- Details of all settings are given on screen, facilitating system functionality checking.
- If there are problems with the power supply the backup functions keep the timer working.
- Indoor unit control groups (from 1 to 16 units in each group).

◈ PC-LH3A

A wireless remote control switch that removes the need for wiring and provides simple one-touch operation. Permits control of two or more units simultaneously.

◈ PC-ARH

Smaller remote control than conventional remote controls. Its main features are setting the unit's temperature and operating mode. It is ideal for facilities such as hotels due to its user-friendliness.

Two remote control switches or a group control (for a maximum of 16 units) can be used in a similar way to the standard remote control switch.

When a problem occurs, an alarm code immediately shows the details of the error.

There are also optional functions such as limiting the operating mode, limiting the maximum temperature in heating/cooling mode, selecting the fan speed, etc.

◈ PSC-A1T

Programmable timer used to set operating schedules for air conditioning systems.

Along with the PSC-A64S and PC-ART controllers, the air conditioners they control can be operated according to the schedule below:

- The timer can be set at 7-day intervals and operation/stop can be set three times a day.
- The remote control switch can be disabled during the OFF time (when used with PSC- A64S and PC-ART).
- Two types of weekly schedule (A and B) can be set and easily changed
  for summer and winter operation.
- Settings are all digitally displayed, allowing operations and settings to be easily checked.

The power failure backup function prevents the timer from stopping because of a power failure (even if it lasts for weeks).

☛ Choice benefits:

PSC-A64S
Central station

CSNET-WEB
Control System

TS001 web screen

PC-A-1I0

HC-A160SMS

Centralized Control Systems

PSC-A64S (central control)

- A group of up to 64 remote control switches can be connected to an H-LINK II to control up to 128 indoor units.
- Up to 8 PSC-A64S units can be connected to an H-LINK II.
- In addition to the basic functions, operation mode and temperature setting,
  it is possible to set the air flow or auto louver.
- When a problem occurs, an alarm code immediately shows the details of the error.
- A signal terminal to provide external inputs is supplied as standard which control the following functions:
- On/Off
- Emergency stop
- Central operation output
- Central alarm output

PSC-A16RS (central control)

- Up to 16 indoor units can be connected.
- User-friendly.

Computer Control Systems

CSNET-WEB (v3)

HITACHI has developed the CSNET WEB system enabling equipment to be controlled remotely from any point of the local corporate network, or even via
the Internet.

CSNET WEB can be connected to the H-LINK network from any point on the network using a non-polarity two-wire cable, facilitating the installation task to the maximum. 16 outdoor units and 128 indoor units can be controlled by each H-LINK.

CSNET WEB offers the following functions:

- Locking of the different setting points.
- Temperature selection.
- Cooling and heating mode selection.
- Fan speed selection.
- Monitoring of energy consumption percentage.
- Automatic cooling/heating mode.
- Annual timer.

TS001 Web screen

Hitachi has developed a 15" touchscreen, which by using the CSNET WEB and without the need for another computer, allows the air conditioning units to be controlled, monitored and managed.

This screen is very practical for surveillance centers.

PC-A-1IO

Allows non-HITACHI units (fans, air processing units, etc) to be incorporated in the H-LINK system. Therefore, specific parameters of these units can be monitored and controlled through the CSNET WEB.

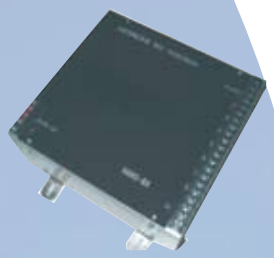
HARC I&O units can regulate up to 5 signals such as fan speed control, off, on, etc.

HC-A160SMS

SMS alarm warning device. The message contains the alarm and the unit to which it refers. This message can be sent up to 5 different numbers.

The message is repeated as a reminder until a response is sent.

☛ Choice benefits:



HARC BX

HARC MODBUS

HC-A64BNP

NOTE:
For more information on the remote control switches see the TC0050 technical catalogue.

◆ Building Management Systems

◈ HARC BX

Integration with installations with intelligent control (Building Management System)

Gateway interface with LON-WORKS BMS systems (installations with intelligent control or BMS). HARC-BX allows control of up to 5 setting points and remote monitoring of up to 9 values.
Connecting the HARC-BX to an H-LINK (communication line between machines) allows the use of up to 8 refrigerant cycles and control of up to 64 indoor units.

The HARC-BX can be connected to any point in the H-LINK system.

◈ HARC MODBUS

Integration with installations with intelligent control (Building Management System)

Gateway Interface to MOD BUS BMS systems.

The use of HARC MOD BUS allows the unit to be remotely controlled, as well as its parameters to be monitored.

Connecting the HARC MOD BUS to an H-LINK (communication line between machines) allows the use of up to 8 refrigerant cycles and control of up to 64 indoor units. A maximum of 8 HARC MOD BUS can be connected to the same H-LINK.

The HARC MOD BUS can be connected to any point in the H-LINK system.

The MOD BUS systems have the advantage that the MOD BUS protocol is an open system and therefore it allows this software to be used at no cost for the user.

◈ HC-A64BNP

Integration with installations with intelligent control (Building Management System)

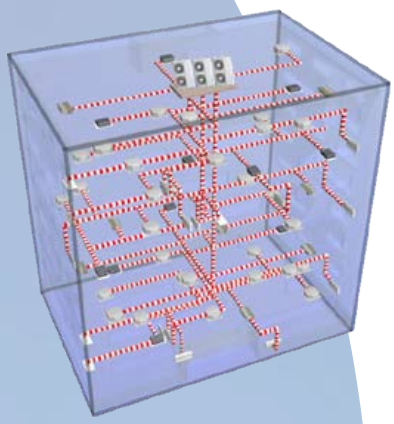
Gateway Interface to BAC NET BMS systems.

The use of HC-A64BNP allows the unit to be remotely controlled, and its parameters to be monitored.

Connecting the HC-A64BNP to an H-LINK (communication line between machines) allows the use of up to 8 refrigerant cycles and control of up to 64 indoor units. Up to eight HC-A64BNP can be connected to the same H-LINK.

The HC-A64BNP can be connected to any point in the H-LINK system.
The advantage of the HC-A64BNP systems is that the BAC NET protocol is an open system and therefore it allows this software to be used at no cost for the user.

☛ Choice benefits:



1.1.3. Flexibility of the system

- **Large variety of options in the standard commands**

  SET FREE units have a great number of standard commands. These options can be easily configured by means of any of the wide variety of HITACHI remote-control switches, or through the PCBs of the indoor and outdoor units. In this way the SET FREE system adapts to each installation.

- **Able to connect one outdoor unit with up to 10 indoor units**

  Utilizing an inverter control, a wide range of operation capacity control is also available. A maximum total combination horsepower of 130% and a minimum total combination horsepower of 50% can be chosen by combination of the indoor units when compared with the nominal outdoor unit capacity. Therefore, the new system can meet individual air conditioning requirements in most office buildings.

Outdoor unit model	Minimum capacity of connectable indoor unit	Maximum number of connectable only for 0.8 and 1.0 indoor units	Maximum number of connectable indoor units	Capacity range of combination
RAS-8FSNM(E)	0.8 HP (22kW)	8	10	50% to 130%
RAS-10FSNM(E)				
RAS-12FSNM(E)				50% to 110%

RAS-8~12FSNM(E)

1.1.4. Availability of Hi-Tool Kit selection software

Hi-Tool Kit is a tool that allows you to design installations and automatically generate all the information necessary to carry out the works. This information is:

- A table to select products.
- Refrigerant and electric diagram generated automatically according to the installation design.
- List of products necessary to carry out the installation.
- Start-up management.

A table to select products

Refrigerant layout

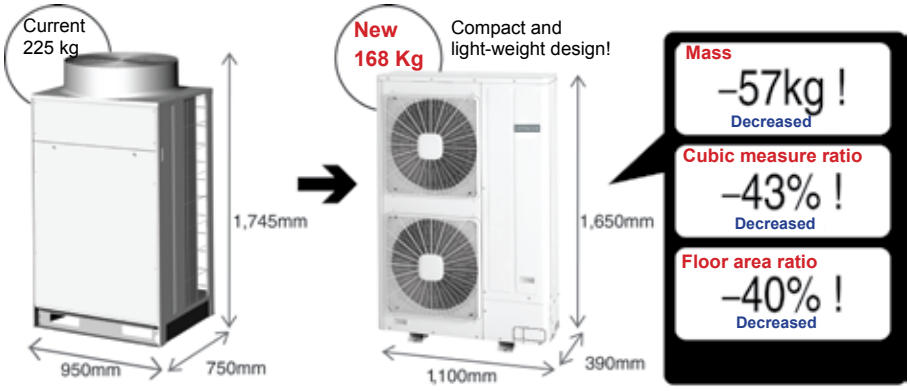
☛ Installation advantages:

1.2. Installation advantages

1.2.1. Top-class compact and light-weight design

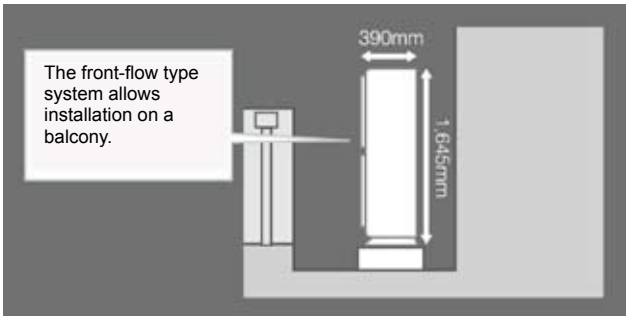
- The compact design greatly improves flexibility in installation.

  Facilitation and flexibility at installation are further advanced by adopting light-weight and compact design outdoor units compared to the current top-flow type unit (FSN1(E) Series).

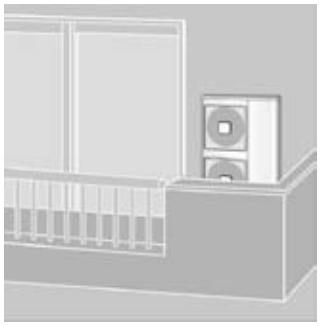


Top Flow type (28.0kW) Side Flow type (28.0kW)

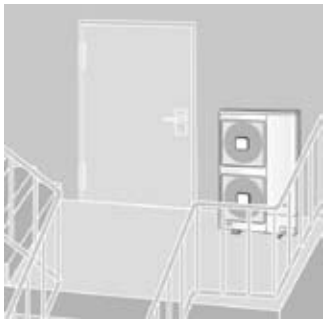
- With a width of only 390 mm, the SET FREE FSNM(E) can be installed on a staircase landing or balcony on each floor.



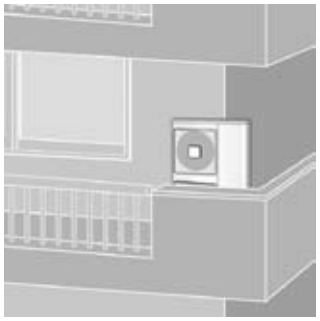
- Space saving installation, the front-flow type system allows installation under the eaves.



Balcony



Landing of outdoor staircase



Under balcony eaves

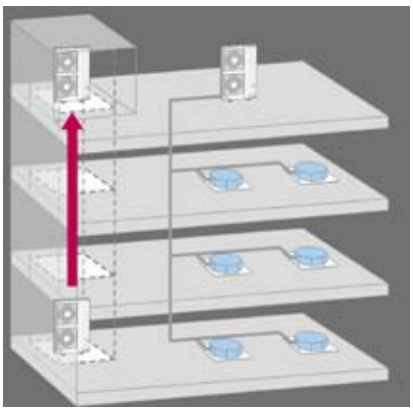
1.2.2. Greater convenience during delivery and installation

- With its light and compact body, the SET FREE FSNM(E) can be easily carried in the elevator even in a small urban site.
- No cranes required for delivery

☛ Installation advantages:

- The unit can be carried at one time. Elevators can be used for delivery

Light and compact body facilitates renewal



1.2.3. Expanded installation flexibility

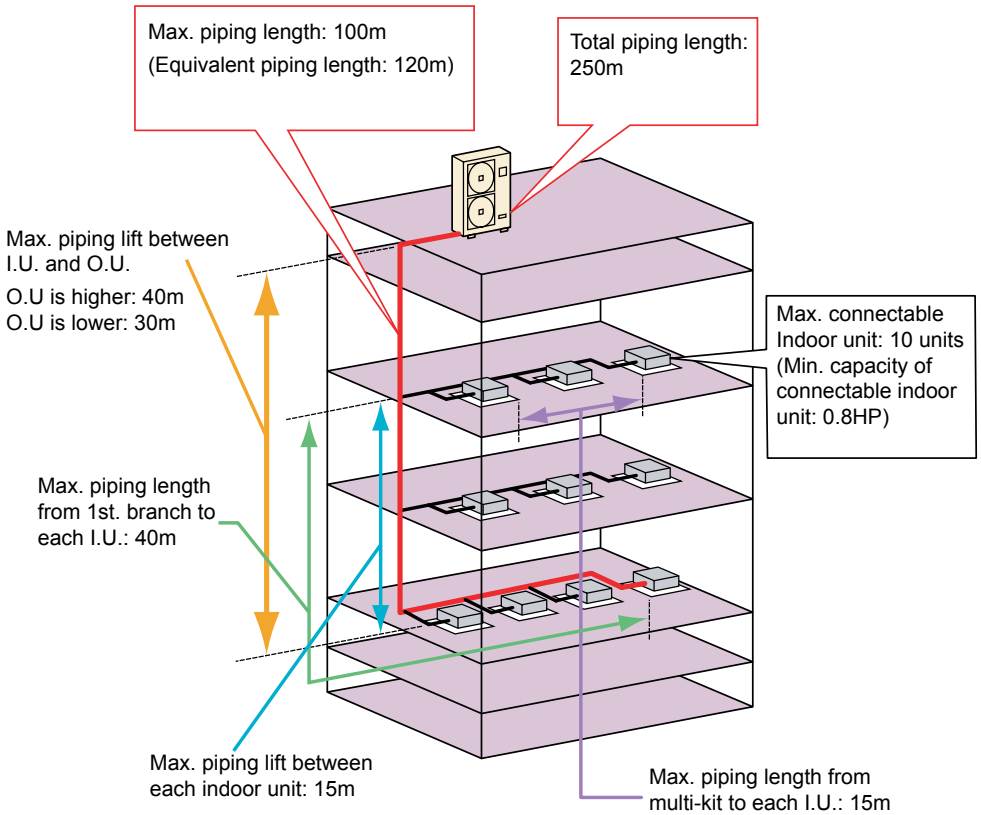
◆ **Flexible installation**

Flexible design and installation is available for this compact type unit comparable with the top-flow type unit (FSN1(E) Series).

- Maximum Connectable Number of Indoor Units : 10 Units
- Minimum Capacity of Connectable Indoor Unit: 0.8HP(*1)

  (Combined Capacity Ratio: 50-130% (RAS-8,10FSNM(E)), 50-110%(RAS-12FSNM(E)))

  (*1): If only the indoor units 0.8 or 1.0HP are connected, recommended maximum connectable number is 8.
  If more than 8, perception of cold draft may occur at the heating operation.
- Total Piping Length: 250m (Maximum Piping Length: 100m)



☛ Installation advantages:

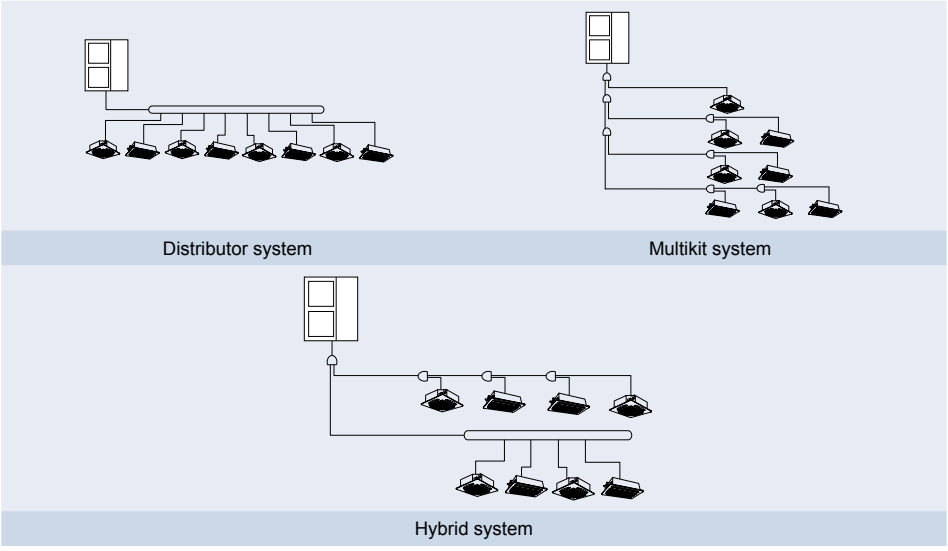
◆ Flexible installation. Multikits and distributors

Able to establish air conditioning systems for various requirements. In case of outdoor unit is installed higher than indoor units, maximum piping length is 100 meters and maximum lift between outdoor unit and indoor units is 40 meters.
If outdoor unit is installed lower than indoor unit, maximum lift between outdoor unit and indoor unit is 30 meters. A maximum lift between each indoor unit is 15 meters, which is almost equivalent to a 4 floor height.

Hitachi provides all the accessories required for mounting the piping system, such as multikits and distributors. Hybrid installations can be applied between multikits and distributors, which makes the installation more flexible and greatly simplifies the problems that using a rigid system can create.

☛ Examples for RAS-10FSNM(E):

Multikits and distributors example supplied by HITACHI:



NOTE:
For additional information concerning the multiple connection kits that Hitachi offers, refer to chapter 7.

◆ Multiple capacity control

To effectively operate the indoor units, the most appropriate refrigerant flow volume is controlled by the number of operating indoor units.

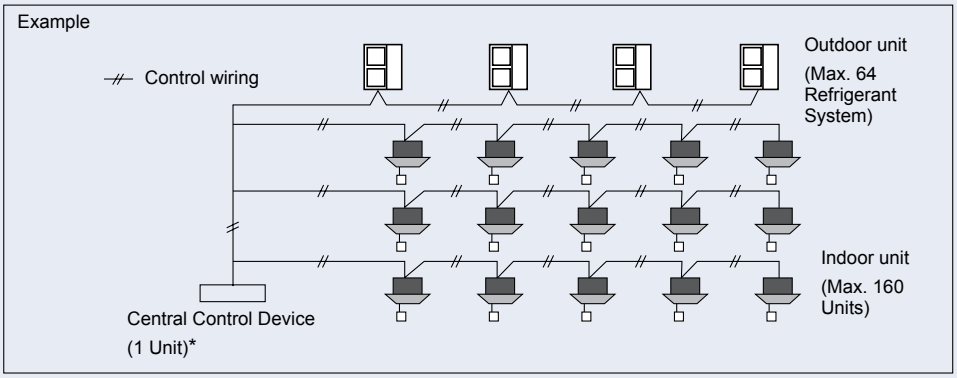
By sensing the air temperature difference between the inlet and outlet of the indoor unit, the electronic expansion opening is controlled to supply the most appropriate refrigerant flow volume. All units can be operated according to their separate operating conditions.

Due to the new control method, we are able to provide 15 meters (almost equal to a 4 floor height) lift between indoor units, resulting in flexible installation.

1.2.4. Easy and Flexible Electrical Installation

◆ Corresponding to H-LINK II System

This SET FREE FSNM(E) series outdoor units corresponds to the new H-LINK II transmission system improved from current H-LINK system. Maximum 64 refrigerant systems and maximum 160 indoor units are available to control by only one central control device when the equipments (central control device, indoor units, remote control switch) in the same transmission system are all corresponding to H-LINK II.



* The above example shows the case that central control device, indoor units and remote control switch are all corresponding to H-LINK II system

NOTES:
When using the H-LINK II system, DIP switches have to be adjusted. If the DIP switches are not set or set incorrectly, an alarm may occur due to transmission failure. Total wiring length for the remote control switch can be extended to up to 5,000 m. If total wiring length less than 30 m, it is possible to use the normal wiring (0.3 mm²).

The H-LINK II system provides maximum flexibility for system design; installation is easy, and total costs are reduced. Furthermore, it can be controlled centrally by connecting CSNET WEB to H-LINK II wiring located in the room next to the room where CSNET WEB is installed.

You can also control of installation by means of the Internet via CSNET WEB

◆ Compare with H-LINK System

Item	H-LINK	H-LINK II
Number of Max. Ref. Group / System	16	64
Address Setting Range of Indoor Units / Ref. Group	0 to 15	0 to 63
Number of Max. Indoor Unit / System	128	160
Total Devices Q'ty in the same H-LINK	145	200
Max. Wiring Length	Total 1,000m (5,000m*)	

*: In case four units of PSC-5HR is used.

◆ The Mixture of H-LINK and H-LINK II

H-LINK II corresponding models can be mixed with H-LINK corresponding models in the same system without any adaptor.

Control System Device	Outdoor Unit Indoor Unit	One H-LINKII System	
		Outdoor Unit (Number of Ref. Group)	Indoor Unit
H-LINK II	H-LINK II	64	160
	H-LINK II / H-LINK Mixed	64 *1)	128
H-LINK	H-LINK II	16	128
	H-LINK II / H-LINK Mixed	16	128

*1) The maximum 16 refrigerant groups are available in one H-LINK system under the following conditions.

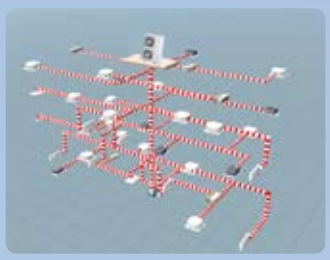
* The outdoor unit corresponding to H-LINK

* The outdoor unit corresponding to H-LINK II connected with the indoor unit corresponding to H-LINK.

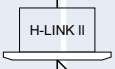
More than 17 indoor units are available to connect with one outdoor unit depending on the outdoor unit capacity. In that case, two refrigerant groups are required for one outdoor unit.

*2) Refer to the next page for the control function when usage models are H-LINK II mixed with H-LINK.

☛ Installation advantages:



Connections layout

System Configuration	Outdoor Unit: H-LINK Indoor Unit: H-LINK II and H-LINK Remote Control Switch: H-LINK II and H-LINK			Outdoor Unit: H-LINK II Indoor Unit: H-LINK II and H-LINK Remote Control Switch: H-LINK II and H-LINK			Outdoor Unit: H-LINK II Indoor Unit: H-LINK II Remote Control Switch: H-LINK II and H-LINK	
Outdoor Unit								
Indoor Unit								
Remote Control Switch								
Setting Range of Refrigerant Group *1)	0 to 15			0 to 15			0 to 15	
Setting Range of Address *1)	0 to 15	0 to 15	0 to 15	0 to 15	0 to 15	0 to 63	0 to 15	0 to 15
Crossoverless of Remote Control Wiring *2)	X	X	X	X	X	X	X	X
Automatic Reset of Setting Temperature *4)	X	●	●	X	●	●	●	X
Operation Lock *4)	X	●	●	X	●	●	●	X
Limitation of Setting Temperature Range *5)	X	●	●	X	●	●	●	X
ON / OFF Timer Setting (72Hr.) *4)	X	●	●	X	●	●	●	X
Elevating Panel Position Setting *4)	X	X	●	X	X	●	X	X
Different Operation Mode Indication *5)	X	X	●	X	X	●	X	X
Indoor Unit Hot-Start Indication *5)	X	X	●	X	X	●	X	X
Change of Indoor Unit Ref. Group No. and Address *4)	X	X	●	X	X	●	X	X
Outdoor Unit Comp. Pre-heating Indication / Cancel *4)	X	X	X	X	X	●	X	X
Indoor Temperature Control for Energy Saving *3)	X	X	X	X	X	●	X	X
Emergency Operation from Remote Control Switch *6)	X	X	X	X	X	●	X	X

*1) The range of ref. group setting and address setting is 0 to 15 when H-LINK corresponding central controller is used.
*2) Only for Inverter UTOPIA type at indoor unit simultaneous operation.
*3) Only for Inverter UTOPIA type.
*4) These functions can be set by wired remote control switch (PC-ART) only.
*5) These functions can be set by wired remote control switch (PC-ART) and half size remote control switch (PC-ARH) only.
*6) This function is not available depending on the outdoor unit type.

1.2.5. Easy and Flexible Control Connection (Central Station, Interficie BMS, CSNET WEB)

◆ **No Polarity**

Thanks to the absence of polarity, any centralized control can be connected directly to the H-LINK II bus, which means that special lines are not needed.

◆ **Auto-Configuration**

Aside from the customized configuration, the control systems are also auto-configurable; for example, they have the capacity of interpreting the type of machine they are connected to, and detecting the type of indoor unit or its power.

☛ Start-up benefits:

1.3. Start-up Benefits

1.3.1. Automatic Start-up Test

◆ Test Run

The automatic test run can be activated through outdoor unit DIP switch or indoor unit remote control switch. The outdoor unit 7-segment display gives all the necessary information to verify the correct operation of the system.

- Connected Outdoor Units Identification system:
  Using a remote control switch, you can confirm what series the operational outdoor units belong to (e.g. single or multiple).
- Automatic identification of each indoor unit.
  They can also be manually assigned using the unit's DIP rotating switch.

◆ Test Run from the Remote Control Switch

Using the remote control, 3 operations can be run.

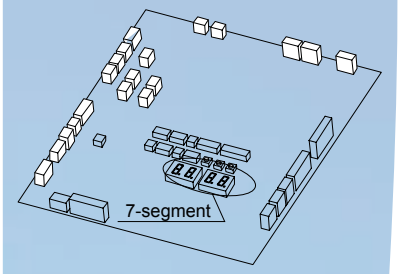
- Auto-diagnostic:
  Quick check of the operating conditions of the indoor units and the outdoor unit.
- Data memory query:
  If an abnormality occurs, the LCD remote control switch shows an alarm code and save all the operation settings of the unit at the time the fault occurs, so that a quick diagnosis can be made of the installation.
- Optional Function Setting:
  The remote control switch allows cancellation of the 4-degree offset in the heating mode and an increase in the fan speed setting, among 29 possible options.
  This way, multiple indoor units can be set at the same time. Also, the configuration can easily be changed, even after the installation has been completed.

Test run from the remote control switch (PC-ART)

◆ Test Run Procedure from the Outdoor Unit:

The outdoor unit PCB is equipped with a 7-segment screen, which depending on the position of the PSWs shows the following parameters in sequence

- Outdoor air temperature
- Discharge gas temperature
- Evaporation temperature in heating mode
- Condensing temperature
- Discharge pressure
- Compressor run time
- Suction pressure



This allows quick and accurate diagnosis of the installation during normal operation or test run.

1.3.2. Service check

◆ Hitachi Service Tools

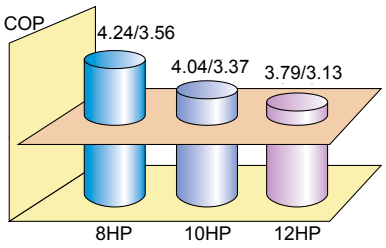
Hitachi also has a powerful IT tool, Hitachi Service Tools. This software can be run from any lap-top computer through an interface connected to the H-LINK II bus, and it can collect several parameters that have an influence on the unit's performance. These parameters can also be monitored in different formats, allowing incidents during start-up to be located quickly.

☛ Functional benefits:

1.4. Functional Benefits

1.4.1. Energy saving

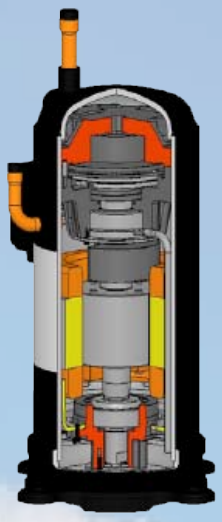
Industry-leading COP and high-efficiency operation have been realized. Significant cost redution in annual electricity charges is available thanks to greatly improved efficiency operation.

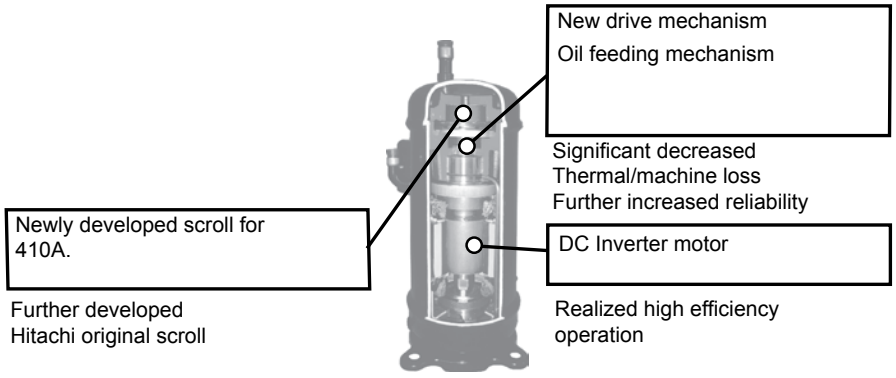


The industry-leading COP is achieved by adopting the following new technologies:

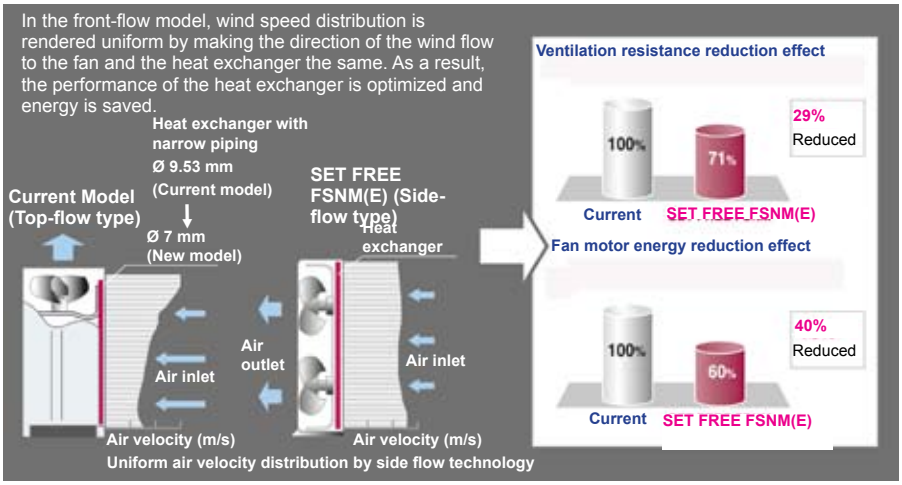
◆ **High efficiency DC Inverter compressor**

- Energy saving by DC Inverter and new drive mechanism
- 50% weight reduction by compact design



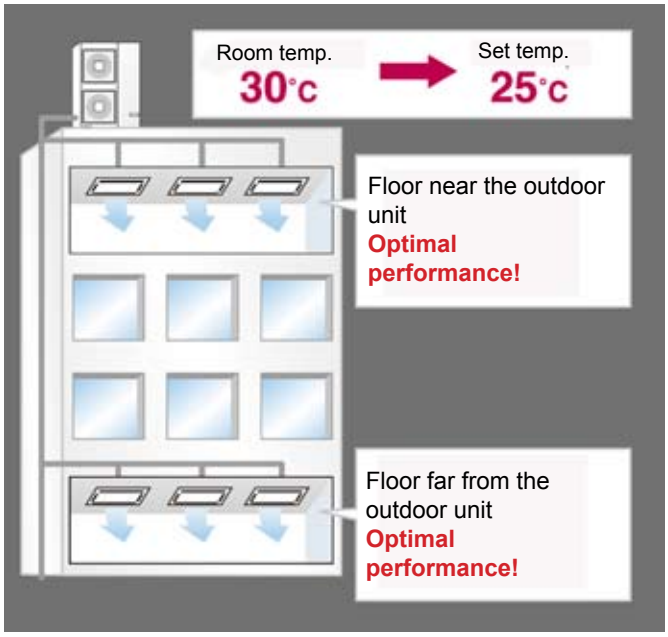


◆ **Energy-saving by side flow technology and new type heat exchanger.**



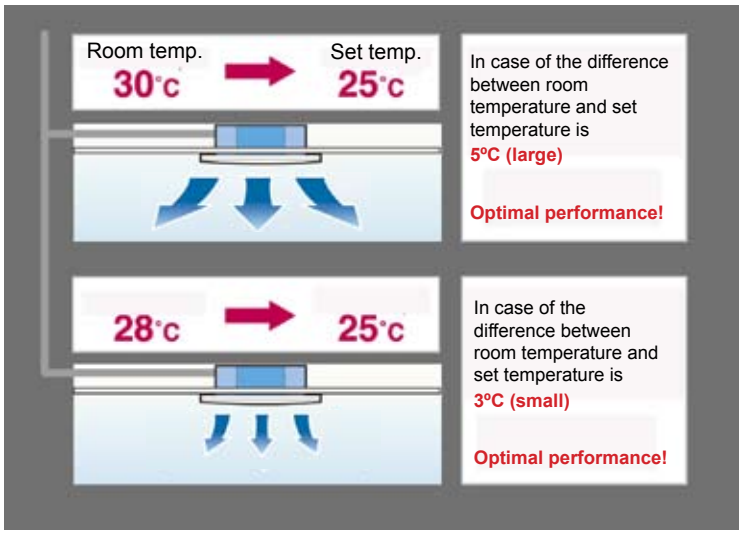
◆ Smart balance control

The performance is the same regardless of the length of the refrigerant pipe.



Quickly senses air temperature difference to demonstrate proper performance.

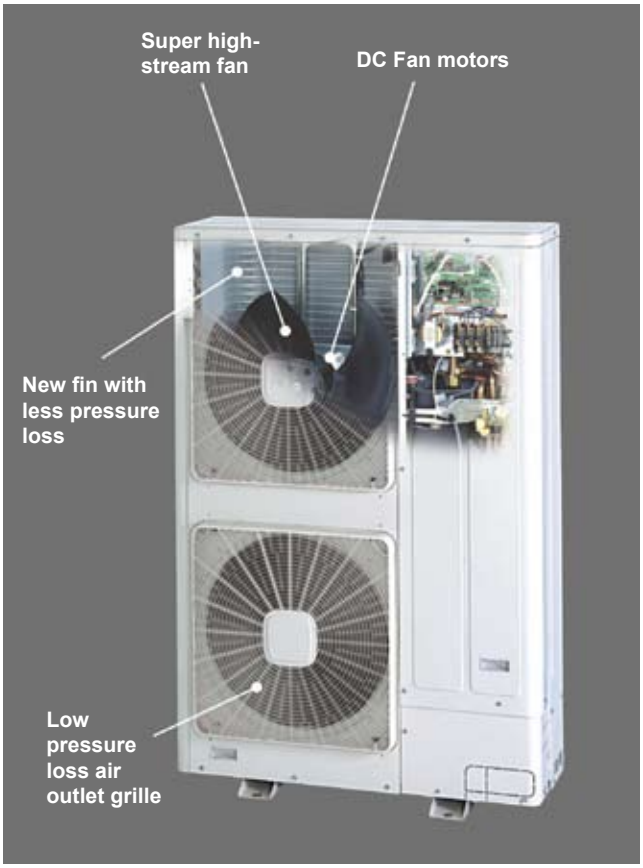
Energy-saving operation without loss realized.



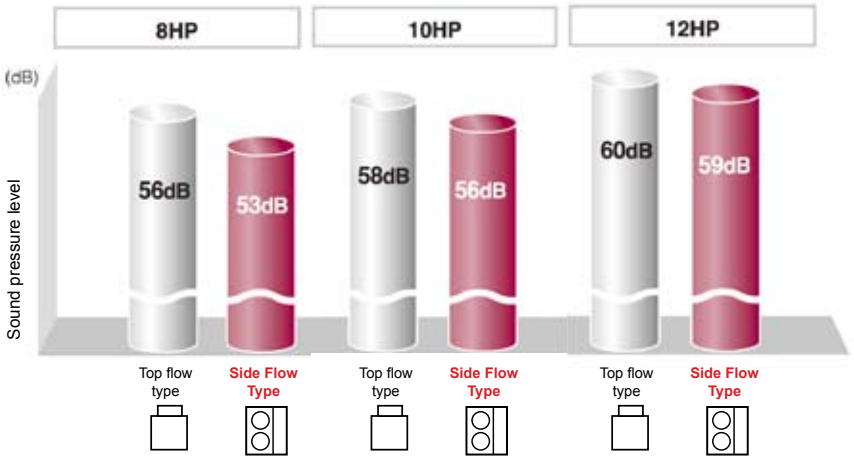
☛ Functional benefits:

1.4.2. Low noise technologies

DC Fan motor, super high-stream fan, low pressure loss fan guard. The industry-leading low noise outdoor unit is realized by adopting the new model fin with low pressure loss.



– Comparison of noise with current model (at cooling operation)

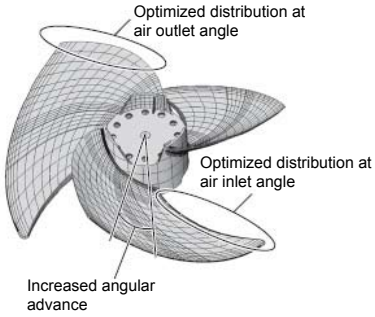


DC fan motor

The smooth rotating fan motor with low vibration reduces the noise generation.

Super high-stream fan

Super high-stream fan of Ø544 mm cuts down the noise.

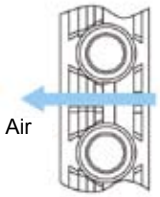


Low pressure loss air outlet grille

The rib structure synchronized with rotation flow from the fan reduces the air resistance at the air outlet grille.

New fin with low pressure loss

The draft resistance is reduced by 20%. Both high-efficiency and low noise operation are simultaneously satisfied.



Lower sound operation during night time

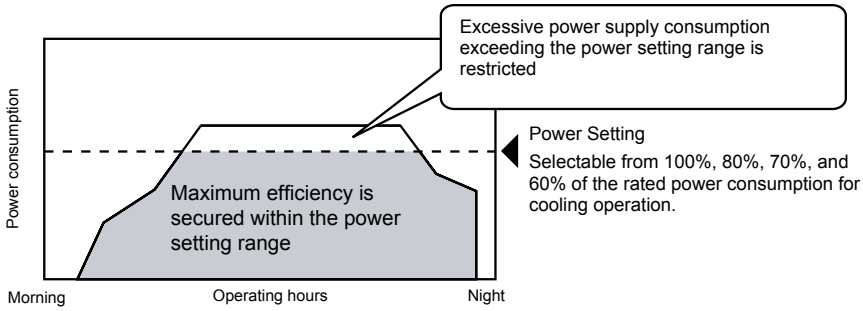
Through computer simulation of fluid turbulence which is the main source of unwanted noise, and by visual observation of fluid flow, operation sound has been thoroughly analyzed.
By improvement of the cabinet structure and fan shape, and by the adoption of a new material and inverter, operation sound has been reduced.
Friendly to people and the environment alike, a low sound operation design has been obtained.

☛ Functional benefits:

1.4.3. New functions

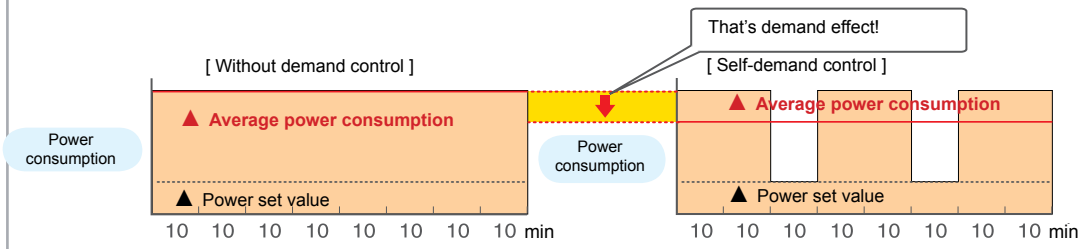
◆ **Self-Demand Control**

A newly developed self-demand function has largely improved energy-saving effects. Since the current is self-detected and demand control performed automatically, no signal wiring work is required. Conventional demand control using demand signals is also available, and you can select various operations as required.



◆ **Wave-mode**

Wave mode equipped to turn demand control ON and OFF alternately at intervals of about 20 min. or 10 min. While power is saved without fail, temperature changes are also minimized to maintain a comfortable room temperature.



◆ **Protection for cold draft at cooling operation**

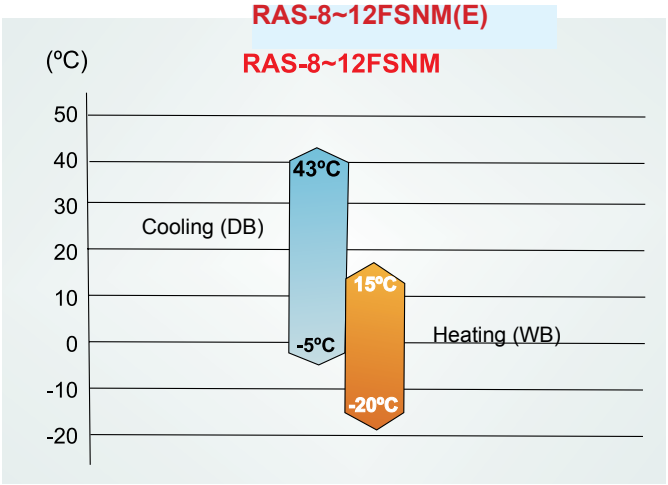
This function is to protect the cold draft while cooling operation at intermediate season or low temperature. This function provides comfortable air conditioning.

1.4.4. Temperature Range

◆ **Wide working range**

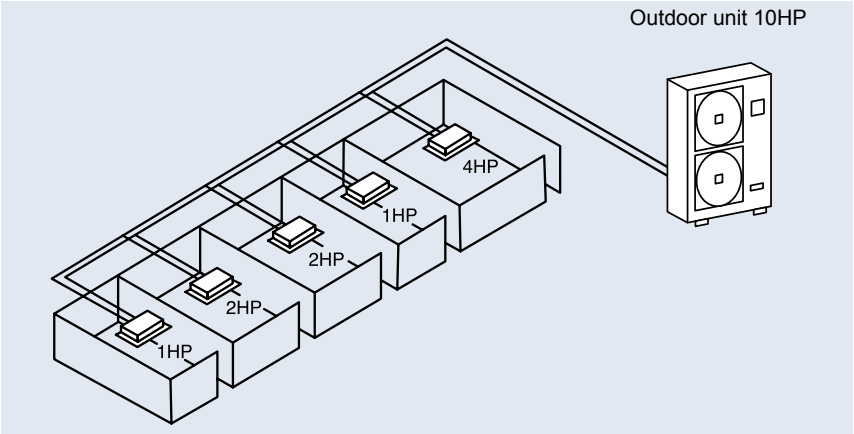
SET FREE FSNM(E) can handle a wide range of outside air conditions, this extending the flexibility of installation space and climatic environment.

The optimized refrigerant cycle makes it possible to work with temperatures of up to -5 ºC in cooling mode.



◆ **Precise control with the wide range inverter**

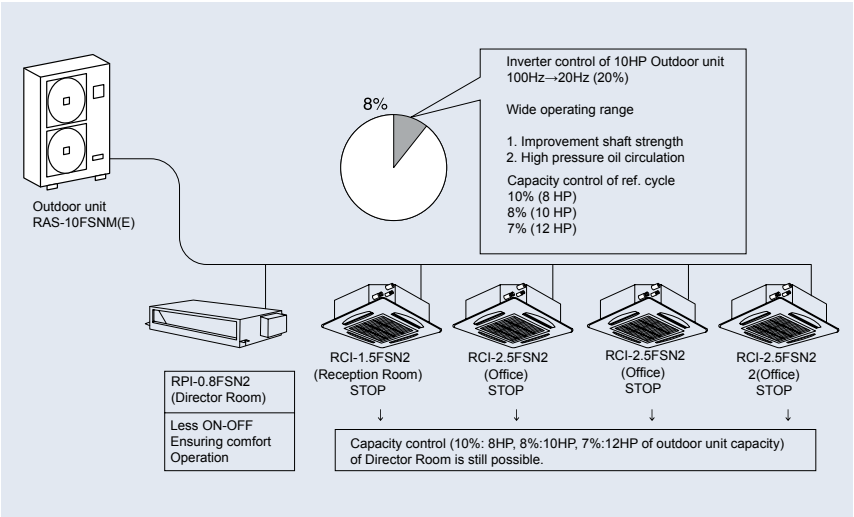
The compressor speed for FSNM(E) series outdoor unit is controlled within a wide range of from 20Hz to 100Hz. Therefore, smooth operation is available without frequently using the ON/OFF control. This new wide range capacity control can meet not only the needs of a wide space but also a small space such as guest rooms and management rooms. Defrosting operation can be quickly performed because of a high compressor speed.



1.4.5. Electronic capacity control

The capacity of the 8 to 12HP outdoor unit is continuously controlled by the inverter from 20% to 100%. This wide working range has been obtained by the improvement of shaft strength and high pressure oil circulation in the scroll compressor. Therefore, an air conditioning system where heat load is greatly changed through the day is easily catered for.

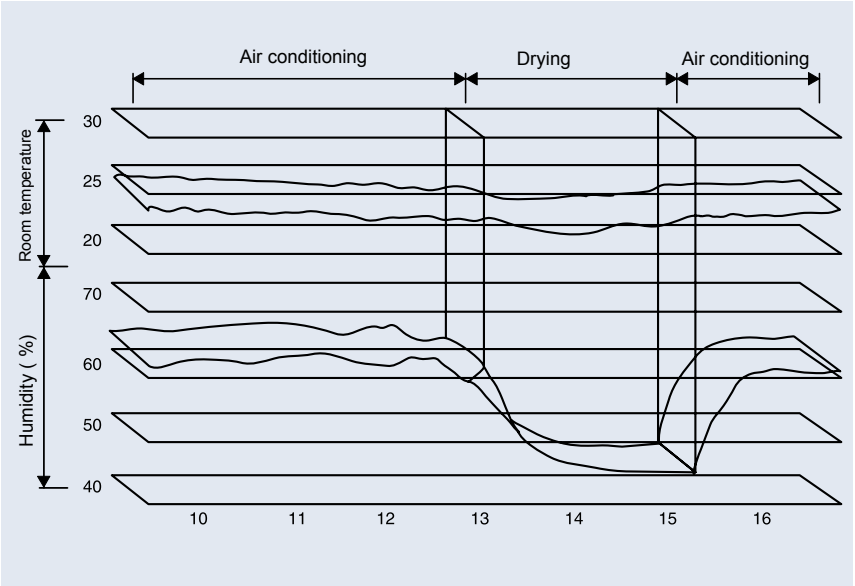
Also, the capacity of each indoor unit is controlled by detecting the inlet and outlet temperatures using an electronic expansion valve. Therefore even a small room down to a 0.8HP indoor unit can be air conditioned without unwanted ON/OFF operation, resulting in comfortable air conditioning.



- Individual operation at minimum 0.8 HP indoor unit:
  The electronic expansion valves installed not only in the outdoor unit, but also in each indoor unit, control the refrigerant flow.

☛ Functional benefits:

- Drying operation control:
  This system combining the inverter speed control with indoor air volume control performs efficient dehumidification with negligible change in room temperature.



1.5. Maintenance benefits

- Minimum maintenance

  Faithful to Hitachi's usual philosophy, SET FREE units have been designed to guarantee great reliability and robustness in order to reduce maintenance operations to a minimum.

- Easy access

  It is easy to access all components of the SET FREE systems. You can access all the components of the unit to carry out necessary tasks via a simple cover

  The whole system is designed to facilitate and simplify maintenance.

- Alarm information in the remote control switch through the PCB

  Alarm signals can be received through the remote control switches (whether individual or centralized), the CSNET WEB software, or via the electric plate of the outdoor unit, thus facilitating maintenance work.

- Alarm codes

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

- SMS Alarm

  The alarm signals can also be received through a simple SMS specifying the cycle affected and the alarm code, allowing incidents to be detected and solved more quickly.

Alarm reception via remote control switch

Alarm reception trough an SMS

CSNET WEB as maintenance tool

1.5.1. Availability of maintenance tools

All the functions of the Hitachi Service Tools for setup are applicable to unit maintenance, both preventive and corrective, so that any problem can be detected and solved immediately.

CSNET WEB is also useful for maintenance tasks.

1.6. Main features of the units

1.6.1. Reduced total outdoor unit capacity

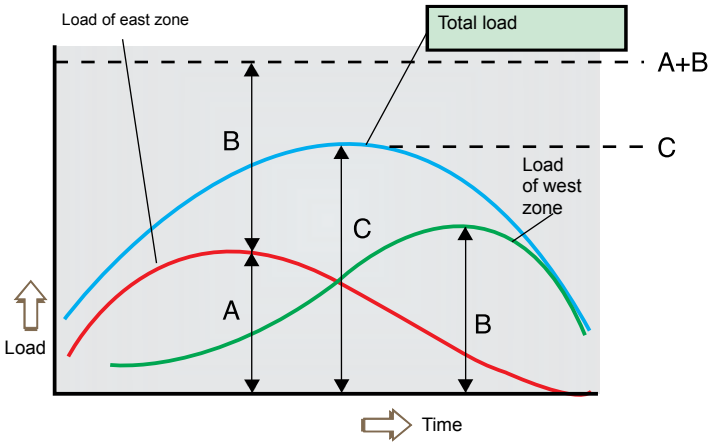
The SET FREE FSNM(E) system enable the outdoor unit to be up to 30% smaller capacity when compared with the current split air conditioning systems. The diagram shows a typical building with a morning peak heat load on the east zone equivalent to a 6HP unit.

In the afternoon a peak occurs on the west zone equivalent to a 7HP unit.

Therefore, a conventional system would require total installed plant of 6HP + 7HP = 13HP. The maximum simultaneous load on the whole building occurs at noon and is equal to 10HP of unit capacity. A SET FREE FSNM(E) system of 10HP can therefore be selected, and this capacity can be directed either to the east or west zone as dictated by the system controls.

$$\text{Saving in installed plant} = \frac{13-10}{13} \times 100 = \textbf{23\%!!!}$$

◈ **Exemple of Air conditioning for building**



- Current type: Selection by total capacity of each maximum load (A+B)

- SET FREE: Selection by total load which occurs simultaneously

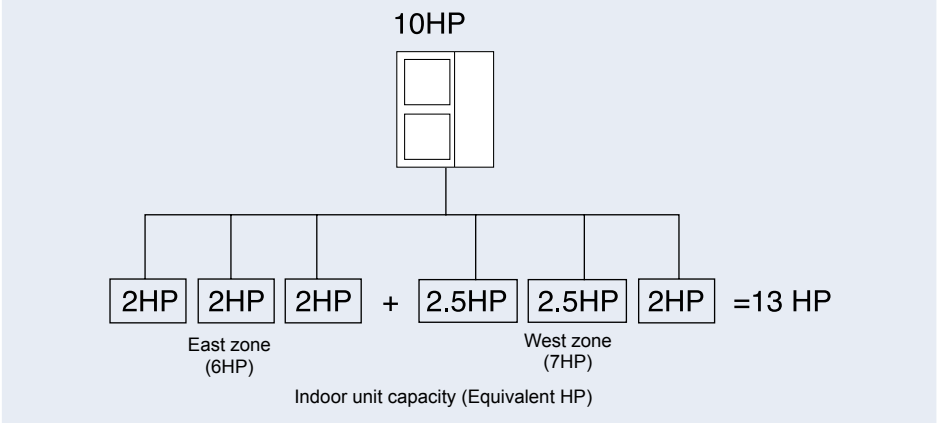
A+B:C = 1 : 0.80 to 0.85

Since partial operation is obtained due to plural indoor unit, the outdoor unit capacity can be selected according to the total load of a building in a day.

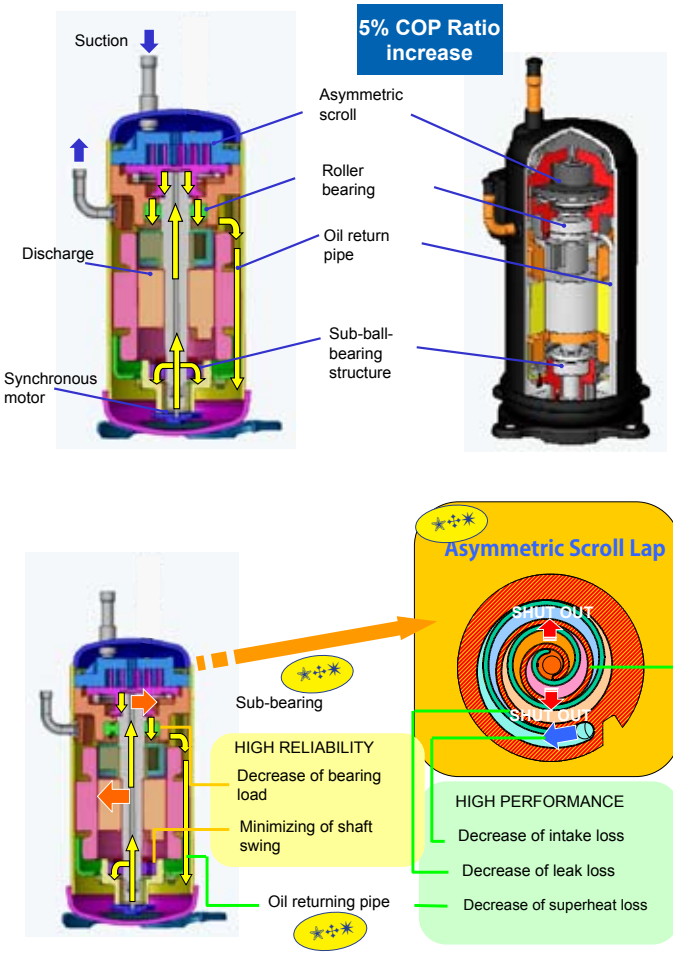
◈ **SET FREE**

Supplies refrigerant according to the load of each room.

$$\text{Load divsersity} = \frac{10}{13} = \textbf{0.77}$$



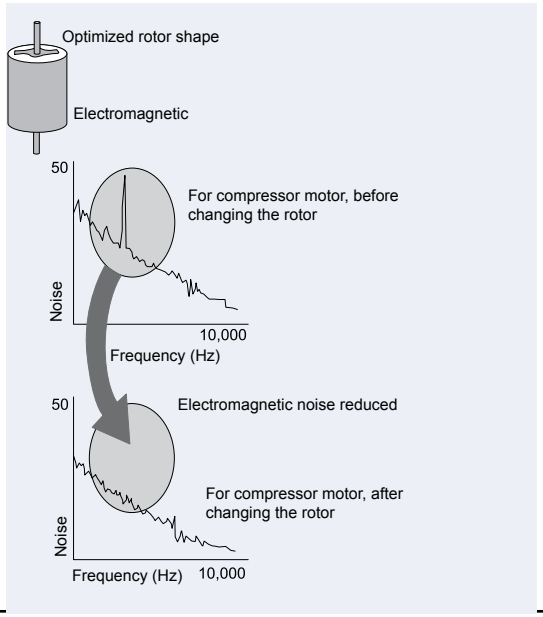
1.6.2. High-efficiency DC Inverter Compressor



◆ **Low noise level**

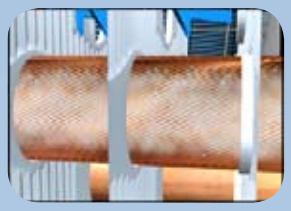
- Noise and vibration

1. The scroll compressor offers low sound and vibration levels because the compression points are spread evenly over the compression stroke, resulting in a very flat torque curve.
2. The minimal number of components used coupled with a high-pressure shell that acts as a silencer further enhances the noise reduction.
3. Because the noise pattern is high-frequency sound it is simple to reduce it to a very low level by using an insulation jacket.
4. Reducing electromagnetic compressor noise.



- Protection against liquid return

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

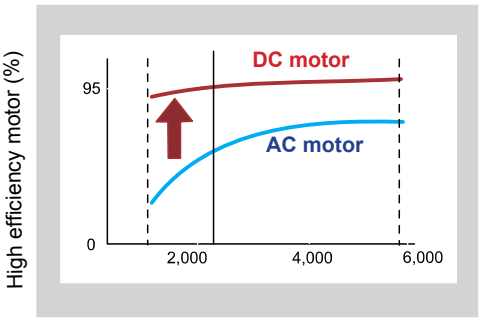


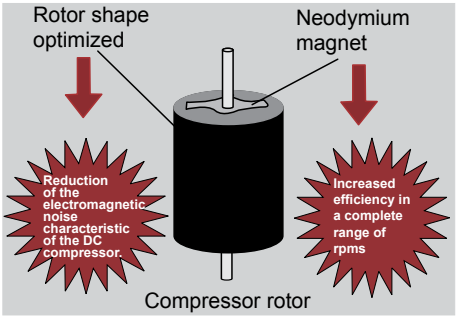
◆ Efficiency

- DC Compressor using Neodymium Magnet.

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

There have been significant improvements in low-speed features, which affect the annual running cost.

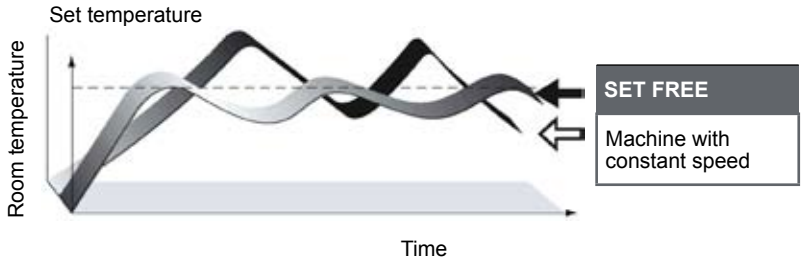




◆ Inverter control

The inverter controls compressor speeds from 30 Hz to 115 Hz, quickly reaching the set temperature and maintaining a stable energy-saving operation, thus reducing the noise since the compressor is not running continuously.

Diagram of operation (in heating mode):

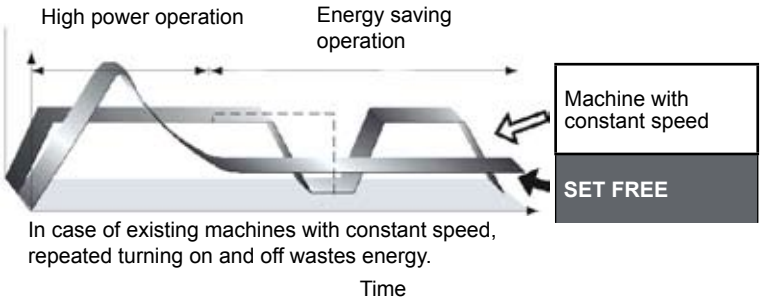


- In the case of Set-Free

Quickly reaches set temperature with high power, then maintains stable energy-saving operation.

- In the case of other constant speed machines:

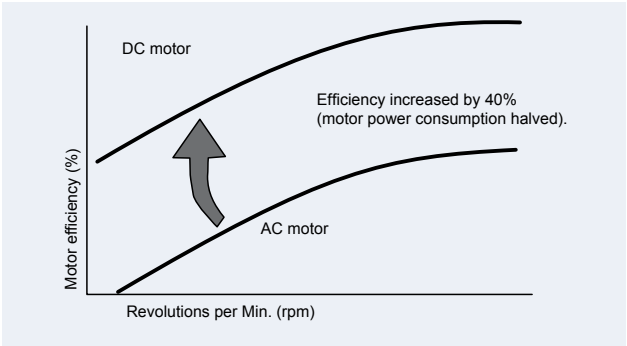
Slowly reaches the set temperature, then turns on and off repeatedly to maintain the temperature, causing uneconomical operation and “power waste”



1.6.3 Enhanced fan motor features for FSNM(E) Series

◆ **DC fan motor with outstanding efficiency**

The DC fan motor greatly improves efficiency compared to conventional products with AC motors. In addition, air blasts are reduced by controlling the rotation speed of the fan. Stable operation is provided against strong head winds of approximately 10m/s on the front face of the outdoor unit.



- PWM (pulse width modulation) concept of speed control

The switching element (a power MOSFET) switches back and forth at a frequency of several tens of kHz. This controls the ON/OFF duty rate per cycle and changes the voltage applied to the fan motor to control the rotation speed.

- New fan propeller

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

◆ **Large variety of operating possibilities**

The use of these machines together with CSNET WEB can increase the performance of these installations even more by the following:

- With a program that avoids continuous functioning in rooms without users and allows heating and cooling just before rooms are occupied.
- Limiting the set temperatures, which means that machines do not work at maximum capacity when comfort does not require it.
- Locking functions from the central control, thus avoiding incorrect or ineffective use of the units.
- All these and many more functions mean that the use of the installation as a whole can be optimized.
- And it is worth remembering that because of the wide range of indoor units you can always find the unit with the power and type of installation that best suits your needs.

☛ Main features of the units:

1.6.4. Complementary Systems

◆ **Fan Units with Energy Recovery, KPI**

– What is a KPI

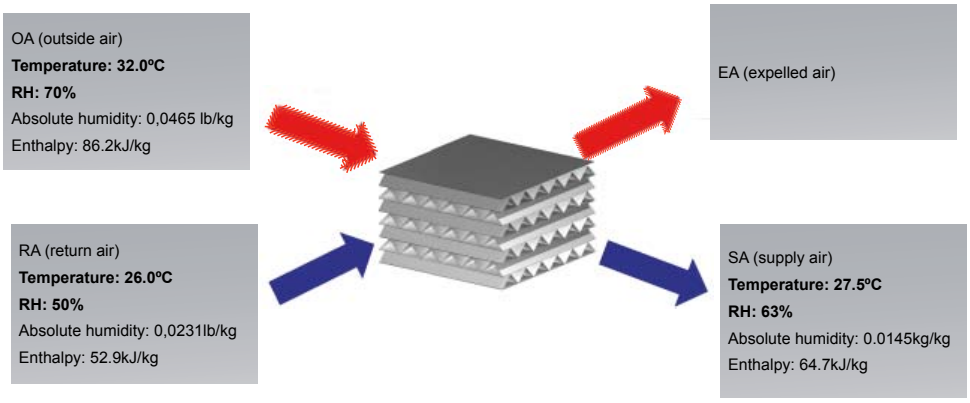
A KPI is a ventilation unit designed to renew the air from a room or area taking out the exhaust air and supplying fresh outdoor air. To reduce the effect of supplying outdoor air in a conditioned room with a big temperature gap between them, the KPI exchange temperature and humidity between both streams, which will make that the outdoor air had a temperature and humidity levels more similar to indoor conditions. The air treatment over outdoor fresh air before supplying leads to a reduction of the air conditioner system load requirement.

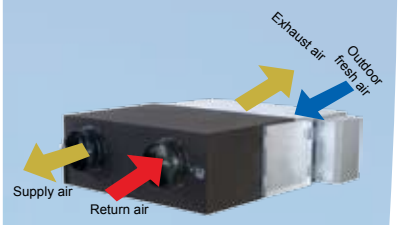
The part responsible of the exchange between both streams is the heat exchanger. The heat exchanger is a cross-flow sheet made of ultra-thin celluloid material that allows an energy exchange by crossing both streams without mixing.

The main benefit of a KPI unit versus other ventilation systems is the possibility to income outdoor air already processed to reduce its temperature and humidity differences with indoor conditions. This treatment reduces the air conditioner system load, which could mean a reduction up to 20% in the whole system power input.

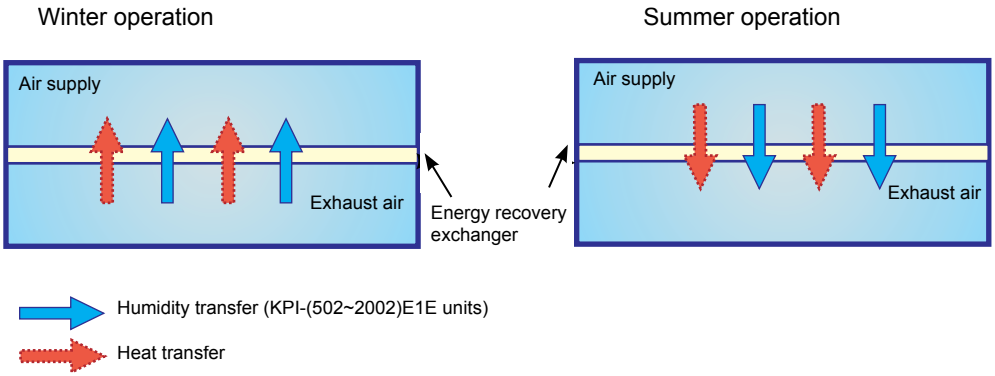
– High efficiency heat exchanger

The heat exchanger is a combination of celluloid ultra-thin plates of 46 µm. Between each plate there are fins of the same material that prevent of mixing both streams. The result is a cross flow of incoming and outcoming streams.





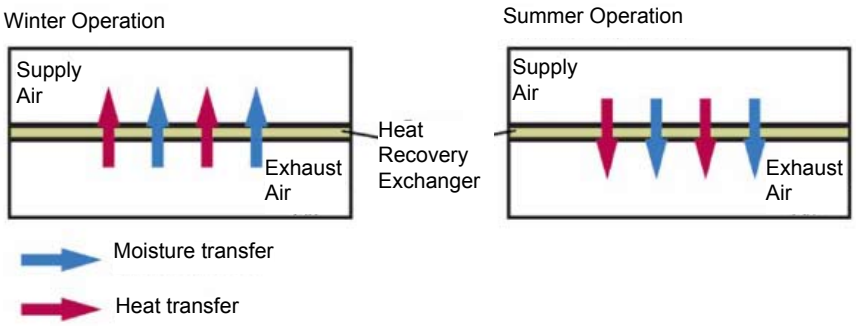
Being separated by the celluloid material, there is an enthalpy exchange between both streams by convection, always from the one with higher level, approaching the fresh air to indoor conditions.



☛ Main features of the units:

KPI units from 500 m³/h to 2000 m³/h have been designed considering the possibility of using them also with an aluminium heat exchanger instead of the factory supplied one in order to fulfil any installation requirement. On the other hand, the biggest unit of 3000 m³/h air flow has been designed only for using it with an aluminium heat exchanger.

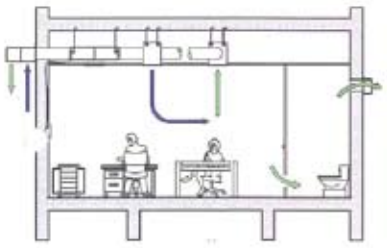
The aluminium heat exchanger principle is the same than for celluloid heat exchangers, but by changing the material the exchange of humidity is not performed, so only the temperature will be exchanged.



The fact of not exchanging humidity and the different properties of aluminium makes that the efficiency of the unit decreases in case of using the aluminium heat exchanger.

– Overload option

If the area to ventilate is a room with different uses depending the zone (dinner areas besides kitchens, rooms next to wet rooms,…) the KPI units can be set to perform an overload on the supplied air that avoids the flow of polluted air or smells.



By setting the remote controller the user could increase one tap the speed of the supplied air fan versus the exhausted air fan. The result is a higher supplying air flow versus the exhausted flow increasing the pressure of the room. This option could be also used in installations where additional extraction systems must be installed to fulfil local regulations. The increased supplied air flow would be able to balance the effect of these extraction systems looking for the best comfort conditions.

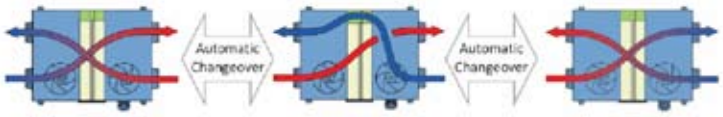
– Operation modes

The units from 500 m³/h to 2000 m³/h have two different operation modes: heat exchange mode and bypass mode.

- If the unit is set in heat exchange mode both streams will cross the heat exchanger element. All features of the unit are performed obtaining the maximum efficiency.
- In case of having an outdoor temperature very close to set indoor temperature, it could be better to avoid the exchange between both streams. For this situation, KPI units have a dumper in exhausted stream that bypasses the heat exchanger element. The outdoor air is then supplied directly from outside.

For choosing between the two operation modes there are three options:

- Automatic mode: Depending indoor and outdoor air sensed temperature and set indoor temperature, it is the control itself that decides which mode is the most appropriate one.



☛ Main features of the units:

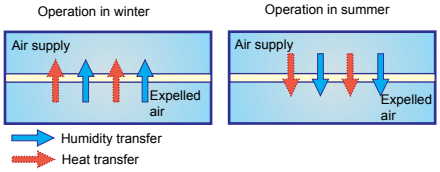
- Forced exchange mode: The dumper is always closed with no incidence of indoor and outdoor air temperatures.
- Free ventilation mode: The dumper will be always open, so the outdoor air will be introduced directly into the room at any temperature it could be.

– Main features of KPI design

- Range of units

A large range of units are available from 500 m³/h to 3000 m³/h nominal air flows.

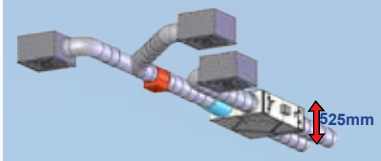
Model	Flow (m³/h)	Temperature Exchange Efficiency
KPI-502E1E	500	75
KPI-802E1E	800	75
KPI-1002E1E	1,000	78
KPI-1502E1E	1,500	78
KPI-2002E1E	2,000	78



• KPI models with heat recovery:

Model	Flow (m³/h)	Temperature Exchange Efficiency
KPI-3002H1E	3,000	54

– Installation



KPI units are very easy to install. It is only necessary the installation of the unit itself in the false ceiling or wherever considered and the installation of the air ducts. As this unit don't have any evaporator no piping work is required except for the drain connection (on the bottom of the unit).

Integrated in a system, the KPI could be connected to charge/discharge grilles or to indoor units available to work with outdoor air.

– Operation flexibility

KPI units have been designed looking for the highest operation flexibility:

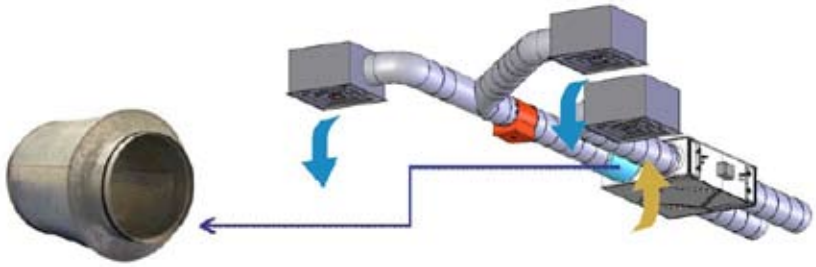
- Possibility to change the celluloid heat exchanger by aluminium heat exchanger when it is necessary to avoid the humidity transfer or when the heat exchanger servicing must be reduced for any reason.
- There are three speeds selectable from the remote controller: high, medium and low. In units from 500 m³/h to 1500 m³/h there is also available an extra-high speed for installations where a higher pressure is required.
- Three operation modes: automatic mode, forced heat exchange and free ventilation mode.

NOTE:
When the indoor unit air is supplied from a KPI unit the working range of the indoor unit should be considered.

☛ Main features
of the units:

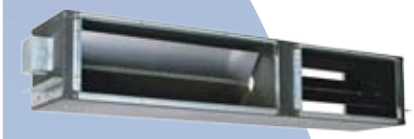
- Servicing:
  All the parts subjected to servicing are completely accessible from outside the unit, with no necessity to uninstall it. The fan motors are accessible from the bottom of the unit, and the heat exchanger and air filter are accessible from one side of the unit, both of them by the same service cover. E-box is just next to heat exchanger/ air filters service cover

- Noise level. Sound attenuator accessory
  Discharge sound level is very important in this kind of units because it is the sound introduced into the room that the people will sense. In addition to an accurate design for minimising the ventilation sound emitted from the unit, there is available a range of sound attenuators easily attachable to the unit with no need of an extra-installation work. The effect of the sound attenuator is a reduction of 7dB(A) on the pressure level sensed in the discharge side.



- Air Filters
  KPI units have two air filters: one for outdoor air and another one for the exhausted air. The filters are located after the fan but before the heat exchanger, avoiding the pollution from outside/inside and the possible emissions by the fan motor to affect the heat exchanger efficiency and ensuring the supplied air quality.

☛ Main features of the units:



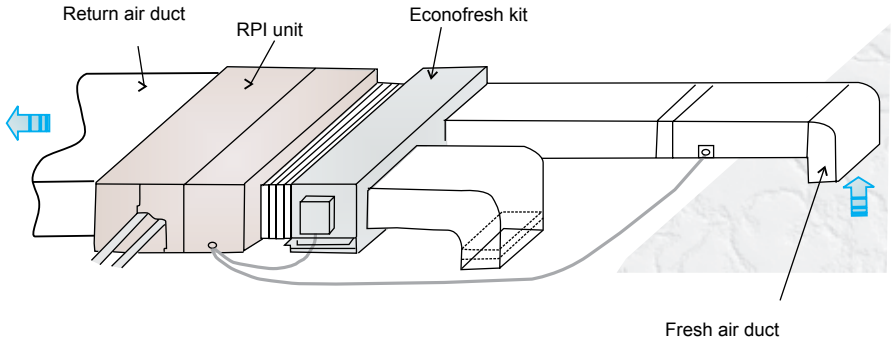
◆ Econofresh Kit

The new Econofresh kit is an intelligent accessory device that is easily installed. It renews room air and saves energy.

No coolant cycle is required. A direct RPI-5HP unit return duct connection is used instead.

The Econofresh kit can provide up to 100% fresh air and has the ability to provide “free cooling” through the damper when the outdoor temperature is below the indoor setting temperature.

This system will not only maintain the correct room temperature and provide fresh air, but also natural cooling. It therefore increases energy savings.



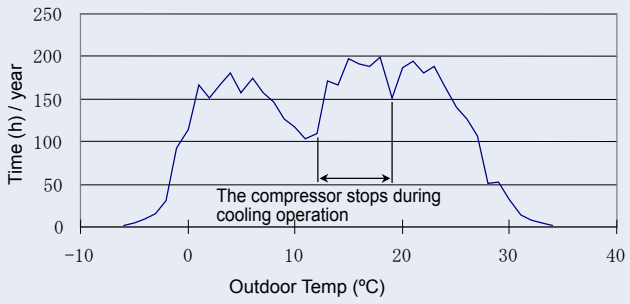
◈ Operation mode

Fresh air cooling during intermediate seasons saves energy.

This unit uses an economizer for cooling, which takes in fresh air if the outdoor temperature is cooler than the indoor air, as shown in the graph below.

In this situation, no compressor is used and thus a remarkable amount of energy is saved.

Graph example of cold region temperature:



The power consumption is reduced by more than 20% during operating mode with cooling by using the Econofresh + kit RPI-5.0FSN2E.

- Fresh clean air revives your room

A fresh air intake system keeps the air in a room always clean.

The optional CO_2 sensor can sense the degree of pollution of the air in the room and automatically control the fresh air flow.

NOTE:

In the case that the Outdoor Air Temperature is lower than 3ºC, Fresh Outdoor Air rate will decrease.

Damper air-flow control provides comfortable cooling

A micro-computer controls the angle of the damper according to both room air temperature and outdoor temperature to adjust the fresh air flow, thus keeping the room temperature constant.

2. General Data

This chapter offers a summary of the most important general data of the indoor, outdoor and complementary units of the SET FREE FSNM(E) series.

Contents

2.1. General data for RAS-8~12FSNM(E)

RAS MODEL			RAS-8FSNM	RAS-10FSNM	RAS-12FSNM
Electrical power supply			3~,380/415V, 50Hz		
Nominal cooling capacity (Min/Nom/Max)		kW	22.4	28.0	33.5
Nominal heating capacity (Min/Nom/Max)		kW	25.0	31.5	37.5
Energy efficiency in cooling mode (EER)			3.56	3.37	3.13
Energy efficiency coefficient in heating mode (COP)			4.24	4.04	3.79
Color (Munsell code)		-	Natural gray (1.0Y 8.5/0.5)		
Sound pressure level Cool/Heat (Night mode)		dB(A)	53/55	56/58	59/61
Sound power level		dB(A)	*To be confirmed*	*To be confirmed*	*To be confirmed*
Outside measurements	Height	mm	1,650	1,650	1,650
	Width	mm	1,100	1,100	1,100
	Depth	mm	390	390	390
Net weight		Kg	170	170	173
Refrigerant		-	R410A		
Flow control		-	Micro-computer control expansion valve		
Compressor		-	Hermetic (scroll)		
Q´ty		-	1	1	1
Power		kW	4.80	6.00	7.20
Heat exchanger			Multi-pass cross-finned tube		
Outdoor fan		-	Propeller fan		
Q´ty		-	2	2	2
Air flow rate		m³/min	121	150	163
Power (pole)		W	170(8)+120(6)	170(8)+170(6)	170(8)+200(6)
Refrigerant pipe connection			Flare-nut connection (factory supplied)		
Size	Liquid piping	mm (in)	ø9.53 (3/8)	ø12.70 (1/2)	ø12.70 (1/2)
	Gas piping	mm (in)	ø19.05 (3/4)	ø22.20 (7/8)	ø25.40-ø28.60 (1)-(1-1/8)
Refrigerant load		Kg	5.0	5.5	6.5
Maximum electrical power consumption		A	14.0	18.0	23.0
Packaging measurements		m³	0.71	0.71	0.71

NOTE:

1. The nominal cooling and heating capacity is the combined capacity of the SET FREE 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

2. The Sound Pressure Level is based on following conditions:
   - 1 meter from the frontal surface of the unit. 1.5 meters from floor level.
   - Voltage of the power source is 230V

   The above data was measured in an anechoic chamber, so reflected sound should be taken into consideration when installing the unit.
3. In case of Night Shift conditions, the noise level decrease 5 dB (A)
4. COP and EER data correspond to Outdoor unit (Indoor unit input power is not considered). Outdoor unit performance has been established in combination with RCI Indoor units.

2.2. Component data for RAS-8~12FSNM(E)

The component data indicated are the following:

- Outdoor unit: Heat exchanger, fan unit and compressor

RAS Model				RAS-8FSNM	RAS-10FSNM	RAS-12FSNM
Heat exchanger	Type		-	Multi-pass cross finned tube		
	Piping	Material	-	Copper tube		
		Outer diameter	Ø mm	7.0	7.0	7.0
		Rows	-	2	2	2
		Number of tubes/coil	-	80	80	80
	Fin	Material	-	Aluminium		
		Pitch	mm	1.9	1.9	1.9
	Maximum operation pressure		MPa	4.15	4.15	4.15
	Total face area		m²	1.86	1.86	1.86
	Number of coils/unit		-	2	2	2
Fan unit	Fan	Type	-	Propeller fan		
		Number/unit	-	2	2	2
		Outer diameter	mm	544	544	544
		Revolutions	rpm	399+745	630+772	630+871
		Nominal air flow/fan	m³/min	121	150	163
	Motor	Type	-	Drip-proof type enclosure		
		Starting method	-	PSC (Permanent split capacitor)		
		Fan Motor (output)	W	170+120	170+170	170+200
		Q´ty	-	2	2	2
		Insulation class	-	E	E	E
Compressor	Inverter type		-	E656DHD	E656DHD	E656DHD

2.3. Component data for compressor

Compressor Model			E656DHD
Compressor type		-	Hermetic Scroll Type
Pressure resistance	Discharge	MPa	4.20
	Suction	MPa	2.21
Motor	Starting method	-	Inverter-Driven
	Poles	-	4
	Insulation class	-	E
Oil type		-	FVC68D
Load amount		liters	1.9

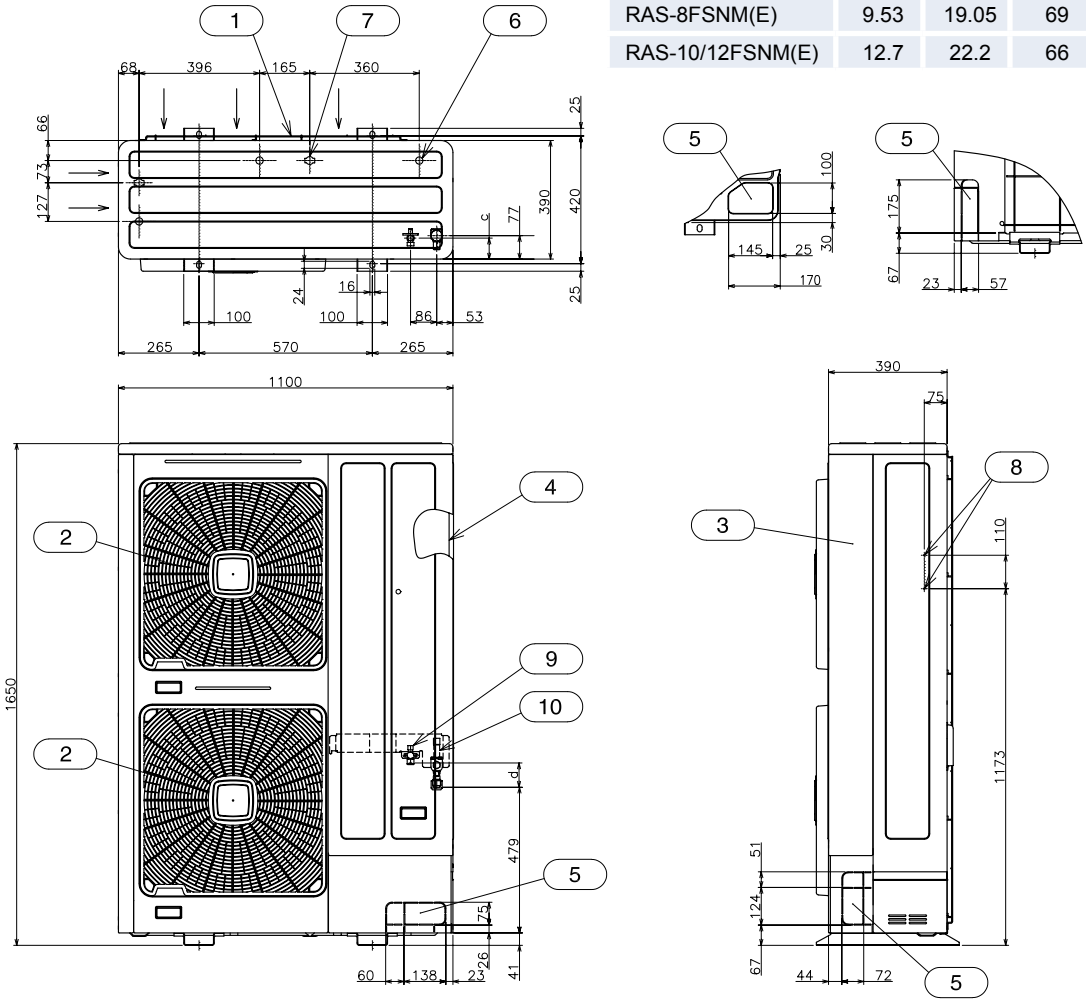
3. Dimensional Data

This chapter shows the dimensions and minimum space required to install each unit of SET FREE FSNM(E) Series.

Contents

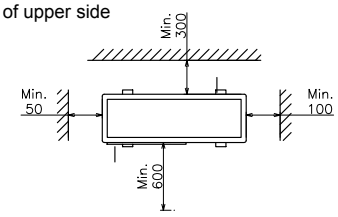
3.1. Dimensional drawing for RAS-8~12FSNM(E)

Models	a	b	c	d
RAS-8FSNM(E)	9.53	19.05	69	80
RAS-10/12FSNM(E)	12.7	22.2	66	61

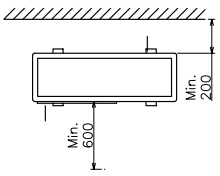


Service space

In case of obstacles on both sides and no obstacles of upper side



In case of no obstacles on both sides, and upper side



Units: mm

No.	Item	Remarks
1	Air intake	
2	Air outlet	
3	Service cover	
4	Electrical switch box	
5	Holes for Refrigerant Piping and electrical wiring piping	
6	Drain holes	3-Ø24
7	Drain holes	2-Ø26
8	Holes for fixing machine to wall	4-(M5)
9	Refrigerant liquid pipe	Flare nut: Øa
10	Refrigerant gas pipe	Flare nut: Øb

4. Capacities and Selection data

This chapter offers a summary of capacities and selection data of the SET FREE FSNM(E) Series.

Contents

4.1. Selection guide

◆ Meaning of model name of indoor unit

Example: RPI - 1.5 FSN2E

- FSN2E: SET-FREE FSN2E Series
- 1.5: Horsepower
- RPI: Unit type

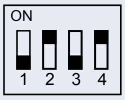
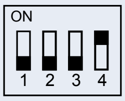
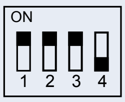
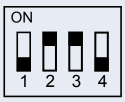
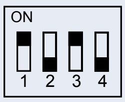
In-the-ceiling type	RPI(M)
4-way cassette type	RCI(M)
2-way cassette type	RCD
Wall type	RPK
Floor type	RPF
Floor concealed type	RPFI
Ceiling type	RPC

NOTE:
Select the indoor units and outdoor unit so as the total indoor horsepower is near to the outdoor horsepower.

◆ Nominal capacity of indoor units

Horsepower (HP) / Capacity		0.8	1.0	1.5	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10.0
Cooling capacity	kW	2.2	2.8	4.0	5.6	7.1	8.0	11.2	14.0	16.0	22.4	28.0
Heating capacity	kW	2.5	3.2	4.8	6.3	8.5	9.0	12.5	16.0	18.0	25.0	31.5

Capacity adjustment by dip switch setting

Horsepower (HP)		1.3		1.8		2.3	
Variable capacity		1.3 ←	1.5	1.8 ←	2.0	2.3 ←	2.5
Cooling capacity	kW	3.8		5.2		6.7	
Heating capacity	kW	4.2		5.6		7.5	
Applicable model		RPI(M), RCI(M), RCD, RPK, RPF, RPFI		RPI, RCI, RCD, RPK, RPC, RPF, RPFI		RPI, RCI, RCD, RPK, RPC, RPF, RPFI	
Indoor unit dip switch setting (DSW3)		1.3HP ←	1.5HP	1.8HP ←	2.0HP	2.3HP ←	2.5HP
		 Lowered	 Standard	 Lowered	 Standard	 Lowered	 Standard

◆ Meaning of model name of outdoor unit

Example: RAS - 8 FSNM(E)

- FSNM(E): SET-FREE FSNM(E) Series
- 8: Horsepower
- RAS: Outdoor unit

◆ Nominal capacity of outdoor unit

Model		RAS-8FSNM(E)	RAS-10FSNM(E)	RAS-12FSNM(E)
Horsepower (HP)		8	10	12
Cooling capacity	kW	22.4	28.0	33.5
Heating capacity	kW	25.0	31.5	37.5

Nominal capacity of outdoor unit is under the condition that the total indoor unit horsepower is same as outdoor unit horsepower.

◆ Outdoor unit capacity at nominal temperature

If the total indoor unit horsepower is not same to the outdoor unit horsepower, refer to "Capacity characteristic curve" in this chapter.

◆ Given Condition (Example)

Total Load for Each Room

Item		Room (1)	Room (2)	Room (3)	Room (4)
Estimated cooling load	kW	4.24	5.35	5.35	6.36
Estimated heating load	kW	4.77	6.00	6.00	7.16

Temperature condition

Cooling	Heating
Outdoor coil air inlet: 30 °C DB	Outdoor coil air inlet: 1/0 °C (DB/WB)
Indoor coil air inlet: 27/19 °C (DB/WB)	Indoor coil air inlet: 20 °C DB

Equivalent piping length between indoor units and outdoor unit: 60m
Piping lift: 20m
(Gas piping size: Normal, refer to “Piping length correction factor” in this chapter)
Correction factor of cooling capacity = 0.82
Correction factor of heating capacity = 0.95
Power source: 50Hz

◆ Selecting matching indoor units and nominal capacity

Select in-the-ceiling type indoor units (Example)

Item		Room (1)	Room (2)	Room (3)	Room (4)	(1)+(2)+(3)+(4)	Outdoor Unit
Selected Model		RPI-2.0	RPI-2.5	RPI-2.5	RPI-3.0	-	RAS-10FSNM(E)
Nominal cooling capacity	kW	5.6	7.1	7.1	8.0	27.8	28.0
Nominal heating capacity	kW	6.3	8.5	8.5	9.0	32.3	31.5

◆ Actual capacity

In the case of the example, the total indoor horsepower is 10HP
(=2.0HP+2.5HPx2+3.0HP).
Therefore, the outdoor unit capacity at the nominal temperature which is selected from the “Capacity characteristic curve” is 28.0 kW at the cooling operation, 31.5 kW at the heating operation under nominal conditions.

a) Actual capacity of outdoor unit
Maximum Actual Capacity of Outdoor Unit
= [Outdoor Unit Capacity at Nominal Temperature
×Correction factor According to Total Indoor Unit Capacity]
×Piping length correction factor
×Correction Factor According to Temperature Condition
Refer to the table in item 6.3 and item 6.4 for Correction Factor according to the temperature condition.
Cooling: 28.0 kW × 0.82 × 1.00 = 23.0 kW
Heating: 31.5 kW × 0.95 × 0.93 = 27.8 kW

b) Actual capacity of each indoor unit
Actual capacity of each indoor unit
= Actual capacity of outdoor unit ×[Each indoor unit's horsepower ÷ Summation of each indoor unit horsepower]
ex.
<RPI-2.0>
Cooling capacity: 23.0 × (2.0[HP]÷(2.0[HP]+2.5[HP]×2+3.0[HP]) = 4.60 kW
Heating capacity: 27.8 × (2.0[HP]÷(2.0[HP]+2.5[HP]×2+3.0[HP]) = 5.56 kW
<RPI-2.5>
Cooling capacity: 23.0 × (2.5[HP]÷(2.0[HP]+2.5[HP]×2+3.0[HP]) = 5.75 kW
Heating capacity: 27.8 × (2.5[HP]÷(2.0[HP]+2.5[HP]×2+3.0[HP]) = 6.95 kW
<RPI-3.0>
Cooling capacity: 23.0 × (3.0[HP]÷(2.0[HP]+2.5[HP]×2+3.0[HP]) = 6.90 kW
Heating capacity: 27.8 × (3.0[HP]÷(2.0[HP]+2.5[HP]×2+3.0[HP]) = 8.34 kW

< Result >

Item			Room (1)	Room (2)	Room (3)	Room (4)	(1)+(2)+(3)+(4)
Selected model			RPI-2.0	RPI-2.5	RPI-2.5	RPI-3.0	-
Actual capacity	Actual cooling capacity	kW	4.60	5.75	5.75	6.90	23.00
	Actual heating capacity	kW	5.56	6.95	6.95	8.34	27.80
Design load	Estimated cooling load	kW	4.24	5.35	5.35	6.36	21.30
	Estimated heating load	kW	4.77	6.00	6.00	7.16	23.93

4.2. Outdoor unit capacity with total horsepower of combined indoor unit

The following tables show the examples of outdoor unit capacity which corresponds with total horsepower of combined indoor unit, according to the charts of "Capacity characteristic curve ".

◆ **RAS-8~12FSNM(E)**

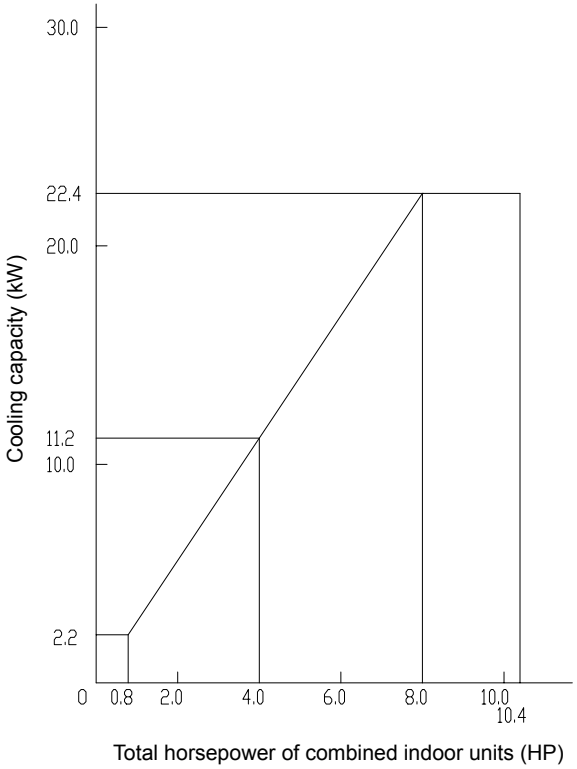
Total (HP)	Outdoor unit capacity (kW)					
	RAS-8FSNM(E)		RAS-10FSNM(E)		RAS-12FSNM(E)	
	Cooling	Heating	Cooling	Heating	Cooling	Heating
4.0	11.20	12.50	-		-	
4.1	11.48	12.81				
4.2	11.76	13.13				
4.3	12.04	13.44				
4.4	12.32	13.75				
4.5	12.60	14.06				
4.6	12.88	14.38				
4.7	13.16	14.69				
4.8	13.44	15.00				
4.9	13.72	15.31				
5.0	14.00	15.63	14.00	15.80		
5.1	14.28	15.94	14.28	16.11		
5.2	14.56	16.25	14.56	16.43		
5.3	14.84	16.56	14.84	16.74		
5.4	15.12	16.88	15.12	17.06		
5.5	15.40	17.19	15.40	17.37		
5.6	15.68	17.50	15.68	17.68		
5.7	15.96	17.81	15.96	18.00		
5.8	16.24	18.13	16.24	18.31		
5.9	16.52	18.44	16.52	18.63		
6.0	16.80	18.75	16.80	18.94	16.80	18.80
6.1	17.08	19.06	17.08	19.25	17.08	19.11
6.2	17.36	19.38	17.36	19.57	17.36	19.42
6.3	17.64	19.69	17.64	19.88	17.64	19.74
6.4	17.92	20.00	17.92	20.20	17.91	20.05
6.5	18.20	20.31	18.20	20.51	18.19	20.36
6.6	18.48	20.63	18.48	20.82	18.47	20.67
6.7	18.76	20.94	18.76	21.14	18.75	20.98
6.8	19.04	21.25	19.04	21.45	19.03	21.29
6.9	19.32	21.56	19.32	21.77	19.31	21.61
7.0	19.60	21.87	19.60	22.08	19.58	21.92
7.1	19.88	22.19	19.88	22.39	19.86	22.23
7.2	20.16	22.50	20.16	22.71	20.14	22.54
7.3	20.44	22.81	20.44	23.02	20.42	22.85
7.4	20.72	23.12	20.72	23.34	20.70	23.16
7.5	21.00	23.44	21.00	23.65	20.97	23.48
7.6	21.28	23.75	21.28	23.96	21.25	23.79
7.7	21.56	24.06	21.56	24.28	21.53	24.10
7.8	21.84	24.37	21.84	24.59	21.81	24.41
7.9	22.12	24.69	22.12	24.91	22.09	24.72
8.0	22.40	25.00	22.40	25.22	22.37	25.03
8.1	22.40	25.00	22.68	25.53	22.64	25.35
8.2	22.40	25.00	22.96	25.85	22.92	25.66
8.3	22.40	25.00	23.24	26.16	23.20	25.97
8.4	22.40	25.00	23.52	26.48	23.48	26.28
8.5	22.40	25.00	23.80	26.79	23.76	26.59
8.6	22.40	25.00	24.08	27.10	24.04	26.90
8.7	22.40	25.00	24.36	27.42	24.31	27.22

Total (HP)	Outdoor unit capacity (kW)					
	RAS-8FSNM(E)		RAS-10FSNM(E)		RAS-12FSNM(E)	
	Cooling	Heating	Cooling	Heating	Cooling	Heating
8.8	22.40	25.00	24.64	27.73	24.59	27.53
8.9	22.40	25.00	24.92	28.05	24.87	27.84
9.0	22.40	25.00	25.20	28.36	25.15	28.15
9.1	22.40	25.00	25.48	28.67	25.43	28.46
9.2	22.40	25.00	25.76	28.99	25.71	28.77
9.3	22.40	25.00	26.04	29.30	25.98	29.09
9.4	22.40	25.00	26.32	29.62	26.26	29.40
9.5	22.40	25.00	26.60	29.93	26.54	29.71
9.6	22.40	25.00	26.88	30.24	26.82	30.02
9.7	22.40	25.00	27.16	30.56	27.10	30.33
9.8	22.40	25.00	27.44	30.87	27.38	30.64
9.9	22.40	25.00	27.72	31.19	27.65	30.95
10.0	22.40	25.00	28.00	31.50	27.93	31.27
10.1	22.40	25.00	28.00	31.50	28.21	31.58
10.2	22.40	25.00	28.00	31.50	28.49	31.89
10.3	22.40	25.00	28.00	31.50	28.77	32.20
10.4	22.40	25.00	28.00	31.50	29.05	32.51
10.5			28.00	31.50	29.33	32.83
10.6			28.00	31.50	29.60	33.14
10.7			28.00	31.50	29.88	33.45
10.8			28.00	31.50	30.16	33.76
10.9			28.00	31.50	30.44	34.07
11.0			28.00	31.50	30.72	34.38
11.1			28.00	31.50	31.00	34.70
11.2			28.00	31.50	31.27	35.01
11.3			28.00	31.50	31.55	35.32
11.4			28.00	31.50	31.83	35.63
11.5			28.00	31.50	32.11	35.94
11.6			28.00	31.50	32.39	36.25
11.7			28.00	31.50	32.67	36.57
11.8			28.00	31.50	32.94	36.88
11.9		-	28.00	31.50	33.22	37.19
12.0			28.00	31.50	33.50	37.50
12.1			28.00	31.50	33.50	37.50
12.2			28.00	31.50	33.50	37.50
12.3			28.00	31.50	33.50	37.50
12.4			28.00	31.50	33.50	37.50
12.5			28.00	31.50	33.50	37.50
12.6			28.00	31.50	33.50	37.50
12.7			28.00	31.50	33.50	37.50
12.8			28.00	31.50	33.50	37.50
12.9			28.00	31.50	33.50	37.50
13.0			28.00	31.50	33.50	37.50
13.1				-	33.50	37.50
13.2					33.50	37.50

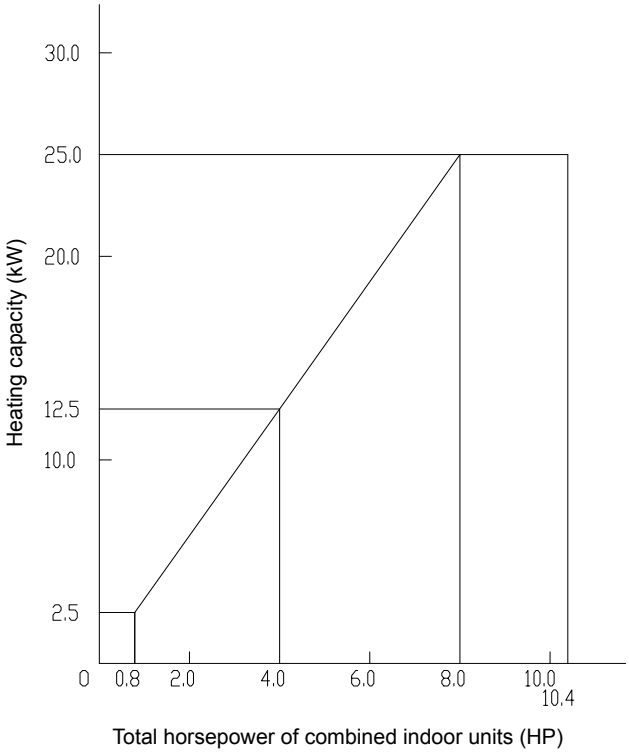
4.3. Capacity characteristic curve

The following charts show the characteristics of outdoor unit capacity which corresponds with total horsepower of combined indoor unit, on standard condition with refrigerant piping of horizontal and 7.5m at length.
See chapter “Outdoor unit capacity with total horsepower of combined indoor unit” for the examples of the actual combinations

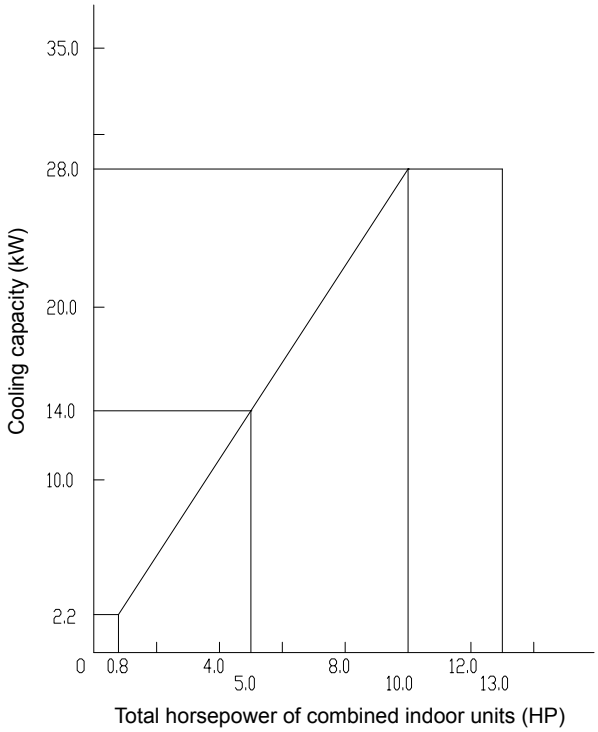
◆ Cooling characteristic curve of RAS-8FSNM(E)



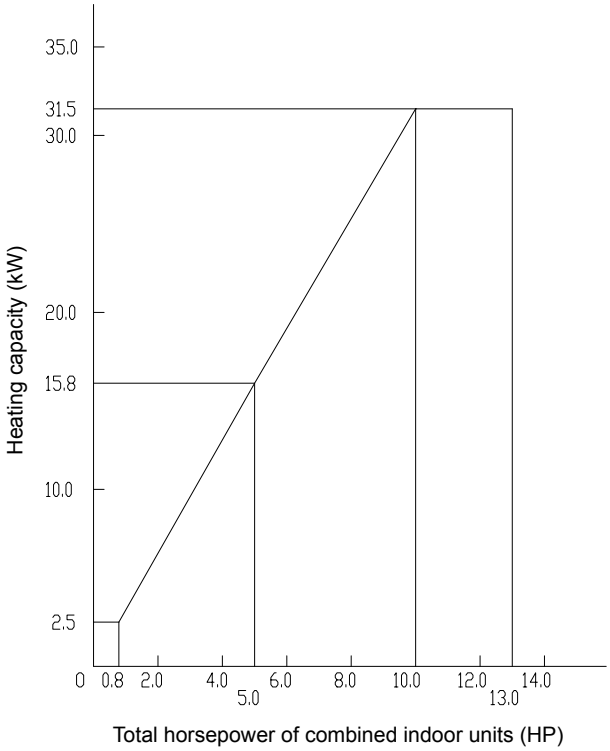
◆ Heating characteristic curve of RAS-8FSNM(E)



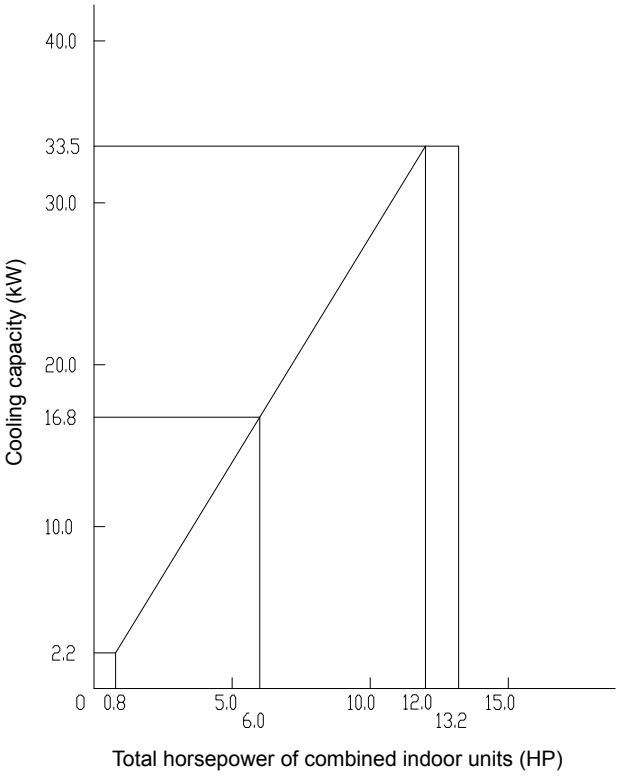
◆ Cooling characteristic curve of RAS-10FSNM(E)



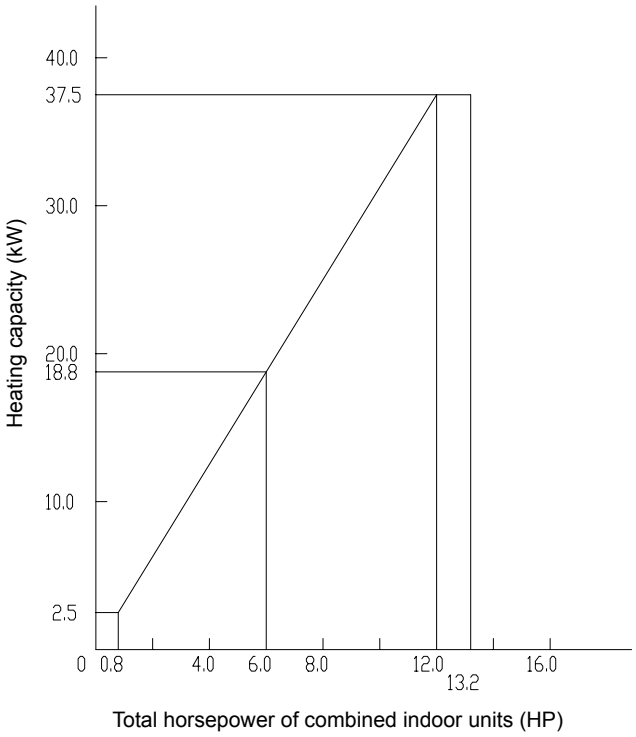
◆ Heating characteristic curve of RAS-10FSNM(E)



◆ **Cooling characteristic curve of RAS-12FSNM(E)**



◆ **Heating characteristic curve of RAS-12FSNM(E)**



4.4. Nominal cooling capacity tables (100% combination)

Model	Outdoor air inlet temperature (°C DB)	Indoor air inlet temperature WB (°C)/(DB (°C))					
		16/(23)	18/(25)	19/(26)	20/(27)	22/(30)	24/(32)
		CAP Max. (CF)	CAP Max. (CF)	CAP Max. (CF)	CAP Max. (CF)	CAP Max. (CF)	CAP Max. (CF)
RAS-8FSNM(E)	25	20.1	21.6	22.4	23.2	24.9	25.7
		(0.90)	(0.96)	(1.00)	(1.04)	(1.11)	(1.15)
	30	20.1	21.6	22.4	23.2	24.9	25.7
		(0.90)	(0.96)	(1.00)	(1.04)	(1.11)	(1.15)
	35	20.1	21.6	22.4	23.2	24.9	25.7
		(0.90)	(0.96)	(1.00)	(1.04)	(1.11)	(1.15)
	40	18.7	20.2	20.9	21.6	22.8	23.0
		(0.83)	(0.90)	(0.93)	(0.96)	(1.02)	(1.03)
RAS-10FSNM(E)	25	25.0	27.0	28.0	29.1	31.0	32.1
		(0.89)	(0.96)	(1.00)	(1.04)	(1.11)	(1.15)
	30	25.0	27.0	28.0	29.1	31.0	32.1
		(0.89)	(0.96)	(1.00)	(1.04)	(1.11)	(1.15)
	35	25.0	27.0	28.0	29.1	31.0	32.1
		(0.89)	(0.96)	(1.00)	(1.04)	(1.11)	(1.15)
	40	23.0	25.1	26.1	26.8	28.1	28.3
		(0.82)	(0.90)	(0.93)	(0.96)	(1.00)	(1.01)
RAS-12FSNM(E)	25	29.9	32.3	33.5	34.6	36.4	37.4
		(0.89)	(0.96)	(1.00)	(1.03)	(1.09)	(1.12)
	30	29.9	32.3	33.5	34.6	36.4	37.4
		(0.89)	(0.96)	(1.00)	(1.03)	(1.09)	(36.60)
	35	29.9	32.3	33.5	34.6	36.3	36.6
		(0.89)	(0.96)	(1.00)	(1.03)	(1.08)	(1.09)
	40	26.9	28.0	28.6	28.8	29.3	29.5
		(0.80)	(0.84)	(0.85)	(0.86)	(0.87)	(0.88)

NOTE:
CAP Max: Compressor capacity at maximum freqüency (kW).
CF: Correction factor according to temperature condition.

4.5. Nominal heating capacity tables (100% combination)

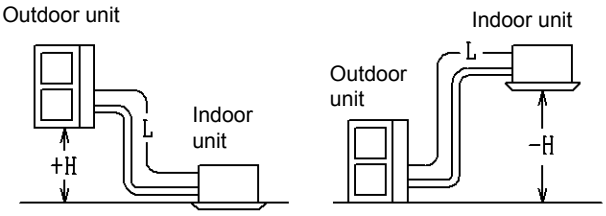
Model	Outdoor air inlet temperature (°C DB)	Indoor air inlet temperature (°C DB)					
		16	18	20	21	22	24
		CAP Max. (CF)	CAP Max. (CF)	CAP Max. (CF)	CAP Max. (CF)	CAP Max. (CF)	CAP Max. (CF)
RAS-8FSNM(E)	-10	18.9	18.7	18.6	18.5	18.4	18.2
		(0.76)	(0.75)	(0.74)	(0.74)	(0.74)	(0.73)
	-5	20.4	20.3	20.2	20.1	20.0	19.8
		(0.82)	(0.81)	(0.81)	(0.80)	(0.80)	(0.79)
	0	23.3	23.1	22.9	22.8	22.7	22.3
		(0.93)	(0.92)	(0.92)	(0.91)	(0.91)	(0.89)
	5	26.5	25.8	25.0	24.5	23.9	22.3
		(1.06)	(1.03)	(1.00)	(0.98)	(0.96)	(0.89)
	6	26.7	26.0	25.0	24.5	23.9	22.3
		(1.07)	(1.04)	(1.00)	(0.98)	(0.96)	(0.89)
	10	28.3	27.3	25.8	24.8	24.0	22.3
		(1.13)	(1.09)	(1.03)	(0.99)	(0.96)	(0.89)
	15	28.3	27.3	25.8	24.8	24.0	22.3
		(1.13)	(1.09)	(1.03)	(0.99)	(0.96)	(0.89)
RAS-10FSNM(E)	-10	23.0	22.8	22.7	22.6	22.5	22.3
		(0.73)	(0.72)	(0.72)	(0.72)	(0.71)	(0.71)
	-5	26.2	26.0	25.9	25.8	25.7	25.5
		(0.83)	(0.83)	(0.82)	(0.82)	(0.82)	(0.81)
	0	29.2	29.0	28.9	28.8	28.6	28.0
		(0.93)	(0.92)	(0.92)	(0.91)	(0.91)	(0.89)
	5	32.4	32.0	31.5	30.9	30.2	28.0
		(1.03)	(1.02)	(1.00)	(0.98)	(0.96)	(0.89)
	6	33.2	32.5	31.5	30.9	30.2	28.0
		(1.05)	(1.03)	(1.00)	(0.98)	(0.96)	(0.89)
	10	35.6	34.3	32.4	31.2	30.2	28.0
		(1.13)	(1.09)	(1.03)	(0.99)	(0.96)	(0.89)
	15	35.6	34.3	32.4	31.2	30.2	28.0
		(1.13)	(1.09)	(1.03)	(0.99)	(0.96)	(0.89)
RAS-12FSNM(E)	-10	26.9	26.7	26.6	26.5	26.4	26.2
		(0.72)	(0.71)	(0.71)	(0.71)	(0.70)	(0.70)
	-5	30.8	30.6	30.5	30.4	30.3	30.1
		(0.82)	(0.82)	(0.81)	(0.81)	(0.81)	(0.80)
	0	34.7	34.5	34.4	34.3	34.2	33.4
		(0.93)	(0.92)	(0.92)	(0.91)	(0.91)	(0.89)
	5	36.9	36.7	36.6	36.4	36.0	33.4
		(0.98)	(0.98)	(0.98)	(0.97)	(0.96)	(0.89)
	6	38.0	37.8	37.5	37.1	36.0	33.4
		(1.01)	(1.01)	(1.00)	(0.99)	(0.96)	(0.89)
	10	40.2	39.8	38.6	37.1	36.0	33.4
		(1.07)	(1.06)	(1.03)	(0.99)	(0.96)	(0.89)
	15	42.4	40.9	38.6	37.1	36.0	33.4
		(1.13)	(1.09)	(1.03)	(0.99)	(0.96)	(0.89)

NOTE:
CAP Max: Compressor capacity at maximum freqüency (kW)
CF: Correction factor according to temperature condition

4.6. Correction factors

4.6.1. 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:

- *If EL is more than 100 m, increase both liquid pipe and gas pipe, by 1 size.*
- *In order to ensure correct unit selection, consider the farthest indoor unit.*

4

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 capacity

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

HCA = HC x F

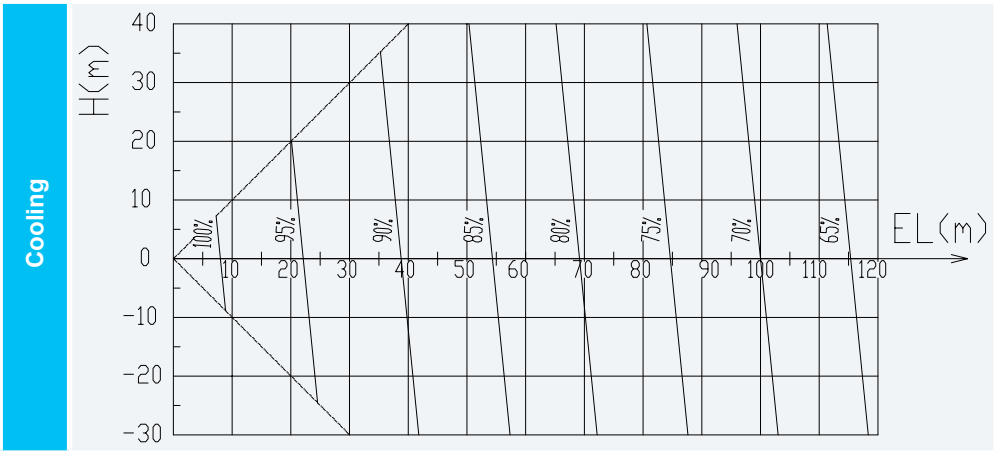
HCA:
Actual corrected heating capacity (kW)

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

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

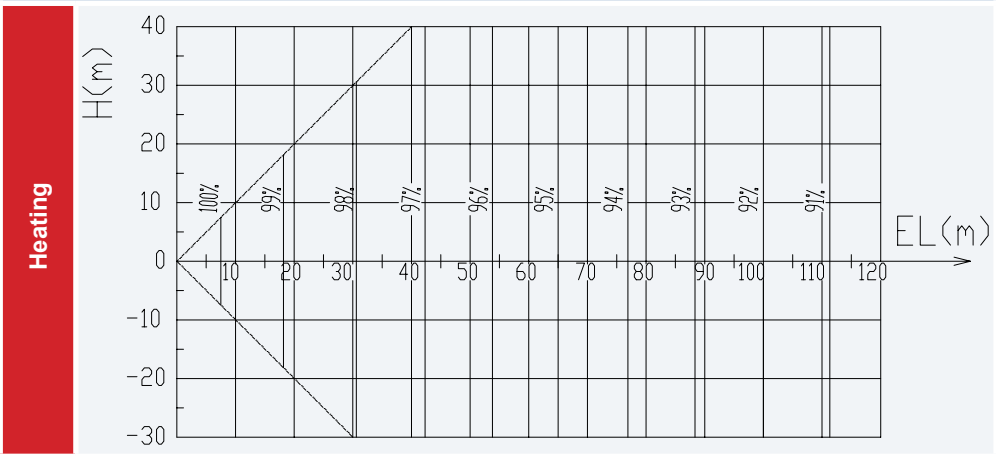
◆ Cooling

RAS-8FSNM(E) to RAS-12FSNM(E)



◆ Heating

RAS-8FSNM(E) to RAS-12FSNM(E)



4.6.2. Defrost correction factor

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

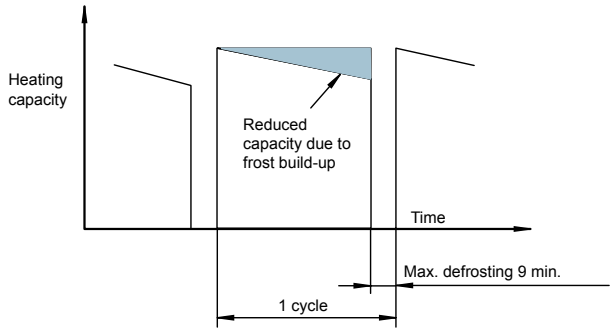
When this type of operation is taken in account, the heating capacity must be corrected according to the following equation:

Corrected heating capacity =
correction factor x heating capacity

Outdoor inlet air temp. (ºC DB) (HR = 85%)	-7	-5	-3	0	3	5	7
Defrosting correction factor f_d	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.



4.7. Sensible heat factor (SHF)

The sensible heat factor of indoor units at each fan speed (Hi, Me, Lo) based on the JIS Standard B8616, is given below:

Indoor unit model	SHF		
	Hi	Med	Low
RCI-1.0FSN2E	0.80	0.77	0.75
RCI-1.5FSN2E	0.77	0.75	0.73
RCI-2.0FSN2E	0.78	0.76	0.75
RCI-2.5FSN2E	0.73	0.71	0.69
RCI-3.0FSN2E	0.79	0.76	0.72
RCI-4.0FSN2E	0.78	0.75	0.72
RCI-5.0FSN2E	0.74	0.70	0.68
RCI-6.0FSN2E	0.73	0.69	0.68
RCIM-1.0FSN2	0.74	0.71	0.70
RCIM-1.5FSN2	0.74	0.71	0.70
RCIM-2.0FSN2	0.71	0.68	0.67
RCD-1.5FSN2	0.73	0.69	0.66
RCD-2.0FSN2	0.75	0.67	0.65
RCD-2.5FSN2	0.74	0.67	0.65
RCD-3.0FSN2	0.74	0.67	0.65
RCD-4.0FSN2	0.73	0.67	0.65
RCD-5.0FSN2	0.69	0.67	0.65
RPC-2.0FSN2E	0.72	0.70	0.67
RPC-2.5FSN2E	0.72	0.70	0.67
RPC-3.0FSN2E	0.72	0.70	0.67
RPC-4.0FSN2E	0.72	0.70	0.67
RPC-5.0FSN2E	0.72	0.70	0.67
RPC-6.0FSN2E	0.72	0.70	0.67
RPI-0.8FSN2E	0.81	0.69	0.69
RPI-1.0FSN2E	0.81	0.69	0.69
RPI-1.5FSN2E	0.73	0.69	0.65
RPI-2.0FSN2E	0.76	0.75	0.74
RPI-2.5FSN2E	0.76	0.74	0.72
RPI-3.0FSN2E	0.75	0.71	0.67
RPI-4.0FSN2E	0.73	0.71	0.65
RPI-5.0FSN2E	0.72	0.68	0.64
RPI-6.0FSN2E	0.72	0.69	0.67
RPI-8.0FSN2E	0.77	0.77	0.70
RPI-10.0FSN2E	0.79	0.79	0.72
RPIM-0.8FSN2E	0.81	0.69	0.69
RPIM-1.0FSN2E	0.81	0.69	0.69
RPIM-1.5FSN2E	0.71	0.68	0.64
RPK-1.0FSN2M	0.73	0.72	0.70
RPK-1.5FSN2M	0.73	0.72	0.70
RPK-2.0FSN2M	0.72	0.72	0.70
RPK-2.5FSN2M	0.72	0.72	0.70
RPK-3.0FSN2M	0.71	0.72	0.70
RPK-4.0FSN2M	0.71	0.72	0.70
RPF-1.0FSN2E	0.73	0.69	0.65
RPF-1.5FSN2E	0.73	0.69	0.65
RPF-2.0FSN2E	0.73	0.69	0.65
RPF-2.5FSN2E	0.73	0.69	0.65
RPFI-1.0FSN2E	0.73	0.69	0.65
RPFI-1.5FSN2E	0.73	0.69	0.65
RPFI-2.0FSN2E	0.73	0.69	0.65
RPFI-2.5FSN2E	0.73	0.69	0.65

◈ The following example shows the method for calculating the factor for latent and sensible heat .

Selected model	Indoor unit		
	RPI-2.0	RPI-2.5	RPI-3.0
Actual capacity	Cooling mode		
	4.60	5.75	6.90

RPI-2.0	Sensible load	Latent load
High fan speed	Performance capacity in cooling mode x Sensible heat factor	Performance capacity in cooling mode x (1-Sensible heat factor)
	4.60 x 0.76 = 3.50 kW	4.60 x 0.24 = 1.10 kW

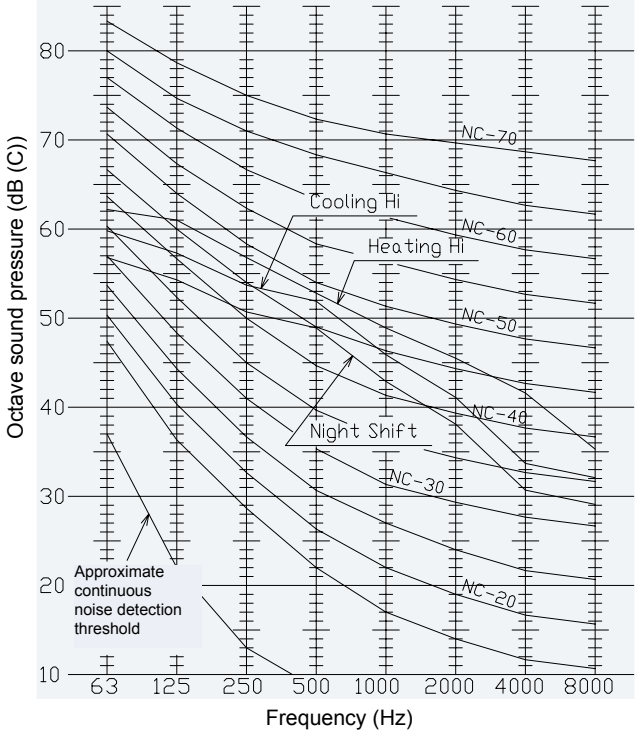
4.8. Sound data

Model: RAS-8FSNM(E) Power supply: 380/415 V, 50 Hz

Measurement point: 1.5 meters from floor level
1 meter from the unit's front surface.

Sound criteria curve

Cool/Heat/Night mode: 53/55/50 dB(A)

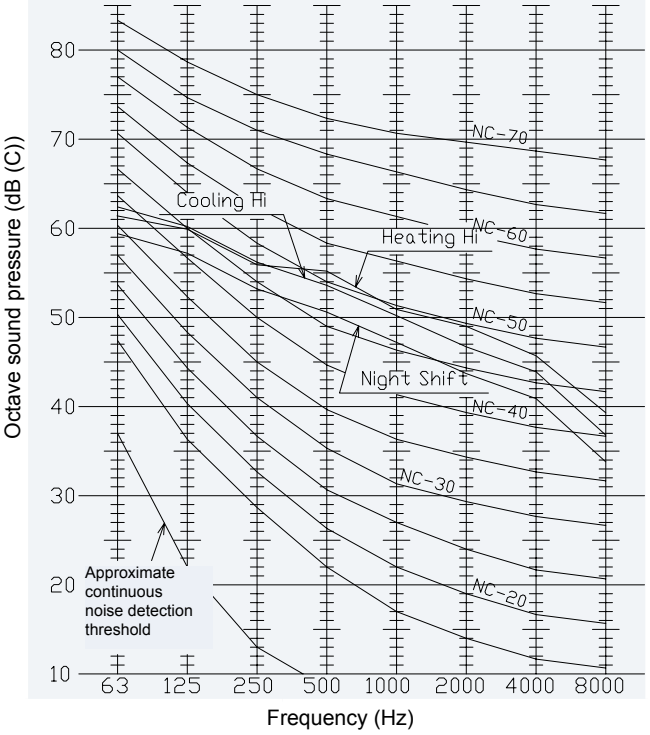


Model: RAS-10FSNM(E) Power supply: 380/415 V, 50 Hz

Measurement point: 1.5 meters from floor level
1 meter from the unit's front surface.

Sound criteria curve

Cool/Heat/Night mode: 56/58/53 dB(A)

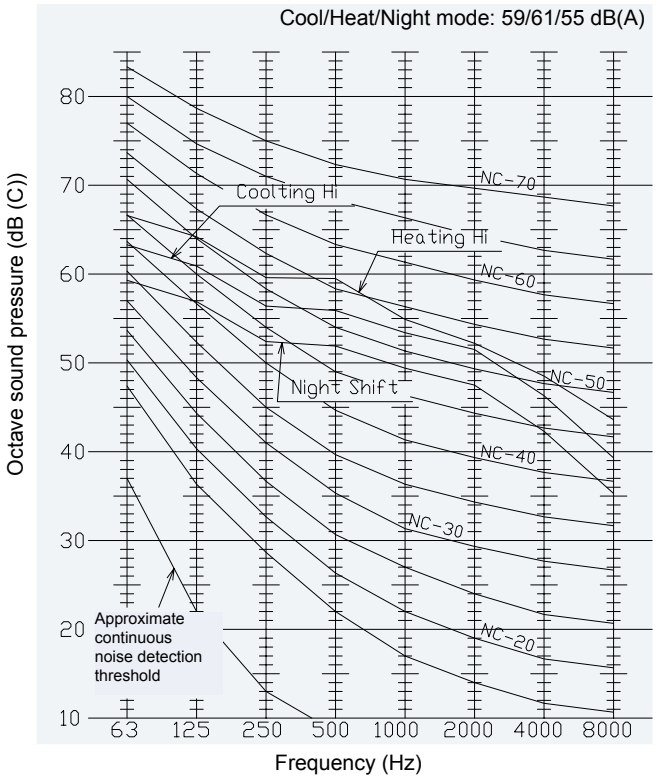


Model: RAS-12FSNM(E) Power supply: 380/415 V, 50 Hz

Measurement point: 1.5 meters from floor level
1 meter from the unit's front surface.

Sound criteria curve

Cool/Heat/Night mode: 59/61/55 dB(A)



4

5. Working Range

This chapter shows the working range of the Hitachi SET FREE FSNM series.

Contents

5.1. Power Supply

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

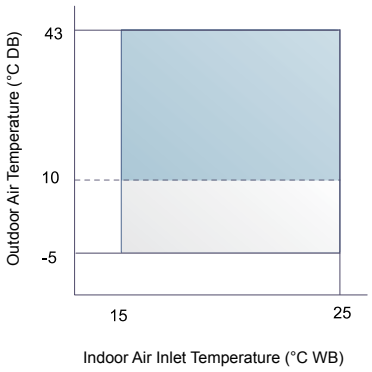
5.2. Temperature range

The temperature range is indicated in the following table:

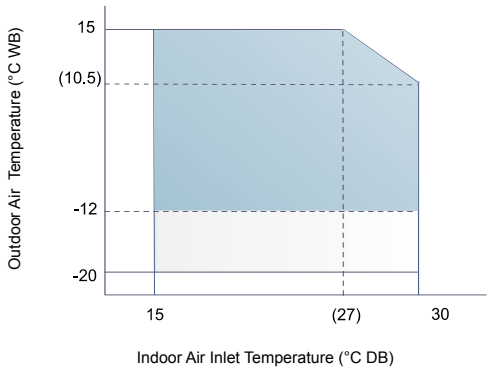
		Cooling Operation	Heating operation
Indoor temperature	Minimum	21 °C DB/15 °C WB	PENDING 15 °C DB
	Maximum	32 °C DB/25 °C WB	27 °C DB
Outdoor temperature	Minimum	–5 °C DB (*)	–20 °C WB (**)
	Maximum	43°C DB	15 °C WB

Temperature Range Diagram:

Cooling Operation



Heating operation



NOTES:

(*) 10 °C DB ~ -5 °C DB, Operation Control Range

(**) -12 °C WB ~ -20 °C WB, Operation Control Range

DB: dry bulb; WB: wet bulb

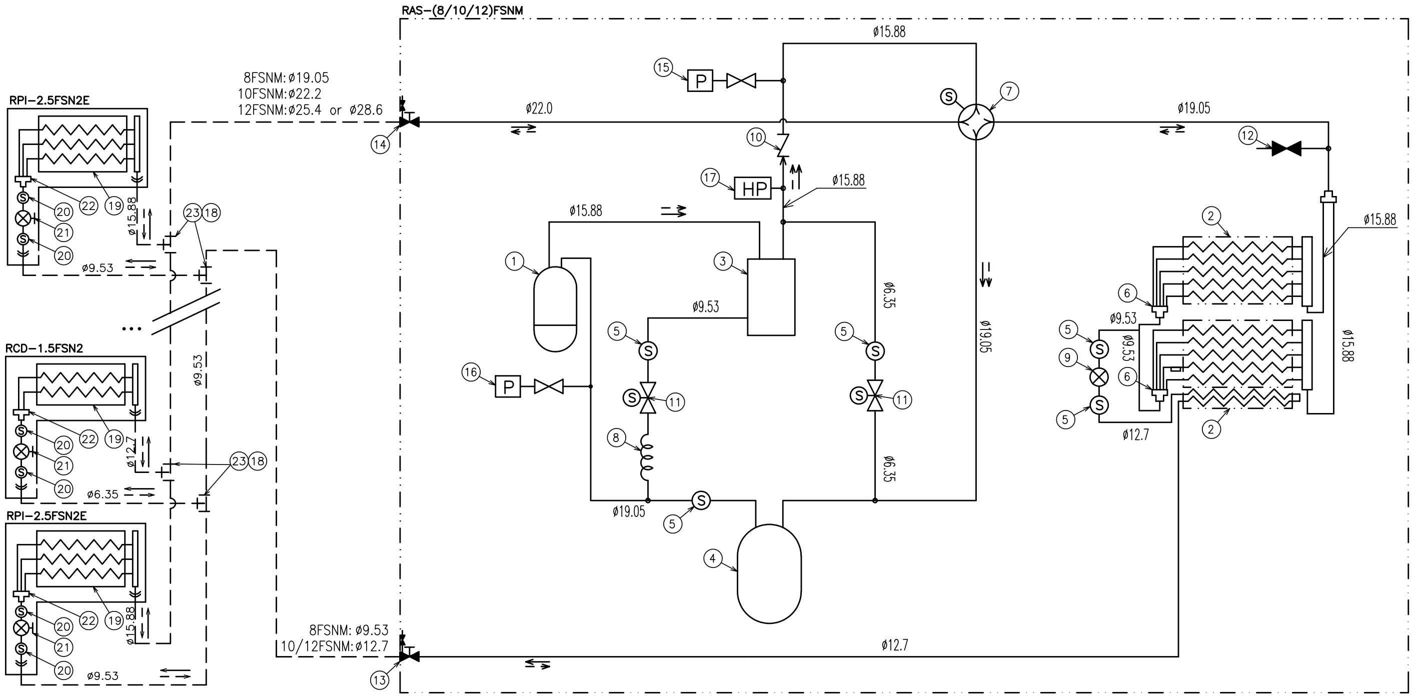
Operation control range

6. Refrigerant Cycle

This chapter shows the refrigerant cycle for each unit of the HITACHI SET FREE FSNM(Ë) Series.

Contents

6.1. Refrigerant cycle for RAS-8~12FSNM(E)



→	⇠	– – –	⟩⟩–	–‖–	–+–	R410A	4.15 MPa
Refrigerant flow for cooling	Refrigerant flow for heating	Refrigerant piping in the installation	Connection with flare nut	Flange connection	Brazing connection	Refrigerant :	Airtight test pressure

No	Item	No	Item	No	Item
1	Compressor	9	Micro-computer control expansion valve	16	Sensor for Refrigerant Pressure (Low pressure sensor)
2	Heat exchanger	10	Check valve	17	High pressure switch for protection
3	Oil separator	11	Solenoid valve	18	Multi-Kit MW-162AN
4	Accumulator	12	Check joint	19	Heat exchanger indoor
5	Strainer	13	Stop Valve for liquid line	20	Strainer indoor
6	Distributor	14	Stop Valve for gas line	21	Expansion valve indoor
7	Reversing valve	14	Stop Valve for gas line	22	Distributor indoor
8	Capillary tube	15	Sensor for Refrigerant Pressure (High pressure sensor)	23	Multi-Kit MW-102AN

7. Piping and refrigerant charge

This chapter shows the piping and refrigerant charge for each unit of the HITACHI SET FREE FSNM(E) series.

Contents

7.1. Refrigerant piping selection

The Set Free FSNM(E) system was designed to take into consideration all possible installation types. Therefore, HITACHI is using two different refrigerant pipe distributors: Multiple connection kits system and distributor system.

7.1.1. Minimum and maximum number of indoor units per outdoor unit

With Set Free FSNM(E) system it's able to connect one outdoor unit with up to 10 indoor units.

Utilizing an inverter control, a wide range of operation capacity control is also availabale. A maximum total combination horsepower of 130% and a minimum total combination horsepowerof 50% can be chosen by combination of the indoor units when compared with the nominal outdoor unit capacity. Therefore, the new system can meet individual air conditioning requirements in most office buildings.

Outdoor unit	Indoor unit				
	Minimum combination capacity (HP)	Maximum combination capacity (HP)	Combination quantity	Minimum individual operation capacity (HP)	Capacity range of combination
RAS-8FSNM(E)	4.0	10.4	10 (8)	0.8	50% to 130%
RAS-10FSNM(E)	5.0	13.0	10 (8)	0.8	
RAS-12FSNM(E)	6.0	13.2	10 (8)	0.8	50% to 110%

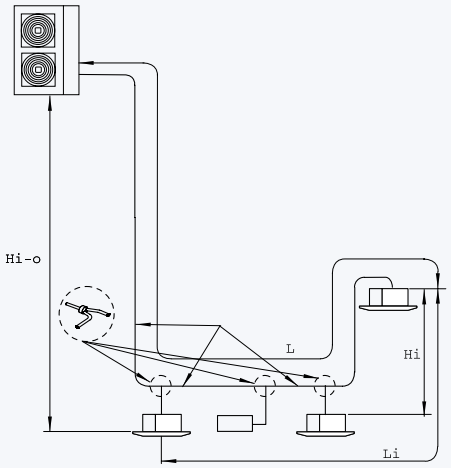
NOTE:

(1): Maximum number of minimum capacity indoor units connectable.

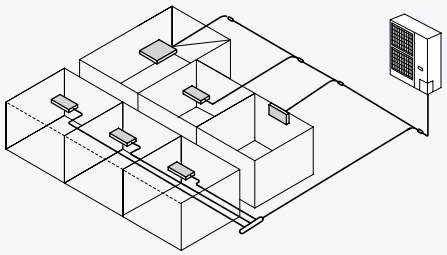
If you connect more than 8, the perception cold draft may occur at heating operation.

7.1.2. Refrigerant piping range

The piping selection and the distribution must be designed according to the following specifications:



Item		Applicable range
Length between O.U. and the farthest I.U.: L (m)	Actual	100
	Equivalent	120
Total piping length (m)		250
Piping length from 1st branch to the farthest I.U: Li (m)		40
Piping length from each I.U (m)		40
Lift between I.U. and O.U.: Hi-o (m)	O.U. is higher	40
	O.U. is lower	30
Lift between I.U.: Hi (m)		15

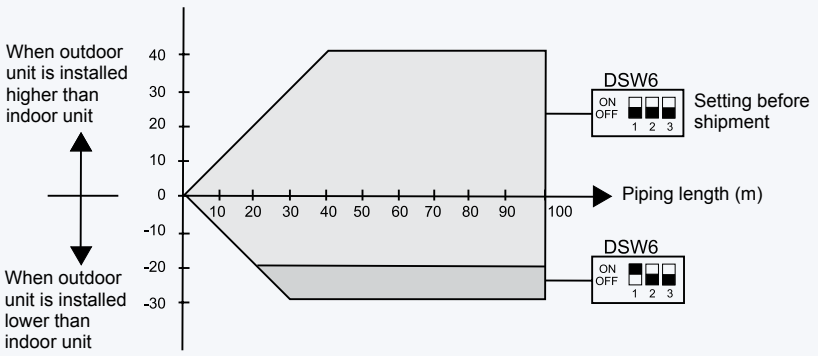


NOTE:

The liquid piping and the gas piping must be of the same length and run along the same route.

7.1.3. Refrigerant piping length by dip switch setting

The refrigerant piping length between indoor units and outdoor units must be designed using the following chart.
Maintain the design point within the dark area of the chart, which shows the height difference according to the piping length.

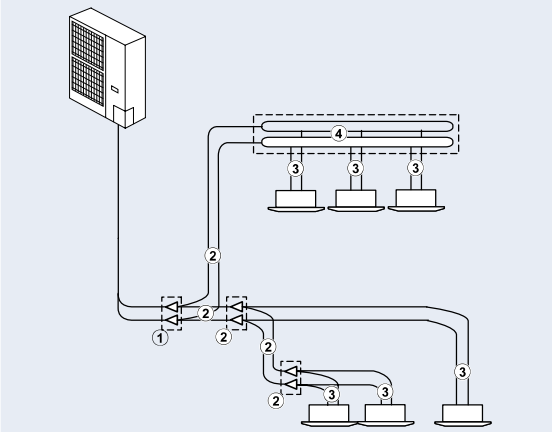


7

7.1.4. Piping size and multiple connections kit

In addition to the epoch-making "Uni-piping" system, where the same pipe size as the main refrigerant pipe can be used, the "Down-pipe" system is also available for piping cost reduction.
As shown in the following table, the "Uni-piping" system is available for 8 HP units.

Unit	Piping systems	
	Uni-piping	Down-size
RAS-8~12FSNM(E)	●	●



NOTE:

In case of Uni-piping system, the pipe size and the multi-kit from the outdoor unit to the last multi-kit is the same.

If the size of the multi-kit positionated after the 2nd kit is bigger than the 1st, use a kit of the same size as the 1st.

If the pipe size after the 1st branch is bigger than the pipe size beteen outdoor unit and the 1st kit, use the pipe of the same size as the 1st kit.

If you want to use "Unipiping" system for other configurations that are not shown in the table, consult with your distributor.

☛ **Table 1:**

① Outdoor unit to first multi-kit

Unit	Pipe size (Ømm)		Multi-kit
	Gas	Liquid	
RAS-8FSNM(E)	19.05	9.53 (*)	MW-102AN
RAS-10FSNM(E)	22.2	12.7	MW-102AN
RAS-12FSNM(E)	25.4~28.6	12.7	MW-162AN

NOTE:

(*): When the equivalent refrigerant pipe length is over 70m, use Ø12.7 liquid pipe. (In this case, use MW-162AN).

☛ **Table 2:**

② First multi-kit to last multi-kit

NOTE:

If the multi-kit size is larger than the first branch, adjust the multi-kit size to the first branch. In case that the selected pipe size after the first branch is larger than the pipe size before the first branch, use the same pipe size as before the branch.

Unit	Pipe size (Ømm)		Multi-kit
	Gas	Liquid	
12≤HP	25.4-28.6	12.7	MW-162AN
9≤HP<12	22.2	9.53	MW-102AN
6≤HP<9	19.05	9.53	MW-102AN
HP<6	15.88	9.53	MW-102AN

☛ **Table 3:**

③ Multi-kit to indoor unit

NOTE:

The multi-kit pipe size should be the same that indoor unit pipe.

Total indoor unit capacity (HP)	Pipe size (Ømm)		Maximum length of liquid pipe (m)
	Gas	Liquid	
0.8 to 2	12.7	6.35	15
2.5 to 6	15.88	9.53	15
8	19.05	9.53	15
10	22.2	9.53	15

☛ **Table 4:**

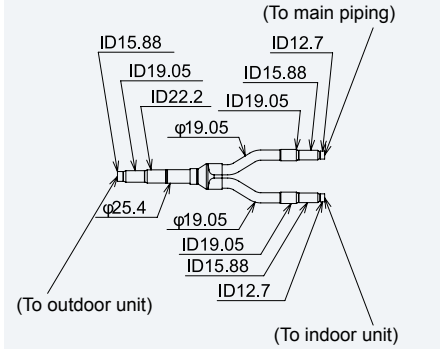
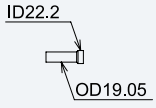
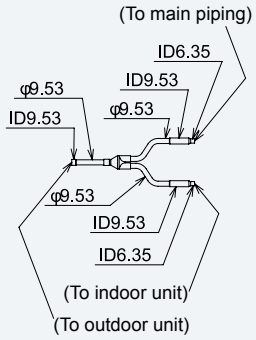
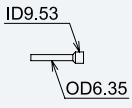
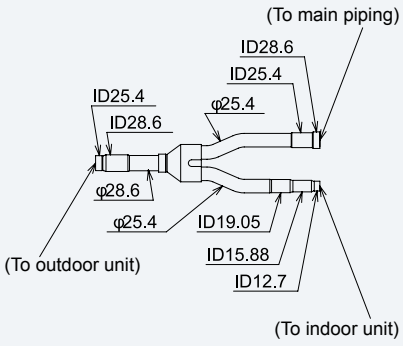
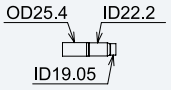
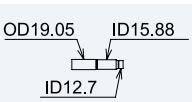
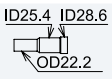
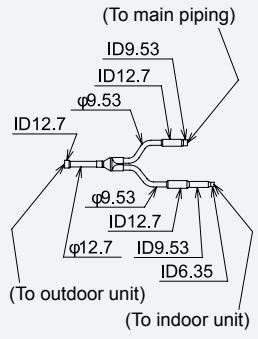
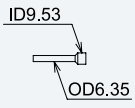
④ Distributor system

Total indoor unit capacity (HP)	Number of branches	Pipe size (Ømm)		Distributor
		Gas	Liquid	
5~8	4	15.88/19.05	9.53	MH-84AN
5~10	8	15.88/19.05/22.2	9.53	MH-108AN

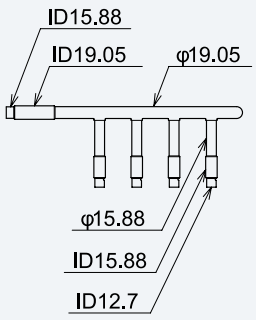
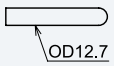
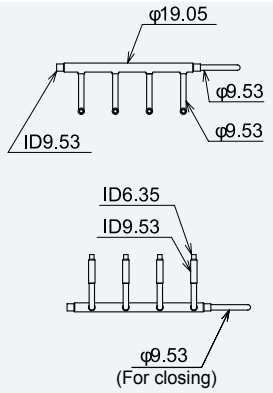
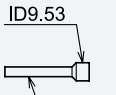
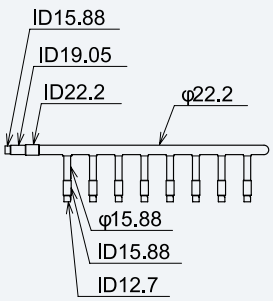
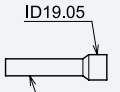
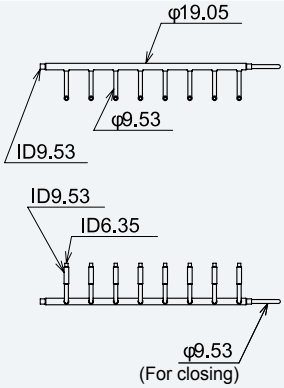
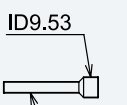
7.2. Multi-kits and distributors

7.2.1. Size data

◆ Multi-kits

	Gas line	Reducer for gas line	Liquid line	Reducer for liquid line
MW-102AN		 Q'ty: 1		 Q'ty: 2
MW-162AN		 Q'ty: 1  Q'ty: 1  Q'ty: 1  Q'ty: 1		 Q'ty: 1

◆ Distributors

	Gas line	Expander for gas line	Closing pipe for gas line	Liquid line	Expander for liquid line	Closing pipe for liquid line
MH-84AN		-	 Q'ty: 2		 Q'ty: 4	 Q'ty: 2
MH-108AN		 Q'ty: 2	 Q'ty: 6		 Q'ty: 8	 Q'ty: 6

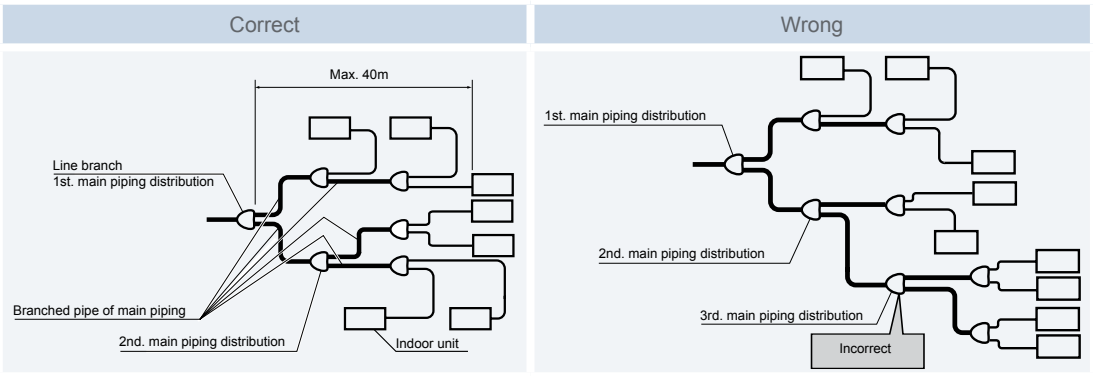
7

7.2.2. Distribution method

◆ Line distribution

With line distribution method, it is possible to make at the first or the second main pipe distribution.
And do not make the main pipe distribution, at or after the third branch.

◈ Branch method



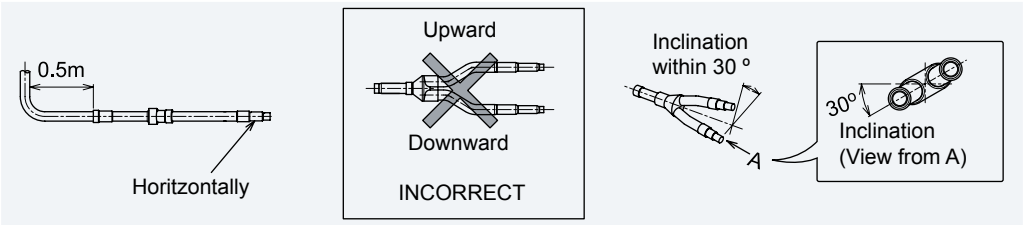
NOTE:

Only the first branch and the second branch of main piping are permitted.

◈ Installation position

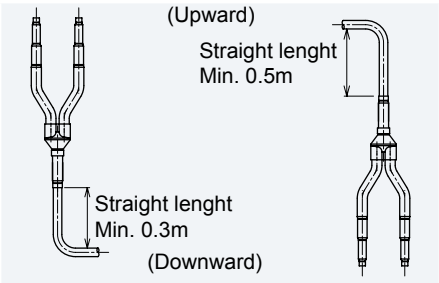
< Horizontal installation >

Locate the branch pipes on the same horizontal plane. (Inclination within 30°)
Make the straight length a minimum of 0.5m after the vertical bend.



< Vertical installation >

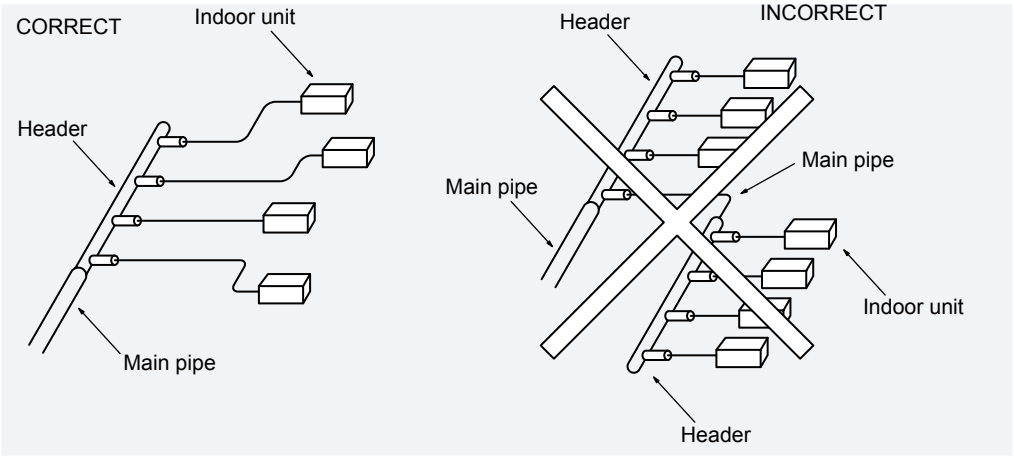
Straight length of the pipe connection on the outdoor unit side is made as follows:
* The collective pipe connection part is installed upward, the straight length must be min. 0.5m.
* The collective pipe connection part is installed downward, the straight length must be min.0.3m.



◆ Header distribution

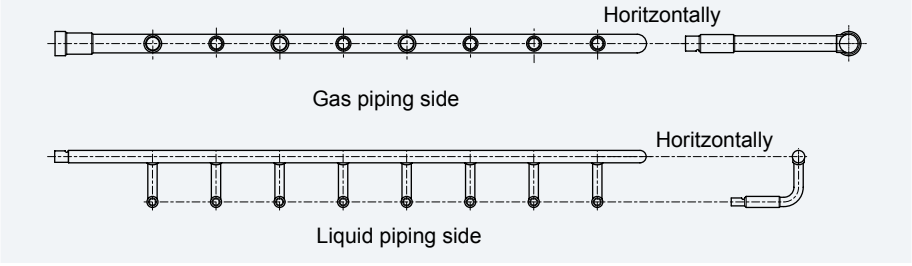
◈ Branch method

Do not connect two header branches consecutively.



◈ Installation position

Perform to install horizontally always.
(Ex.: In case of model MH-108AN)



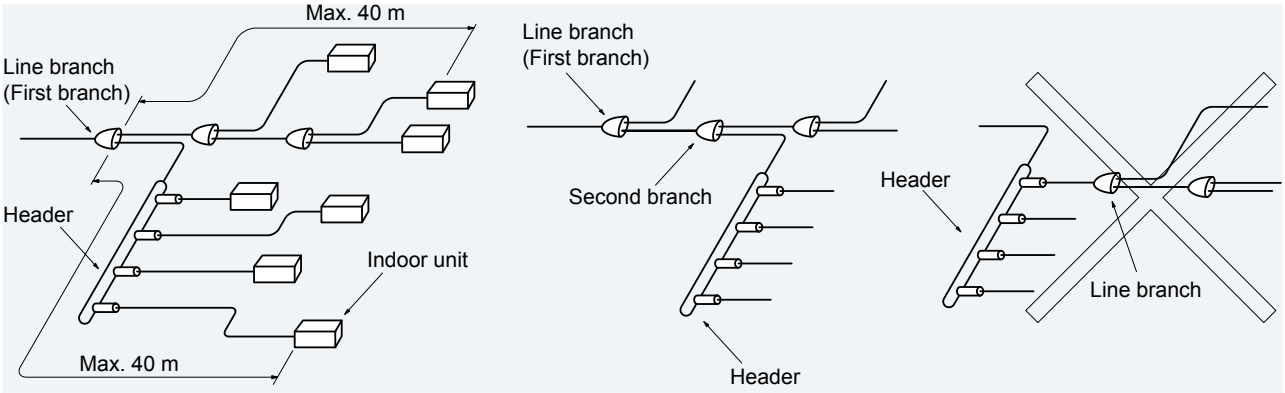
7

CAUTION:

Seal the end of branch pipes which are not connected, by brazing factory supplied closing pipes.

◈ Combination branch

- It is possible to conect the header to the second branch, when the first branch is also the line branch.
- Do not connect a line branch to a header branch.



7.2.3. Copper pipes and sizes

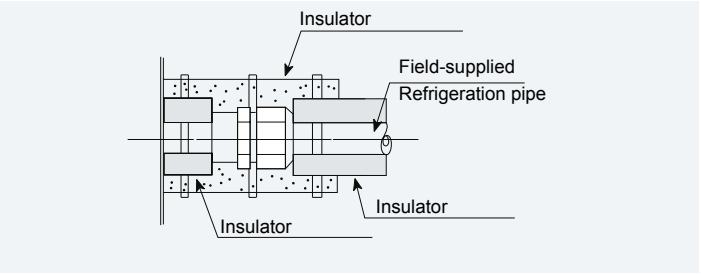
1. Prepare locally-supplied copper pipes.
2. Select the pipe size of a suitable thickness and material. Use the table below to select the required piping.

Nominal diameter		Thickness (mm)	Copper type
(mm)	(in.)		
6.35	1/4	0.80	Rolled
9.53	3/8	0.80	Rolled
12.70	1/2	0.80	Rolled
15.88	5/8	1.00	Rolled
19.05	3/4	1.00	Piping
22.23	7/8	1.00	Piping
25.40	1	1.00	Piping
28.60	1-1/8	1.00	Piping

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. Use 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:

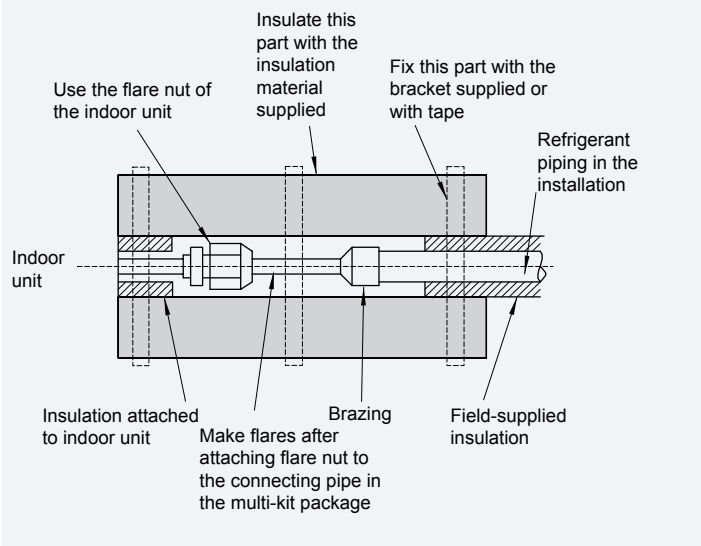


CAUTION:

- Do not use saws. grindstones or other tools which might create copper dust.
- When cutting pipes, secure the part for brazing in accordance to national and local regulations.
- Use security glasses and gloves for cutting or welding works.

Piping connections

When connecting liquid piping for the unit where the piping is longer than 15 meters. apply a piping size of Ø9.53. Fix the connecting pipe as shown in the following figure. Use the insulation attached to the indoor unit.

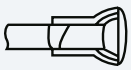


NOTE:

- 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's shown in the right figures.
- If piping installation cannot be completed until the following day or longer. solder the ends of the piping closed 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 that contents NH3 because can damage cooper pipe material and can be a source of future leakage.

Right	Wrong
	

NOTE:

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

CAUTION:

Perform insulation work when the surface temperature reaches the room temperature. Otherwise it is possible that the insulation will melt.

If the ends of the piping system are open after accomplishing piping work. securely attach caps or vinyl bags to the ends of the piping. avoiding the invasion of moisture and dust.

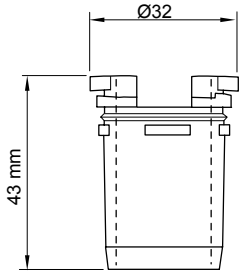
Insulation

Attach insulation packet with multi-kit to each branch utilizing 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.

Outdoor unit drain kit (DBS-26) (Optional accessory)

In the case that drain water from the heat exchanger of the outdoor unit is required to be collected, use the drain kit. However, it is not recommended to use it in a snow fall area.

If the drain water is required to be collected completely, provide a field-supplied drain pan under the outdoor unit.



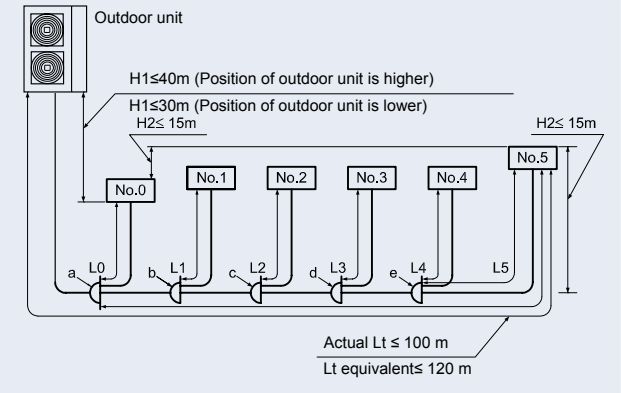
Outdoor unit HP	Drain kit quantity (units)
8 to 12 HP	DBS-26 x 4

7.3. Amount refrigerant charge

7.3.1. Additional refrigerant charge calculation (R410A)

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.



◆ **Calculating method of additional refrigerant charge (W kg)**

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

☛ **Step 1:**

Additional refrigerant charge calculation for liquid piping (W_1 (kg))

(Fill in the following table)

Pipe diameter (mm)	Total piping length (m)	Additional charge (kg/m)	Subtotal (kg)
Ø12.7		x 0.12	
Ø9.53		x 0.07	
Ø6.35		x 0.03	

☛ **Step 2:**

Additional refrigerant charge calculation for indoor unit (W_2 (kg))

When the outdoor unit is combined with indoor units RPI-8/10FSN2E, it´s necessary an additional refrigerant charge (W_2) = 1 kg/unit.

For indoor units lower than 8 HP, the additional refrigerant charge it's not needed.

☛ **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:

Total additional refrigerant charge: $W = W_1 + W_2$

The following table shows the maximum additional refrigerant quantity allowed by unit.

Outdoor unit	Max. additional ref. charge quantity (kg)
RAS-8~12FSNM(E)	13.5

- Charging work

Charge refrigerant (R410A) into the system according to the instructions described in "SMGB0059_rev0".

- Record of additional charge

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

Total refrigerant charge: $W_{TOT} = W + W_0$

This system = ☐ + ☐ = ☐ kg

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

Outdoor unit	W_0 outdoor unit refrigerant charge (kg)
RAS-8FSNM(E)	5.0
RAS-10FSNM(E)	5.5
RAS-12FSNM(E)	6.5

Record the refrigerant charge quantity in order to facilitate maintenance and servicing activities.

Total additional charge W ☐ kg
Total Ref. charge ☐ kg
Date of ref. charge work
☐ / ☐ / ☐

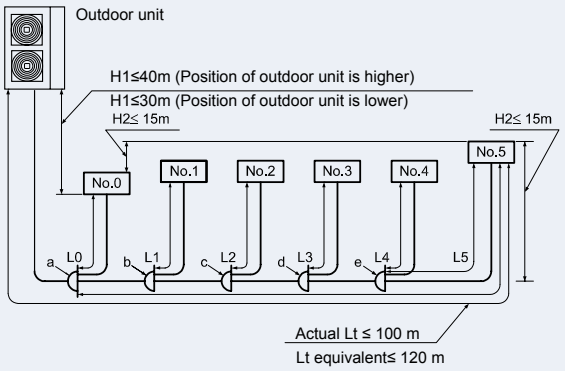
NOTE:

The total additional refrigerant charge quantity calculated, should not exceed the maximum additional refrigerant charge quantity allowed.

When the additional refrigerant charge is over the maximum additional refrigerant charge allowed by the unit, it's necessary to adjust the piping length of the installation.

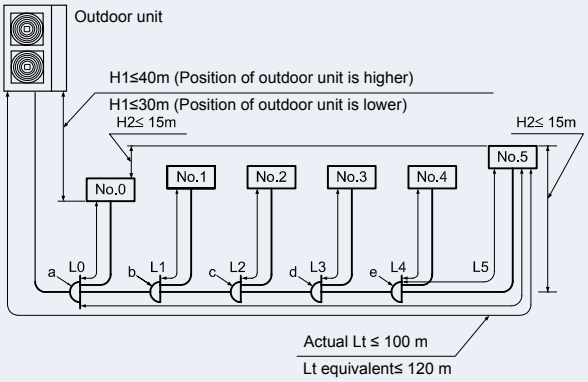
7.3.2. Samples

◆ Total system of SET-FREE FSNM(E) series

ITEM		DISTRIBUTOR SYSTEM
Example of systems **1: Simple installation with distributor** This figure shows examples of 6 indoor units combined with one outdoor unit. The refrigerant pipes are shown as single line in the diagrams. However, liquid line piping and gas line piping are required in the field.		
Total piping length		≤ 250 m
Maximum piping length	Actual length	Lt ≤ 100 m
	Equivalent length	Lt ≤ 120 m
Maximum lift between outdoor and indoor unit	In the case that the position of outdoor unit is higher than that of indoor unit.	H1 ≤ 40 m
	In the case that the position of outdoor unit is lower than that of indoor unit.	H1 ≤ 30 m
Maximum lift between each indoor unit or multi-kit and indoor unit		H2 ≤ 15 m
Maximum piping length between multi-kit and indoor unit	Between the “a” kit and the farthest indoor unit	L ≤ 40 m
	Between each multi-kit and each indoor unit	L0. L1. L2. L3. L4. L5 ≤ 15 m
Example: Outdoor unit: RAS-8FSNM(E)		
Selecting the distributor.		Use MH-108AN (8 branches)
1) Quantity of additional refrigerant charge. The quantity is calculated by the following equation: $W\ (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$ 1.1) W_{11} (kg): (Total length (m) of Ø22.2 Liquid piping) x 0.39 W_{12} (kg): (Total length (m) of Ø19.05 Liquid piping) x 0.28 W_{13} (kg): (Total length (m) of Ø15.88 Liquid piping) x 0.19 W_{14} (kg): (Total length (m) of Ø12.7 Liquid piping) x 0.12 W_{15} (kg): (Total length (m) of Ø9.53 Liquid piping) x 0.07 W_{16} (kg): (Total length (m) of Ø6.35 Liquid piping) x 0.030 1.2) W_2 (kg): Total quantity of additional refrigerant of each indoor unit (kg)	1.1) Liquid piping	**Example:** Mark: Lt-L5 | L0 | L1 | L2 | L3 | L4 | L5 Size: Ø9.53 | Ø6.35 | Ø6.35 | Ø6.35 | Ø6.35 | Ø6.35 | Ø6.35 Length: 61 | 5 | 3 | 5 | 3 | 3 | 5 W_{15} = 61 x 0.07 = 4.27 kg W_{16} = (5+3+5+3+5+3) x 0.03 = 0.72 kg
	1.2) Indoor unit	**Example:** Indoor Unit No.: 0 | 1 | 2 | 3 | 4 | 5 Corresponding power (HP): 1.5 | 1.5 | 1 | 1 | 1.5 | 1.5 Additional refrigerant quantity: Indoor units that do not require refrigerant charge W_2 = 0 kg
	Total	$W\ (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$ = 0 + 0 + 0 + 0 + 4.27 + 0.72 + 0 = 4.99 kg
2) Checking the maximum quantity of additional refrigerant charge: ($W < W_{MAX}$)		4.99 kg < 13.5 kg (CORRECT)
3) Total refrigerant charge: W_{TOT} (kg)= W_0 + W W_0 : Outdoor unit refrigerant charge before shipment (kg)		W_{TOT} = 5.0 + 4.99 = 9.99 kg

NOTES:

- Refer to "Refrigerant piping work" to know all the information necessary for the calculation of the addtional refrigerant charge.
- Refer to "Additional refrigerant charge calculation" in this chapter to know the maximum quantity of additional refrigerant charge (W_{MAX}) and the outdoor unit refrigerant charge before shipment (W_0).

ITEM		MULTI-KITS UNI-PIPING SYSTEM
Example of systems **2: Simple installation with multi-kits (Uni-piping)** This figure shows examples of 6 indoor units combined with one outdoor unit. The refrigerant pipes are shown as a single line in the diagrams. However, liquid line piping and gas line piping are required in the field.		
Total piping length		≤ 250 m
Maximum piping length	Actual length	Lt ≤ 100 m
	Equivalent length	Lt ≤ 120 m
Maximum lift between outdoor and indoor unit	In the case that the position of outdoor unit is higher than that of indoor unit.	H1 ≤ 40 m
	In the case that the position of outdoor unit is lower than that of indoor unit.	H1 ≤ 30 m
Maximum lift between each indoor unit or multi-kit and indoor unit		H2 ≤ 15 m
Maximum piping length between multi-kit and indoor unit	Between the “a” kit and the farthest indoor unit	L ≤ 40 m
	Between each multi-kit and each indoor unit	L0. L1. L2. L3. L4. L5 ≤ 15 m

Example: Outdoor unit: RAS-8FSNM(E)

Choice of each multi-kit

Mark	a,b,c,d,e
Multi-kit	MW-102AN

1) Quantity of additional refrigerant charge.

The quantity is calculated by the following equation:

$W\ (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$

1.1) W_{11} (kg): (Total length (m) of Ø22.2 Liquid piping) x 0.39

W_{12} (kg): (Total length (m) of Ø19.05 Liquid piping) x 0.28

W_{13} (kg): (Total length (m) of Ø15.88 Liquid piping) x 0.19

W_{14} (kg): (Total length (m) of Ø12.7 Liquid piping) x 0.12

W_{15} (kg): (Total length (m) of Ø9.53 Liquid piping) x 0.07

W_{16} (kg): (Total length (m) of Ø6.35 Liquid piping) x 0.030

1.2) W_2 (kg): Total quantity of additional refrigerant of each indoor unit (kg)

1.1) Liquid piping

Example:

Mark	Lt-L5	L0	L1	L2	L3	L4	L5
Size	Ø9.53	Ø6.35	Ø6.35	Ø6.35	Ø6.35	Ø6.35	Ø6.35
Length	60	5	3	5	3	5	3

W_{15} = 60 x 0.07 = 4.2 kg

W_{16} = (5+3+5+3+5+3) x 0.03 = 0.72 kg

1.2) Indoor unit

Example:

Indoor Unit No.	0	1	2	3	4	5
Corresponding power (HP)	1	1	1.5	1.5	1.5	1.5
Additional refrigerant quantity	Indoor units that do not require ref. charge					

W_2 = 0 kg

Total

$W\ (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$
$= 0 + 0 + 0 + 0 + 4.2 + 0.72 + 0 = 4.92$ kg

2) Checking the maximum quantity of additional refrigerant charge: ($W < W_{MAX}$)

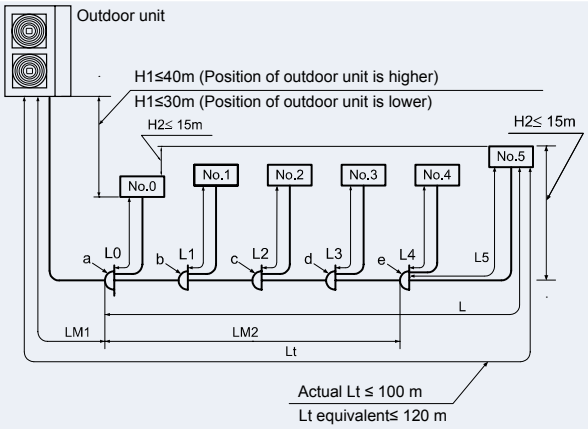
4.92 kg < 13.5 kg (CORRECT)

3) Total refrigerant charge: W_{TOT} (kg)= W_0 + W
W_0 : Outdoor unit refrigerant charge before shipment (kg)

W_{TOT} = 5.0 + 4.92 = 9.92 kg

NOTES:

- Refer to “Refrigerant piping work” to know all the information necessary for the calculation of the addtional refrigerant charge.
- Refer to “Additional refrigerant charge calculation” in this chapter to know the maximum quantity of additional refrigerant charge (W_{MAX}) and the outdoor unit refrigerant charge before shipment (W_0).

ITEM		MULTI-KITS DOWN-SIZE SYSTEM
Example of systems **3: Simple installation with multi-kits (Down-size)** This figure shows examples of 6 indoor units combined with one outdoor unit. The refrigerant pipes are shown as a single line in the diagrams. However, liquid line piping and gas line piping are required in the field.		
Total piping length		≤ 250 m
Maximum piping length	Actual length	Lt ≤ 100 m
	Equivalent length	Lt ≤ 120 m
Maximum lift between outdoor and indoor unit	In the case that the position of outdoor unit is higher than that of indoor unit.	H1 ≤ 40 m
	In the case that the position of outdoor unit is lower than that of indoor unit.	H1 ≤ 30 m
Maximum lift between each indoor unit or multi-kit and indoor unit		H2 ≤ 15 m
Maximum piping length between multi-kit and indoor unit	Between the “a” kit and the farthest indoor unit	L ≤ 40 m
	Between each multi-kit and each indoor unit	L0. L1. L2. L3. L4. L5 ≤ 15 m

Example: Outdoor unit: RAS-10FSNM(E)

Choice of each multi-kit

Mark	a	b,c,d,e
Multi-kit	MW-162AN	MW-102AN

1) Quantity of additional refrigerant charge.

The quantity is calculated by the following equation:

$W\ (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$

1.1) W_{11} (kg): (Total length (m) of Ø22.2 Liquid piping) x 0.39

W_{12} (kg): (Total length (m) of Ø19.05 Liquid piping) x 0.28

W_{13} (kg): (Total length (m) of Ø15.88 Liquid piping) x 0.19

W_{14} (kg): (Total length (m) of Ø12.7 Liquid piping) x 0.12

W_{15} (kg): (Total length (m) of Ø9.53 Liquid piping) x 0.07

W_{16} (kg): (Total length (m) of Ø6.35 Liquid piping) x 0.030

1.2) W_2 (kg): Total quantity of additional refrigerant of each indoor unit (kg)

1.1) Liquid piping

Example:

Mark	LM1	LM2	L0	L1	L2	L3	L4	L5
Size	Ø12.7	Ø9.53	Ø6.35	Ø6.35	Ø6.35	Ø6.35	Ø6.35	Ø6.35
Length	45	20	5	3	5	3	5	3

W_{14} = 45 x 0.12 = 5.4 kg
W_{15} = 20 x 0.07 = 1.4 kg
W_{16} = (5+3+5+3+5+3) x 0.03 = 0.72 kg

1.2) Indoor unit

Example:

Indoor Unit No.	0	1	2	3	4	5
Corresponding power (HP)	2	2	1	1	2	2
Additional refrigerant quantity	Indoor units that do not require ref. charge					

W_2 = 0 kg

Total

$W\ (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$
= 0 + 0 + 0 + 5.4+ 1.4 + 0.72 + 0 = 7.52 kg

2) Checking the maximum quantity of additional refrigerant charge: ($W < W_{MAX}$)

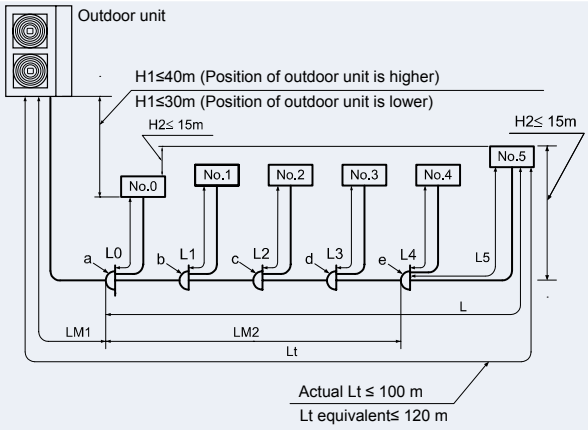
7.52 kg < 13.5 kg (CORRECT)

3) Total refrigerant charge: W_{TOT} (kg)= W_0 + W
W_0 : Outdoor unit refrigerant charge before shipment (kg)

W_{TOT} = 5.5 + 7.52 = 13.02 kg

NOTES:

- Refer to "Refrigerant piping work" to know all the information necessary for the calculation of the addtional refrigerant charge.
- Refer to "Additional refrigerant charge calculation" in this chapter to know the maximum quantity of additional refrigerant charge (W_{MAX}) and the outdoor unit refrigerant charge before shipment (W_0).

ITEM		MULTI-KITS DOWN-SIZE SYSTEM
Example of systems **4: Simple installation where the length from the outdoor unit (RAS-8FSNM(E)) to the first branch is over 70 m (Down-size)** This figure shows examples of 6 indoor units combined with one outdoor unit. The refrigerant pipes are shown as a single line in the diagrams. However, liquid line piping and gas line piping are required in the field.		
Total piping length		≤ 250 m
Maximum piping length	Actual length	Lt ≤ 100 m
	Equivalent length	Lt ≤ 120 m
Maximum lift between outdoor and indoor unit	In the case that the position of outdoor unit is higher than that of indoor unit.	H1 ≤ 40 m
	In the case that the position of outdoor unit is lower than that of indoor unit.	H1 ≤ 30 m
Maximum lift between each indoor unit or multi-kit and indoor unit		H2 ≤ 15 m
Maximum piping length between multi-kit and indoor unit	Between the “a” kit and the farthest indoor unit	L ≤ 40 m
	Between each multi-kit and each indoor unit	L0. L1. L2. L3. L4. L5 ≤ 15 m

Example: Outdoor unit: RAS-8FSNM(E)

Choice of each multi-kit

Mark	a	b,c,d,e
Multi-kit	MW-162AN	MW-102AN

1) Quantity of additional refrigerant charge.

The quantity is calculated by the following equation:

$W\ (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$

1.1) W_{11} (kg): (Total length (m) of Ø22.2 Liquid piping) x 0.39

W_{12} (kg): (Total length (m) of Ø19.05 Liquid piping) x 0.28

W_{13} (kg): (Total length (m) of Ø15.88 Liquid piping) x 0.19

W_{14} (kg): (Total length (m) of Ø12.7 Liquid piping) x 0.12

W_{15} (kg): (Total length (m) of Ø9.53 Liquid piping) x 0.07

W_{16} (kg): (Total length (m) of Ø6.35 Liquid piping) x 0.030

1.2) W_2 (kg): Total quantity of additional refrigerant of each indoor unit (kg)

1.1) Liquid piping

Example:

Mark	LM1	LM2	L0	L1	L2	L3	L4	L5
Size	Ø12.7 (*1)	Ø9.53	Ø6.35	Ø9.53	Ø9.53	Ø6.35	Ø9.53	Ø9.53
Length	76	15	5	3	5	3	5	3

W_{14} = 76 x 0.12 = 9.12 kg
W_{15} = 15 x 0.07 = 1.05 kg
W_{16} = (5+3+5+3+5+3) x 0.03 = 0.72 kg

1.2) Indoor unit

Example:

Indoor Unit No.	0	1	2	3	4	5
Corresponding power (HP)	1.5	1.5	1	1	1.5	1.5
Additional refrigerant quantity	Indoor units that do not require ref. charge					

W_2 = 0 kg

Total

$W\ (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$
= 0 + 0 +0 + 9.12+ 1.05 + 0.72 + 0 = 10.89 kg

2) Checking the maximum quantity of additional refrigerant charge: ($W < W_{MAX}$)

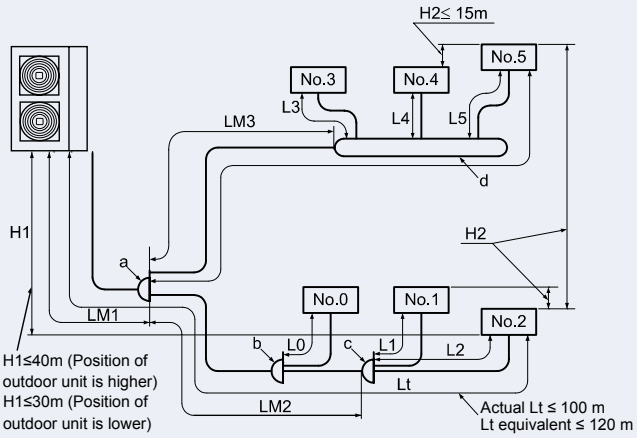
10.89 kg < 13.5 kg (CORRECT)

3) Total refrigerant charge: W_{TOT} (kg)= W_0 + W
W_0 : Outdoor unit refrigerant charge before shipment (kg)

W_{TOT} = 5.0 + 10.89 = 15.89 kg

NOTES:

- Refer to "Refrigerant piping work" to know all the information necessary for the calculation of the addtional refrigerant charge.
- Refer to "Additional refrigerant charge calculation" in this chapter to know the maximum quantity of additional refrigerant charge (W_{MAX}) and the outdoor unit refrigerant charge before shipment (W_0).
- (*1): When the equivalent refrigerant piping length is over 70 m in RAS-8FSN2E units (76 m in this example), the pipe size of the line from the outdoor unit to the first branch should be increased with the reducer (field supplied) from Ø9.53 to Ø12.7. In this case, use MW-162AN

ITEM		DOWN-SIZE DISTRIBUTOR AND MULTI-KITS SYSTEM WITH REDUCTION
Example of systems **5: Line distribution method where is needed an additional refrigerant charge for indoor unit. (Down-size)** This figure shows examples of 6 indoor units combined with one outdoor unit. The refrigerant pipes are shown as a single line in the diagrams. However, liquid line piping and gas line piping are required in the field.		
Total piping length		≤ 250 m
Maxmum piping length	Actual length	Lt ≤ 100 m
	Equivalent length	Lt ≤ 120 m
Maximum lift between outdoor and indoor unit	In the case that the position of outdoor unit is higher than that of indoor unit.	H1 ≤ 40 m
	In the case that the position of outdoor unit is lower than that of indoor unit.	H1 ≤ 30 m
Maximum lift between each indoor unit or multi-kit and indoor unit		H2 ≤ 15 m
Maximum piping length between multi-kit and indoor unit	Between the “a” kit and the farthest indoor unit	L ≤ 40 m
	Between each multi-kit and each indoor unit	L0. L1. L2. L3. L4. L5 ≤ 15 m

Example: Outdoor unit: RAS-12FSNM(E)

Choice of each multi-kit

Mark	a	b,c	d
Multi-kit	MW-162AN	MW-102AN	MH-84HAN

1) Quantity of additional refrigerant charge.

The quantity is calculated by the following equation:

$W (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$

1.1) W_{11} (kg): (Total length (m) of Ø22.2 Liquid piping) x 0.39

W_{12} (kg): (Total length (m) of Ø19.05 Liquid piping) x 0.28

W_{13} (kg): (Total length (m) of Ø15.88 Liquid piping) x 0.19

W_{14} (kg): (Total length (m) of Ø12.7 Liquid piping) x 0.12

W_{15} (kg): (Total length (m) of Ø9.53 Liquid piping) x 0.07

W_{16} (kg): (Total length (m) of Ø6.35 Liquid piping) x 0.030

1.2) W_2 (kg): Total quantity of additional refrigerant of each indoor unit (kg)

1.1) Liquid piping

Example:

Mark	LM1	LM2	LM3	L0	L1	L2	L3	L4	L5
Size	Ø12.7	Ø9.53	Ø9.53	Ø9.53	Ø6.35	Ø6.35	Ø6.35	Ø6.35	Ø6.35
Length	50	15	10	8	5	3	5	3	3

W_{14} = 50 x 0.12 = 6 kg;
W_{15} = (15+10+8) x 0.07 = 2.31 kg
W_{16} = (5+3+5+3+3) x 0.03 = 0.57 kg

1.2) Indoor unit

Example:

Indoor Unit No..	0	1	2	3	4	5
Corresponding power (HP)	8 (*1)	0.8	0.8	0.8	0.8	0.8
Additional refrigerant quantity	Indoor unit Nº0: 1 kg					

W_2 = 1 kg

Total

$W (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$
= 0 + 0 + 0 + 6 + 2.31 + 0.57 + 1 = 9.88 kg

2) Checking the maximum quantity of additional refrigerant charge: ($W < W_{MAX}$)

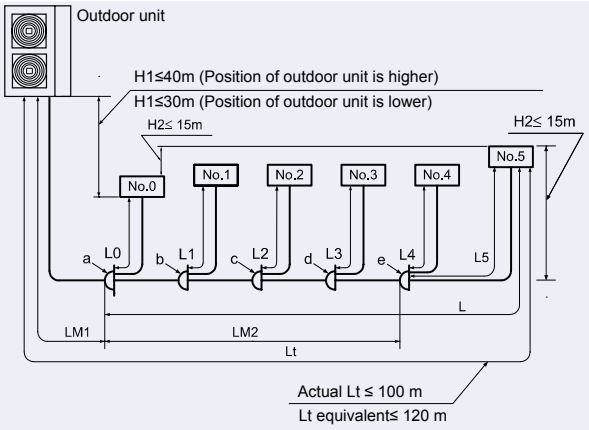
9.88 kg < 13.5 kg (CORRECT)

3) Total refrigerant charge: W_{TOT} (kg)= W_0 + W
W_0 : Outdoor unit refrigerant charge before shipment (kg)

W_{TOT} = 6.5 + 9.88 = 16.38 kg

NOTES:

- Refer to "Refrigerant piping work" to know all the information necessary for the calculation of the addtional refrigerant charge.
- Refer to "Additional refrigerant charge calculation" in this chapter to know the maximum quantity of additional refrigerant charge (W_{MAX}) and the outdoor unit refrigerant charge before shipment (W_0).
- (*1): When the outdoor unit is combined with indoor units RPI-8/10FSN2E, it´s necessary an additional refrigerant charge (W_2) = 1 kg/unit.

ITEM		MULTI-KITS DOWN-SIZE SYSTEM
Example of systems **6: Simple installation where the additional refrigerant charge is over the maximum additional refrigerant charge allowed by the unit. (Down-size)** This figure shows examples of 10 indoor units combined with one outdoor unit. The refrigerant pipes are shown as a single line in the diagrams. However, liquid line piping and gas line piping are required in the field.		
Total piping length		≤ 250 m
Maximum piping length	Actual length	Lt ≤ 100 m
	Equivalent length	Lt ≤ 120 m
Maximum lift between outdoor and indoor unit	In the case that the position of outdoor unit is higher than that of indoor unit.	H1 ≤ 40 m
	In the case that the position of outdoor unit is lower than that of indoor unit.	H1 ≤ 30 m
Maximum lift between each indoor unit or multi-kit and indoor unit		H2 ≤ 15 m
Maximum piping length between multi-kit and indoor unit	Between the “a” kit and the farthest indoor unit	L ≤ 40 m
	Between each multi-kit and each indoor unit	L0. L1. L2. L3. L4. L5 ≤ 15 m
Example: Outdoor unit: RAS-12FSNM(E)		
Choice of each multi-kit		Mark: a = MW-162AN; b,c,d,e = MW-102AN
1) Quantity of additional refrigerant charge. The quantity is calculated by the following equation: $W (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$ 1.1) W_{11} (kg): (Total length (m) of Ø22.2 Liquid piping) x 0.39 W_{12} (kg): (Total length (m) of Ø19.05 Liquid piping) x 0.28 W_{13} (kg): (Total length (m) of Ø15.88 Liquid piping) x 0.19 W_{14} (kg): (Total length (m) of Ø12.7 Liquid piping) x 0.12 W_{15} (kg): (Total length (m) of Ø9.53 Liquid piping) x 0.07 W_{16} (kg): (Total length (m) of Ø6.35 Liquid piping) x 0.030 1.2) W_2 (kg): Total quantity of additional refrigerant of each indoor unit (kg)	1.1) Liquid piping	**Example:** Mark: LM1 / LM2 / L0 / L1 / L2 / L3 / L4 / L5 Size: Ø12.7 / Ø9.53 / Ø6.35 / Ø6.35 / Ø9.53 / Ø9.53 / Ø9.53 / Ø9.53 Length: 72 / 15 / 11 / 11 / 13 / 13 / 10 / 12 W_{13} = 72 x 0.12 = 8.64 kg; W_{14} = (15+13+13+10+12) x 0.07 = 4.41 kg W_{15} = (10+12) x 0.03 = 0.66 kg
	1.2) Indoor unit	**Example:** Indoor Unit No.. / Corresponding power (HP): 0: 1; 1: 1; 2: 2.5; 3: 2.5; 4: 2.5; 5: 2.5 Additional refrigerant quantity: Indoor units that do not require ref. charge W_2 = 0 kg
	Total	$W (kg) = W_{11}+W_{12}+W_{13}+W_{14}+W_{15}+W_{16}+W_2$ = 0 + 0 + 0 + 8.64 + 4.41 + 0.66 + 0 = 13.71 kg
2) Checking the maximum quantity of additional refrigerant charge: ($W < W_{MAX}$)		13.71 kg > 13.5 kg (INCORRECT) *(1)
3) Total refrigerant charge: W_{TOT} (kg)= W_0 + W W_0 : Outdoor unit refrigerant charge before shipment (kg)		W_{TOT} = 6.5 + 13.71 = 20.21 kg

NOTES:

- Refer to "Refrigerant piping work" to know all the information necessary for the calculation of the addtional refrigerant charge.
- Refer to "Additional refrigerant charge calculation" in this chapter to know the maximum quantity of additional refrigerant charge (W_{MAX}) and the outdoor unit refrigerant charge before shipment (W_0).
- (*1): When the additional refrigerant charge is over the maximum additional refrigerant charge allowed by the unit, it's necessary to adjust the piping length of the installation.

7.4. Caution on refrigerant leakage

7.4.1. Maximum permissible concentration of HCFC/HFC gas

The refrigerant R410A, charged in the Set Free FSNM(E) 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 HCFC/HFC gas, R410A in air is 0.44 kg/m³, according to EN378-1

Therefore, some effective measure must be taken to lower the R410A concentration in air below 0.44 kg/m³, in case of leakage.

7.4.2. Calculation of refrigerant concentration

1. Calculate the total quantity of refrigerant R (kg) charged in the system connecting all the indoor units of 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.

$$\frac{R}{V} \leq C$$

R: Total quantity of charged refrigerant (kg)
V: Room volume (m³)
C: Refrigerant concentration 0.44 kg/m³ for R410A

7.4.3. Countermeasure for refrigerant leakage

The facility must have the following features in case of fire:

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. Provide a ventilator, linked with a gas leak detector, of 0.4 m^3/min. or more ventilating capacity per Japanese Refrigeration Ton (= compressor displacement 5.7 m^3/h) of the air conditioning system utilizing refrigerant R410A.

Model	Tonnes
RAS-8~12FSNM(E)	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.

8. Electrical Data

This chapter describes the electrical requirements for each unit of the HITACHI SET FREE FSNM(E) Series.

Contents

8.1. Electrical data for RAS-8~12FSNM(E)

Model	Main Unit Power			Applicable Voltage		Compressor and Fan Motors						Max. IPT [kW]	Max. Cur. [A]
	U [V]	PH	f [Hz]	U max. [V]	U min [V]	PH	STC [A]	Cooling Operation		Heating Operation			
								IPT [KW]	RNC [A]	IPT [KW]	RNC [A]		
RAS-8FSNM	380/415	3	50	456	342	3	8/8	6.30	10.3/9.4	5.90	9.6/8.8	8.2	14
RAS-10FSNM							8/8	8.30	13.6/12.4	7.80	12.7/11.7	10.8	18
RAS-12FSNM							8/8	10.70	17.3/15.8	9.90	16.0/14.7	13.9	23

U: Power voltage
PH: Phase (φ)
f: Frequency
STC: Starting current
RNC: Operating current
IPT: Total input power
Cur: Current

NOTES:

1. The above performance data is based on 100% capacity combination of the indoor units and rated operating compressor frequency.
2. The above performance data is based on 7.5 m equivalent piping length and 0 m piping lift.
3. The compressor is started by an inverter, resulting in extremely low starting current.

9. Electrical Wiring

This chapter describes the electrical wiring connections and how to set the dip switches of the HITACHI SET FREE FSNM(E) Series.

Contents

9.1 General Check

WARNING:

- *Turn OFF the main power switch on the indoor and outdoor units before carrying out electrical wiring or regular checks.*
- *Check to ensure that the indoor fan and the outdoor fan have stopped before electrical wiring work or a periodical check is performed.*
- *Protect wires, drainpipe, electrical parts, etc. from rats or other small animals.*
  If all these parts are not protected, rats or other small animals may gnaw at them and possibly cause a fire.
- *Make sure the wires are not touching the refrigerant pipes, plate edges and electrical parts on the inside of the unit.*
  Otherwise the wires will be damaged and may cause a fire.

WARNING:

Secure the wires firmly with the clamp to the inside of the indoor unit.

NOTE:

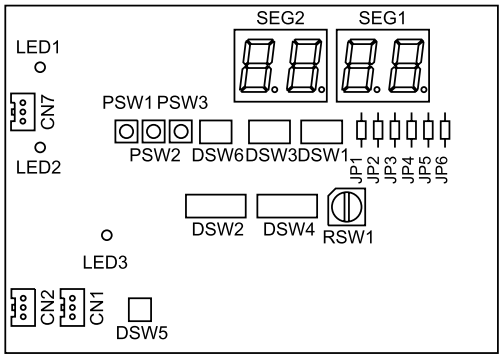
Fix the rubber bushes with adhesive when the outdoor unit ducts are not used.

1. *Make sure that the field-supplied electrical components (main power switches, circuit breakers, wires, duct connectors and wire terminals) have been properly selected according to the electrical data in this technical catalog. Make sure that the components comply with the National Electrical Code (NEC).*
2. *Check to ensure that the power supply voltage is within ± 10% of the rated voltage.*
3. *Check the capacity of the electrical wiring. If the power source capacity is too low, the system cannot be started due to voltage drop.*
4. *Check to ensure that the earth wire is connected.*
5. *Main power source switch*
   Install a multi-pole main switch with a space of 3.5mm or more between each phase.

9.2. Setting and Function of DIP Switches for RAS-8~12FSNM(E)

Quantity and position of DIP Switches.The PCB in the outdoor unit is operated with 6 types of dip switches and 3 types of push switch.

PCB1



NOTE:

- *The mark "■" indicates position of dips switches. Figures show setting before shipment or after selection.*
- *By using DSW4, the unit is started or stopped after 10 to 20 seconds after the switch is operated.*
- *Number this outdoor unit to distinguish from other outdoor units for service and maintenance. And write the number in the space right.*

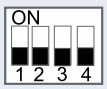
CAUTION:

- *Before setting dips switches, firstly turn off power source and set the position of the dips switches. If the switches are set without turning off the power source, the contents of the setting are invalid.*

◆ DSW1: Test operation and service setting

Setting is required, for test operation and operating the compressor.

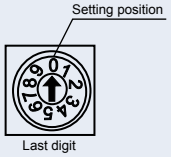
- **DSW1**

Setting before shipment	
Test cooling operation	
Test heating operation	
Compressor forced stop	

- **RSW1: Ref. cycle Nº setting**

  Setting is required.

  Set by inserting slotted screwdriver into the groove.

Setting before shipment	

◆ DSW2: Optional function setting

Setting is required, when optional functions are required.

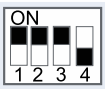
Setting before shipment	

Set the designated pin ON for the setting items in the table.

Setting Item	Pin No.
-	1
-	2
-	3
-	4
Function setting	5
External Input/Output selection	6

◆ DSW3: Capacity setting

No setting is required.

Model	Setting Position
RAS-8FSNM(E)	
RAS-10FSNM(E)	
RAS-12FSNM(E)	

◆ DSW4: Ref. Cycle Nº setting

Setting is required

Setting before shipment	 (Setting for the ten digit)

DSW5: End terminal resistance

No setting is required

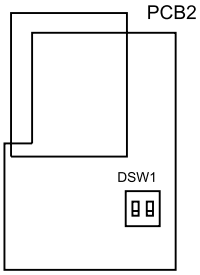
Setting before shipment	

DSW6: Height difference

Setting is required

Setting before shipment	
The indoor unit is located higher than outdoor unit (20 to 30 m)	
Fine-tuning of heating capacity	

PCB2



DSW1: (On PCB2)

No setting is required

When set Nº1 pin to ON, the electric current detection is canceled. Nº 1 pin should be set back to OFF after electrical work.	

JP1~6: Jumper cable

Nº	380-415V 50 Hz	Nº	380-415V 50 Hz
JP1	●	JP4	✕
JP2	●	JP5	●
JP3	✕	JP6	●

● With jumper cable
✕ Without jumper cable

Jumper cable setting is different depending on the power supply voltage. Make sure to check the jumper cable setting before exchanging PCB1.
Pay attention not to damage other electric parts when cutting jumper cables.

CAUTION:

If the power source is open phase, "05" will be displayed at 7-segment on the outdoor PCB, and the compressor will not be operated. In this case check for the connection of power source terminal.

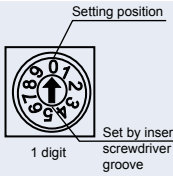
Setting for transmitting

It is required to set the refrigerant cyce Nos and end terminal resistance for this H-LINK or H-LINKII system.

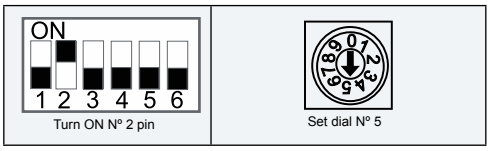
Setting of Refrigerant Cycle No.

In the same refrigerant cycle, set the same refrigerant cycle Nº for the outdoor unit and the indoor units as shown below.

As for setting indoor unit refrigerant cycle Nº, set the RSW2 and DSW5 on the indoor unit PCB.

	Setting Switch	
	 10 digit	 1 digit
Outdoor unit	DSW4	RSW1
Indoor unit (H-LINK II)	DSW5	RSW2

Ex.: In case of setting refrigerant cycle Nº 25

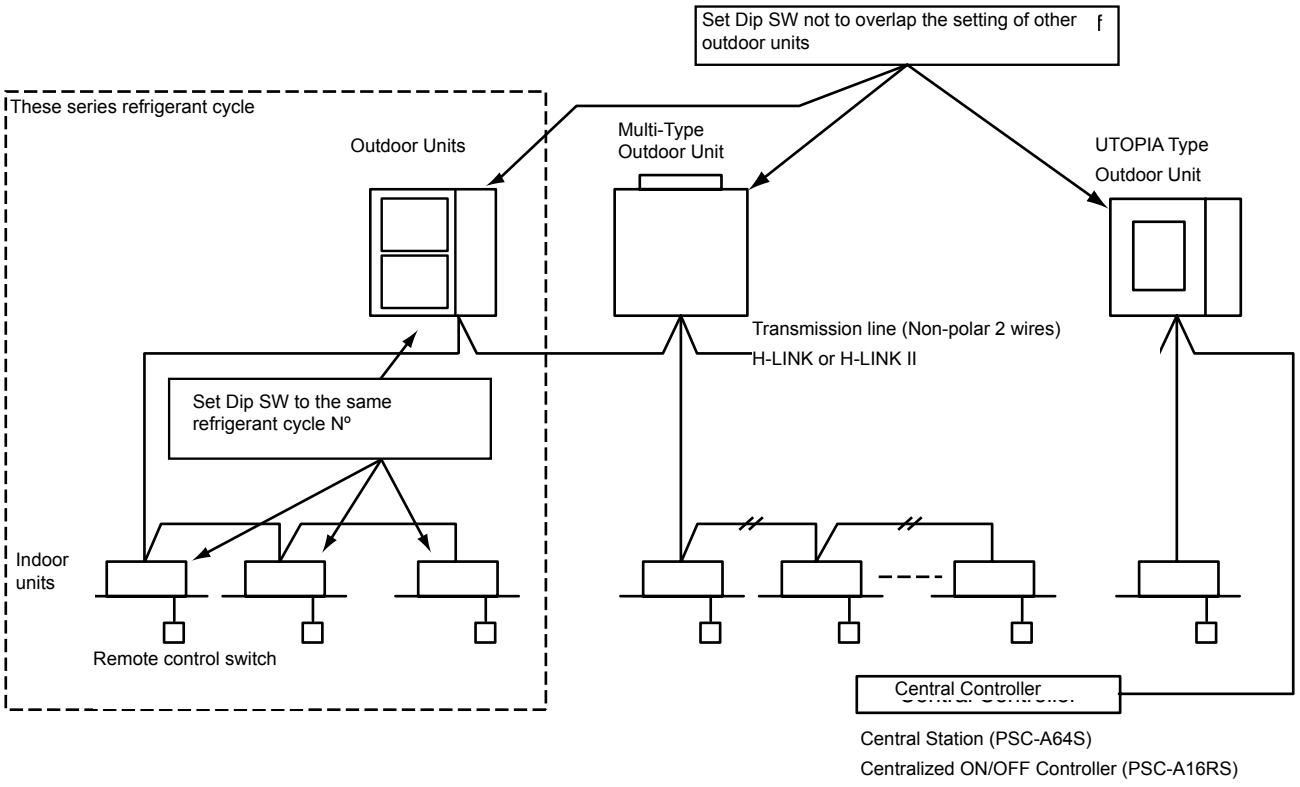


DSW and RSW setting before shipment is 0.
Maximum in setting refrigerant cycle No. is 63.

Setting of end terminal resistance

Before shipment, No. 1 pin of DSW5 is set at the “ON” side. In the case that the outdoor units quantity in the same H-LINK or H-LINKII is 2 or more, set No. 1 pin of DSW5 at the “OFF” side from the 2nd unit. If only one outdoor unit is used, no setting is required.

Setting of end terminal resistance	
DSW5	
Before shipment	Cancellation
	



Maximum Units per Refrigerant System
(In Case of H-LINK II)

Outdoor Unit	64 units
Indoor Unit	160 units

NOTE

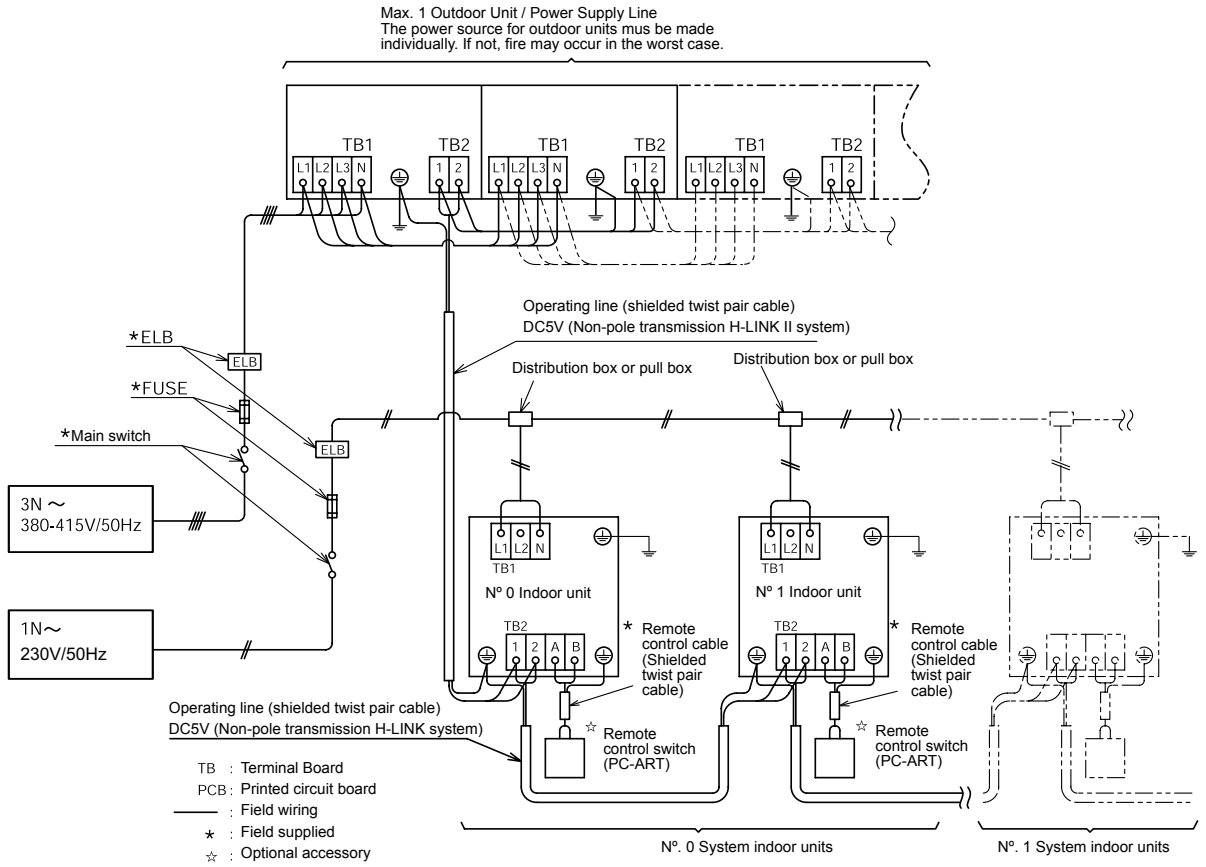
If H-LINK II adaptive and non-adaptive indoor and outdoor unit are connected together, the maximum indoor units to be connected are 128 units.

9.3. Common Wiring

9.3.1. Electrical Wiring between Indoor and Outdoor Units

- Connect the electrical wires between the indoor unit and the outdoor unit as shown below.
- 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 0.75mm^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 300m. 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.

WARNING:
Take care with the connection of the operating line. Incorrect connection may cause a failure of the PCB.



9.4. Wiring Size

◆ Connection Wiring

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

◈ Indoor units

Model	Power Supply	Maximum Current (A)	Size of Power Supply Cable	Size of Transmission Cable
			EN60 335-1 ❶	EN60 335-1 ❶
All indoor units (*)	230V/1 phase/50Hz	5.0	0.75mm²	0.75mm²
RPI-8/10		10.0	1.5mm²	

(*) Except RPI-8/10

◈ Outdoor units

Model	Power Supply	Maximum Current	Power Source Cable Size		Transmitting Cable Size
			EN60 335-1 *1	MLFC *2	Shielded Twist Pair Cable
RAS-8FSNM(E)	380-415V/50Hz 380V/60Hz	14	2.5mm²	2.0mm²	0.75mm²
RAS-10FSNM(E)		18	4.0mm²	3.5mm²	
RAS-12FSNM(E)		23	4.0mm²	3.5mm²	

* Refer to the notes for selection of the power source cable size.

NOTES:

1. Follow local codes and regulations when selecting field wires.
2. The wire sizes marked with *1 in the table of this page are selected at the maximum current of the unit according to the European Standard, EN60 335-1. Use the wires which are not lighter than the ordinary tough rubber sheathed flexible cord (code designation H05RN-F) or ordinary polychloroprene sheathed flexible cord (code designation H05RN-F).
3. The wire sizes marked with *2 in the table of this page are selected at the maximum current of the unit according to the wire, MLFC (Flame Retardant Polyflex Wire) manufactured by Hitachi Cable Ltd., Japan.
4. Use a shielded cable for the transmitting circuit and connect it to ground.
5. In the case that power cables are connected in series, add each unit maximum current and select wires below.

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

◆ Main Switch Protection

Select the main switches according to the following table.

◈ Indoor units

Model	Power Source	Maximum Running Current (A)	CB(A)	ELB no. poles/A/mA
All indoor units (*)	1~230V/50Hz	5.0	6	2/40/30
RPI-(8.0/10.0)FSN2E		10.0	16	

(*) Except RPI-8/10

◈ Outdoor units

Model	Power Source	Maximum Running Current (A)	CB(A)	ELB no. poles/A/mA
RAS-8FSNM	3~380-415V/50Hz	14.0	20	4/20/30
RAS-10FSNM		18.0	30	4/30/30
RAS-12FSNM		23.0	30	4/30/30

NOTE:

ELB: Differential switch.
CB: Magnetothermic switch.

10. Optional Functions Available

This chapter gives a brief explanation of the optional functions available for the new SET FREE FSNM series.

Contents

10.1.Optional Functions Available for Outdoor Units

Optional functions	
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.
Thermostatic stoppage order.	When this function is activated the compressor is stopped and the indoor units are put under Thermo-OFF condition.
Snow sensor	This function operates all the outdoor fans at full speed during compressor stoppage if it detects the snow sensor is covered.
Enforced stoppage	This function produces and emergency stoppage, compressor and indoor fans do not operate.
Changeover of defrosting condition	This function changes the defrosting operation conditions. It is especially useful in cold areas.
Demand Current Control	This function regulates Outdoor running current, 60%, 70%, 80%, if demanded current is above set current the indoor unit capacity is reduced still thermo off if needs
Indoor unit fan control during thermo-OFF at heating	This function activates the Indoor fans as a cycle (2 min ON, 6 min OFF) in order to reduce the unpleasent aspects of Indoor Thermo-OFF working conditions.
Cancellation of heating outdoor ambient temperature limit	This function allows to operate in heating mode without upper ambient temperatures restriction.
Cancellation of cooling outdoor ambient temperature limit	This function allows to operate in cooling mode without low ambient temperatures restriction.
Night mode (low sound) operation	This function decreases the sound levels of the units, and the cooling capacity is also decreased.
Slow defrost setting	When this function is activated the indoor fan speed at defrost mode changes to slow instead of stopping the fan.
Cancellation of Outdoor Hot-Start Limit	This function allows to start the Outdoor unit without waiting the Temperature of compressor is bigger than 40ºC
Piping length setting	This function indicates to the unit the distance between the Outdoor and the farthest indoor unit is bigger than 100 m.
Low noise setting	This function reduces the maximum speed of the fan motor, consequently the noise level is reduced.
Wave function setting	This function regulates Outdoor running current, if demanded current is above set current the indoor unit capacity is reduced still thermo off if needs. The running current control is not a fixed value it is changing between a maximum value.
Priority Cooling Capacity Mode	
Priority Heating Capacity Mode	
Cold Draft (1/2)	IU discharge air temperature is to low the OU is changing the working conditions in order to avoid this low temperature air discharge
Signal Capture	This function provides information on the units operation, (Operation, Alarm, Compressor ON, Defrosting Signals) so the necesary devices can be activated
Signal capture	This function provides information on the unit's operations so the necessary devices can be activated.

Available

Not available

11. Troubleshooting

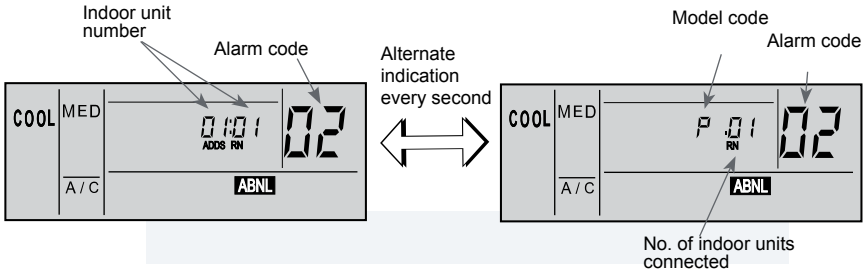
This chapter provides you with a concise description of the most common alarm codes of the new SET FREE FSNM (E) Series.

Contents

If RUN lamp flashes for 2 seconds, there is a failure in transmission between the indoor unit and the remote control switch. Possible causes are:

The remote cable is broken
Contact failure in remote control cable
IC or microcomputer defective
In all cases, contact your service provider.

If RUN lamp flashes 5 times (5 seconds) with unit number and alarm code displayed, note the alarm code (see table below) and contact your service provider.



11.1. Alarm Codes for FSNM(E) Series

Code	Category	Content of Abnormality	Leading Cause
01	Indoor Unit	Activation of Protection Device	Activation of Float Switch, High Level in Drain Pan
02	Outdoor Unit	Activation of Protection Device	Activation of PSH, Pipe Clogging, Excessive Refrigerant, Inert Gas Mixing
03	Transmission	Abnormality between Indoor and Outdoor (or Outdoor and Outdoor)	Incorrect Wiring, Loose Terminals, Disconnect Wire, Tripping of Fuse
04		Abnormality between Inverter PCB and Outdoor PCB	Transmission Failure (Loose Connector)
05	Supply Phase	Abnormality Power Source Phases	Incorrect Power Source, Connection to Reversed-Phase, Open Phase
06	Voltage	Abnormal Inverter Voltage	Outdoor Voltage Drop, Insufficient Power Capacity
07	Cycle	Decrease in Discharge Gas Superheat	Excessive Refrigerant Charge, Failure of Thermistor, Incorrect Wiring
08		Increase in Discharge Gas Temperature	Insufficient Refrigerant Charge, Pipe Clogging, Failure of Thermistor, Incorrect Wiring
11	Sensor on Indoor Unit	Inlet Air Thermistor	Incorrect Wiring, Disconnecting Wiring
12		Outlet Air Thermistor	
13		Freeze Protection Thermistor	
14		Gas Piping Thermistor	
19	Fan Motor	Activation of Protection Device for Indoor Fan	Fan Motor Overheat, Locking
21	Sensor on Outdoor Unit	High Pressure Sensor	Incorrect Wiring, Disconnecting Wiring
22		Outdoor Air Thermistor	
23		Discharge Gas Thermistor	
24		Evaporating Piping Thermistor	
29		Low Pressure Sensor	
31	System	Incorrect Capacity of Outdoor Unit and Indoor Unit	Incorrect Setting of Capacity Combination
35		Incorrect Setting of Indoor Unit No.	Duplication of Indoor Unit No.
38		Abnormality of Protective Circuit in Outdoor Unit	Failure of Protection Detecting Circuit (Failure of Protection Detecting Device, Abnormality of Outdoor PCB, Incorrect Wiring of PCB)
43	Protection Device	Activation of Low Pressure Decrease Protection Device	Defective Compression (Failure of Compressor of Inverter, Loose Power Supply Connection)
44		Activation of Low Pressure Increase Protection Device	Overload at Cooling, High Temp. at Heating, Locking (Loose Connector)
45		Activation of High Pressure Increase Protection Device	Overload Operation (Clogging, Short-Pass), Pipe Clogging, Insufficient Refrigerant, Inert Gas Mixing
47		Activation of Low Pressure Decrease Protection Device (Vacuum Operation)	Insufficient Refrigerant, Refrigerant Piping Clogging, Locking (Loose Connector)
48		Activation of Inverter Overcurrent Protection Device	Overload Operation, Compressor Failure
51	Sensor	Abnormal current sensor	Current sensor failure
53	Inverter	Inverter error signal detection	Driver IC Error Signal Detection (Protection for Overcurrent, Low Voltage, Short-Circuit)
54		Increase of inverter fin temperature	Abnormal inverter fin thermistor, heat exchanger clogging, abnormal fan
55		Inverter failure	Inverter PCB failure
57	Outdoor fan motor	Abnormality of fan motor	Disconnecting wiring or incorrect wiring between control PCB (PCB1) and Fan Relay PCB (PCB3, PCB5), Failure of Fan Motor
EE	Compressor	Compressor protection alarm	Failure of compressor
b1	Outdoor unit no. Setting	Incorrect outdoor unit no. Setting	Over 64 No. is set for address or refrigerant cycle.
b5	Indoor unit No. Setting	Incorrect indoor unit no. Setting	More than 17 non-corresponding to H-LINKII Units are Connected to One System.

CE

Hitachi Air Conditioning Products Europe, S.A.
Ronda Shimizu,1 - Políg. Ind. Can Torrella
08233 Vacarisses (Barcelona) España
ISO 9001 Certified by AENOR, Spain
ISO 14001 Certified by AENOR, Spain

Hitachi Appliances, Inc.
Shimizu-shi, Shizuoka-ken, Japan
ISO 9001 Certified by JQA, Japan
ISO 14001 Certified by JQA, Japan

Hitachi Air Conditioning Products (M) Sdn. Bnd.
Lot No. 10, Jalan Kemajan Bangi Industrial Estate
43650 Bandar Baru Bangi, Selangor Darul Ehsan, Malaysia
Certification ISO 9001, Malaysia
Certification ISO 14001, Malaysia

HITACHI
Inspire the Next

TCGB0059 rev.0 - 04/2009 - Printed in Spain