MITSUBISHI ELECTRIC

Changes for the Better

AIR CONDITIONING SYSTEMS

CITY MULTI

R32 City Multi Technical Manual

System Design and General Safety Considerations

2nd edition

R32 City Multi Technical Manual

1. INTRODUCTION 2
2. R32 REFRIGERANT 3
2-1. R32 refrigerant characteristics 3
3. INSTALLATION REQUIREMENTS FOR R32 REFRIGERANT 5
3-1. Safety measures against refrigerant leaks specified in IEC60335-1 and IEC60335-2-40 5
3-2. Compliance of Mitsubishi City Multi air conditioning systems with IEC60335-1/IEC60335-2-40 5
3-3. Refrigerant leakage prevention for the lowest basement 11
3-4. Precautions for shut off devices (Shut off valve kit [CMR-M100KT-E] and BC controller [CMB-M-V-MA/MB-SV(-TR)]) 12
3-5. Precautions for installing indoor units 18
3-6. Precautions for installing alarm device (MA remote controller, model name: PAR-42MAAB or later) 20
3-7. Setting up an independent power supply for the sensor and alarm kit (PAC-SL72SA-E) — EN378 requirement 28
3-8. Precautions for mesh ceiling 30
3-9. Restrictions on installation environment of outdoor units 31

This manual is for the following models that use R32 refrigerant.
*For the latest applicable models, check with local distributors.

Outdoor unit

Category	Model
Heat Recovery R2-Series	PURY-M_YXM-A (-BS)
Heat Recovery R2-Series (High efficiency)	PURY-EM_YXM-A (-BS)
Heat Pump Y-Series	PUHY-M_YXM-A (-BS)
Heat Pump Y-Series (High efficiency)	PUHY-EM_YXM-A (-BS)

BC Controller

Category	Model
Main BC Controller	CMB-M_V-MA-SV
Sub BC Controller	CMB-M_V-MB-SV

Indoor unit

Category	Model
Ceiling cassette (4-way flow type)	PLFY-MS_VEM2-E
	PLFY-MS_VFM2-E
Ceiling concealed (Low static pressure type)	PEFY-MS_VMS(L)-A
Ceiling concealed (Medium static pressure type)	PEFY-MS_VMA(L)-A1
Ceiling concealed (High static pressure type)	PEFY-MS_VMHS-A
Ceiling suspended	PCFY-MS_VKM2-E
Wall mounted	PKFY-MS_VLM2-E
	PKFY-MS_VKM2-E

2-1. R32 refrigerant characteristics

2-1-1. Chemical characteristics

R32, one of the two components of R410A, is a less toxic and chemically stable hydrofluorocarbon. Because R32 has an atmospheric lifespan of just 4.9 years, it has little impact on global warming. However, since R32 has a high percentage of hydrogen, it is slightly flammable.

<Comparison table of R32 and R410A characteristics>

	HFC	
Refrigerant	R32	R410A
Component	HFC32	HFC32/HFC125
Composition (%)	100	50/50
Type	Single refrigerant	Near-azeotropic refrigerant mixture
Chlorine	Not contained	Not contained
Safety class	A2L	A1/A1
Pressure (physical property) [MPa (abs)] *1	3.14	3.07
Boiling point [°C]	-51.7	-51.4
Vapor pressure (25°C) [MPaG]	1.588	1.557
Ozone Depletion Potential (ODP) *2	0	0
Global Warming Potential (GWP) *3	675	2090
Charging	Liquid and gas charging	Liquid charging
Additional charging when refrigerant leaks	Allowed	Allowed

*1 Physical property at 50°C

*2 Relative to CFC11

*3 GWP = Global Warming Potential (Each value is based on the IPCC Forth Assessment Report.)

2-1-2. Pressure characteristics

As shown in the table below, the vapor pressure of R32 is almost as high as that of R410A at the same temperatures. As with R410A, perform installation and servicing with high-pressure resistant tools and materials.

<Comparison table of saturated vapor pressure> Unit (MPa)

Temperature (°C)	Refrigerant	
	R32	R410A
-20	0.30	0.30
0	0.71	0.70
20	1.37	1.34
40	2.38	2.32
60	3.84	3.73
65	4.29	4.17

* The figures are calculated using NIST REFPROP V8.0.

2-1-3. Flammability

R32 may burn slightly if the following conditions (gas concentration and ignition energy) are met.

[1] Flammable gas concentration (when mixed with air)

R32 may burn if within the following flammable range when an ignition source is near. However, in comparison with propane, for example, R32 may not burn unless its concentration is higher than that of isobutane. Although the flammable concentration range of R32 could lead to oxygen deficiency (oxygen level of less than 18%), this is not typical in normal working environments.

<Flammable range> Unit (vol%)

	R32	(Reference) R600a (isobutane)
Upper limit	29.3	8.6
Lower limit (source: ISO 817)	14.4	1.57

[2] Energy required for ignition

R32 requires a large amount of energy for ignition and will not be ignited by static electricity from the human body or sparks from an electronic lighter (energy: a few mJ). Therefore, it can be said that R32 is harder to ignite than isobutane.

<Minimum ignition energy> Unit (mJ)

	R32	(Reference) R600a (isobutane)
Minimum ignition energy	15	0.62

[3] Combustion speed

Since the combustion speed of R32 is slow, it does not burn explosively like isobutane.

<Combustion speed> Unit (cm/s)

	R32	(Reference) R600a (isobutane)
Combustion speed	6.7	34.2

As noted above, R32 will not ignite under normal air conditioning or working conditions. However, in the event of ignition, be careful of spreading flames.

3-1. Safety measures against refrigerant leaks specified in IEC60335-1 and IEC60335-2-40

Since R32 refrigerant is slightly flammable, refrigerant charge limits or installation of safety devices as shown below, are required to avoid the risk of fire in the room if the refrigerant leaks.
The installation of safety devices is required if the refrigerant concentration exceeds LFL × CF in the room in case of a refrigerant leak (in ENHANCED TIGHTNESS REFRIGERATING SYSTEMS).
For details, refer to 3-4. "Precautions for shut off devices (Shut off valve kit [CMR-M100KT-E] and BC controller [CMB-M-V-MA/MB-SV(-TR)])".

Refrigerant gas charge limit

$$m \leq LFL \times CF \times A \times h_r$$

m : Refrigerant gas amount (kg)
A : Floor area (m^2)
h_r : Leakage height (m)
CF : Concentration factor

or

Implementing safety measures

Shut off device or Circulation airflow system or Ventilation system or Natural ventilation or Alarm

* LFL: Lower Flammability Limit (kg/m^3)
refers to the minimum concentration of refrigerant that can propagate a flame when uniformly mixed with air.
R32: 0.307(kg/m^3)

Note
What is IEC60335-1/IEC60335-2-40?
→Safety Standard for Household and Similar Electrical Appliances
♦IEC60335-1: Household and similar electrical appliances - Safety – Part 1: General requirements
♦IEC60335-2-40: Household and similar electrical appliances - Safety – Part 2-40: Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers

3-2. Compliance of Mitsubishi City Multi air conditioning systems with IEC60335-1/IEC60335-2-40

To comply with IEC60335-1/IEC60335-2-40, Mitsubishi R32-compatible City Multi air conditioning systems have optional safety devices listed below. The following shut off devices comply with the requirements for ENHANCED TIGHTNESS REFRIGERATING SYSTEMS.

Shut off device

♦Shut off valve kit (CMR-M100KT-E) *For Y-Series
♦BC controller (CMB-M***V-MA/MB-SV(-TR)) *For R2-Series

Detector/Alarm

♦Alarm: MA remote controller (PAR-42MAAB and later)
♦Detector: The indoor units are equipped with a built-in refrigerant sensor. (For applicable models, refer to the catalogs.)
♦Sensor and alarm kit: Sensor and alarm kit (PAC-SL72SA-E)
*For R2, a power supply interface for alarm kit may be necessary for connection.

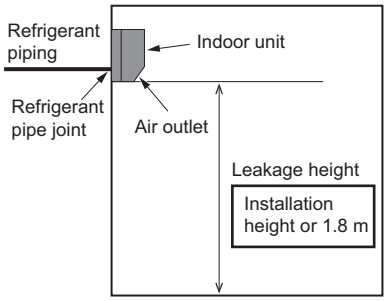
For your reference, the following shows the selection flow of R32-compatible City Multi air conditioning systems and safety equipment, as well as installation illustrations of the safety devices against refrigerant leaks into the room.

Note
Check the following when selecting or installing safety devices.
♦The M-NET remote controller (ME remote controller) cannot be connected to R32 air conditioning systems.
♦Reassess the safety measures if you change the room layout.
♦Check whether each indoor unit is used in large space or with a safety device.
♦Shut off devices used as safety devices differ between the City Multi Y-Series and R2-Series.

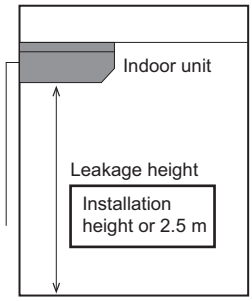
3-2-1. For indoor leakage height

Leakage height refers to the distance from the floor to a potential refrigerant leak point, and is defined as the lesser of either the installation height of the indoor unit or the installation height of the refrigerant piping joint (excluding brazed joints) connected to the indoor unit. For details, see the illustrations below. The installation height of the indoor unit is the distance from the floor to the bottom of the air outlet.

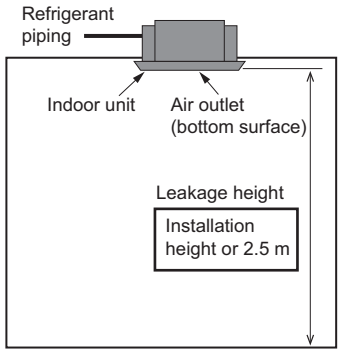
(1) Leakage height for wall-mounted indoor unit



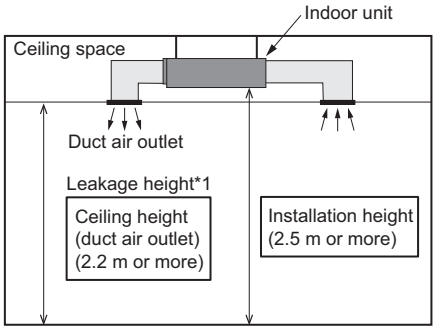
(2) Leakage height for ceiling suspended indoor unit



(3) Leakage height for ceiling cassette indoor unit



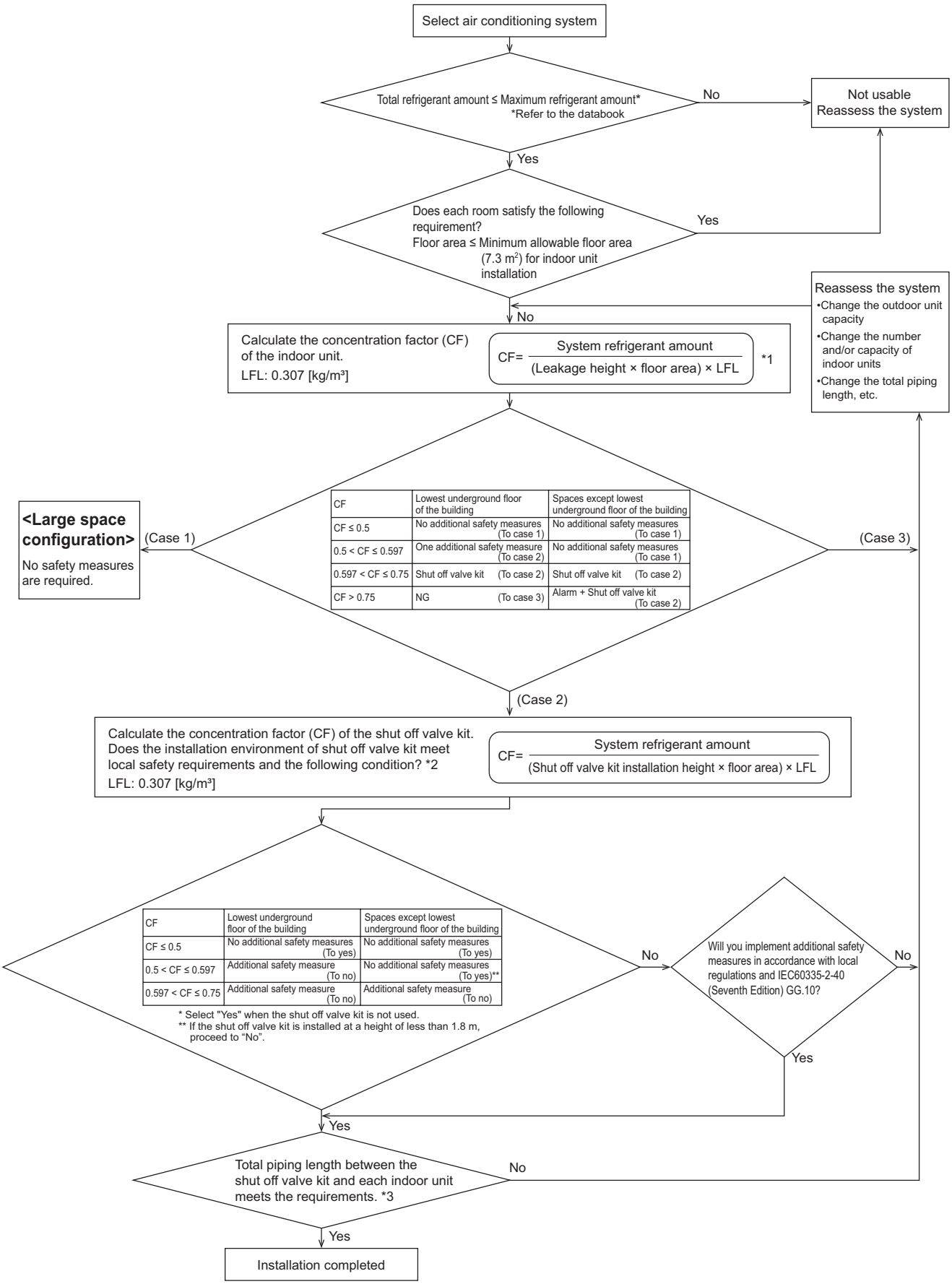
(4) Leakage height for ceiling concealed indoor unit



*1 When installing a duct for ceiling concealed models, the leakage height is defined as the installation height of the ceiling (duct air outlet).

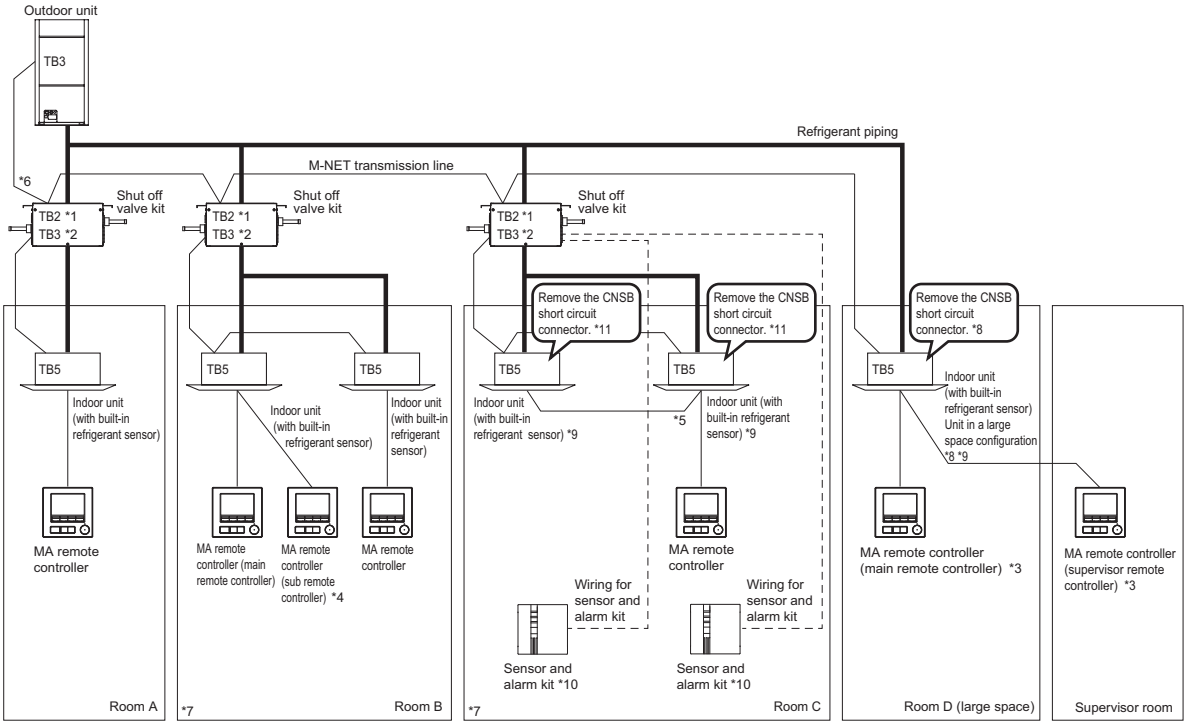
■City Multi Y-Series

<Safety measure selection flow>



*1 For details, refer to **3-4-1. "[1] Determining the necessity of the additional safety measure"**.
*2 For details, refer to **3-4-1. "[2] Shut off valve kit installation requirements"**.
*3 For details, refer to **3-4-1. "[3] Shut off valve kit installation requirements (for piping length)"**.
* Regardless of whether an air conditioning system is installed in the lowest basement or not, ensure that the total refrigerant amount of the air conditioning system with the highest refrigerant amount in the building, when divided by the volume of the lowest basement, does not exceed the LFL × CF. For details, refer to **3-3. "Refrigerant leakage prevention for the lowest basement"**.
* Installation requirements may be defined by the New Design Tool Software of Mitsubishi Electric Corporation.
* If any safety measure is used, either a built-in refrigerant sensor in the indoor unit or a sensor and alarm kit is required.

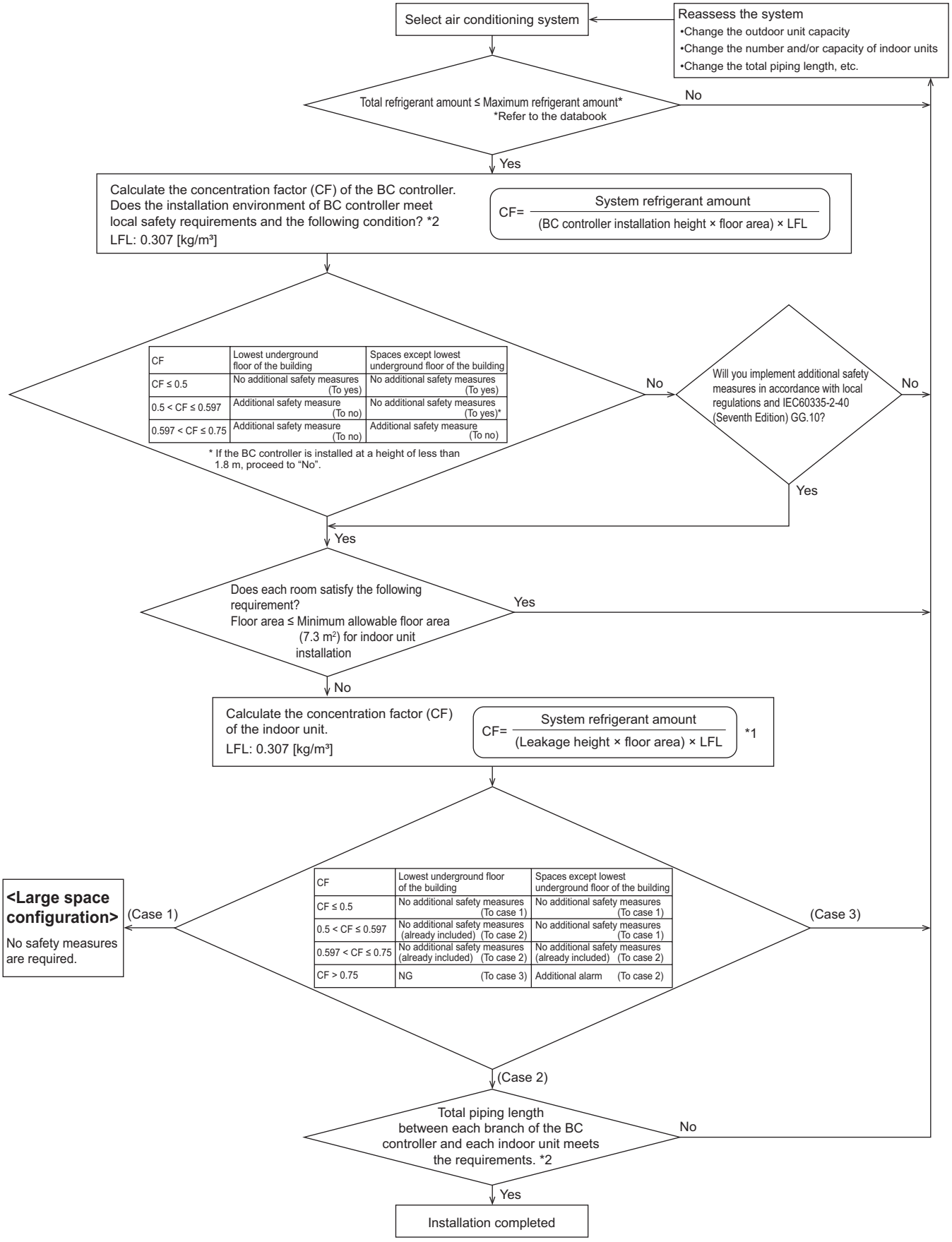
<System diagram>
When using shut off device (with sensor and alarm kit)



Room A: A shut off valve kit is connected to one indoor unit.
Room B: A shut off valve kit is connected to multiple indoor units (the diagram illustrates two indoor units).
Room C: A shut off valve kit is connected to multiple indoor units and the sensor and alarm kit (S/A kit) is used (the diagram illustrates two indoor units).
Room D: For use in large space.
→ No safety devices are required.

*1 Connect the outdoor unit, indoor unit, and shut off valve kit to TB2 on the shut off valve kit.
*2 Up to 8 indoor units can be connected to TB3 on the shut off valve kit.
*3 When using a supervisor remote controller, connect two MA remote controllers (PAR-42MAAB or later), and set one as the main controller and the other as the supervisor remote controller using the Main/Sub setting.
The main controller cannot be used as a supervisor remote controller.
A supervisor remote controller can be connected to any indoor unit.
*4 For requirements for pairing MA remote controllers, refer to **[3-6. Precautions for installing alarm device (MA remote controller, model name: PAR-42MAAB or later)].**
*5 For requirements for grouping indoor units, refer to **[3-6. Precautions for installing alarm device (MA remote controller, model name: PAR-42MAAB or later)].**
*6 The quantity of connectible shut off valve kits depends on the equivalent power supply of the connected outdoor unit.
Calculate the number of the shut off valve kit by referring to the Data Book for the outdoor unit or MELANS Centralized Controller Technical Manual.
*7 One shut off valve kit can be connected to indoor units installed in multiple rooms.
*8 For large space configuration, remove the CNSB short circuit connector on the indoor unit circuit board to disable the built-in refrigerant sensor in the indoor unit.
For the conditions for removal of the CNSB short circuit connector, refer to **[3-5. [2] Enable/disable settings for refrigerant sensor (CNSB short circuit connector)].**
*9 If disabled, the built-in refrigerant sensor in the indoor unit does not issue refrigerant leak alarm.
*10 One sensor and alarm kit (S/A kit) can be installed as a safety measure for one or multiple indoor units to detect refrigerant leakage.
S/A kit installation requirements must be met. For details, refer to the S/A Kit Installation Manual.
*11 When using the S/A kit, remove the CNSB short circuit connector on the indoor unit circuit board to disable the built-in refrigerant sensor in the indoor unit.
For the conditions for removal of the CNSB short circuit connector, refer to **[3-5. [2] Enable/disable settings for refrigerant sensor (CNSB short circuit connector)].**
When using the S/A kit, remove the CNSB short circuit connector on all indoor units connected to the TB3 on the shut off valve kit.
The built-in refrigerant sensor in the indoor unit and the refrigerant sensor of the S/A kit cannot be used simultaneously.

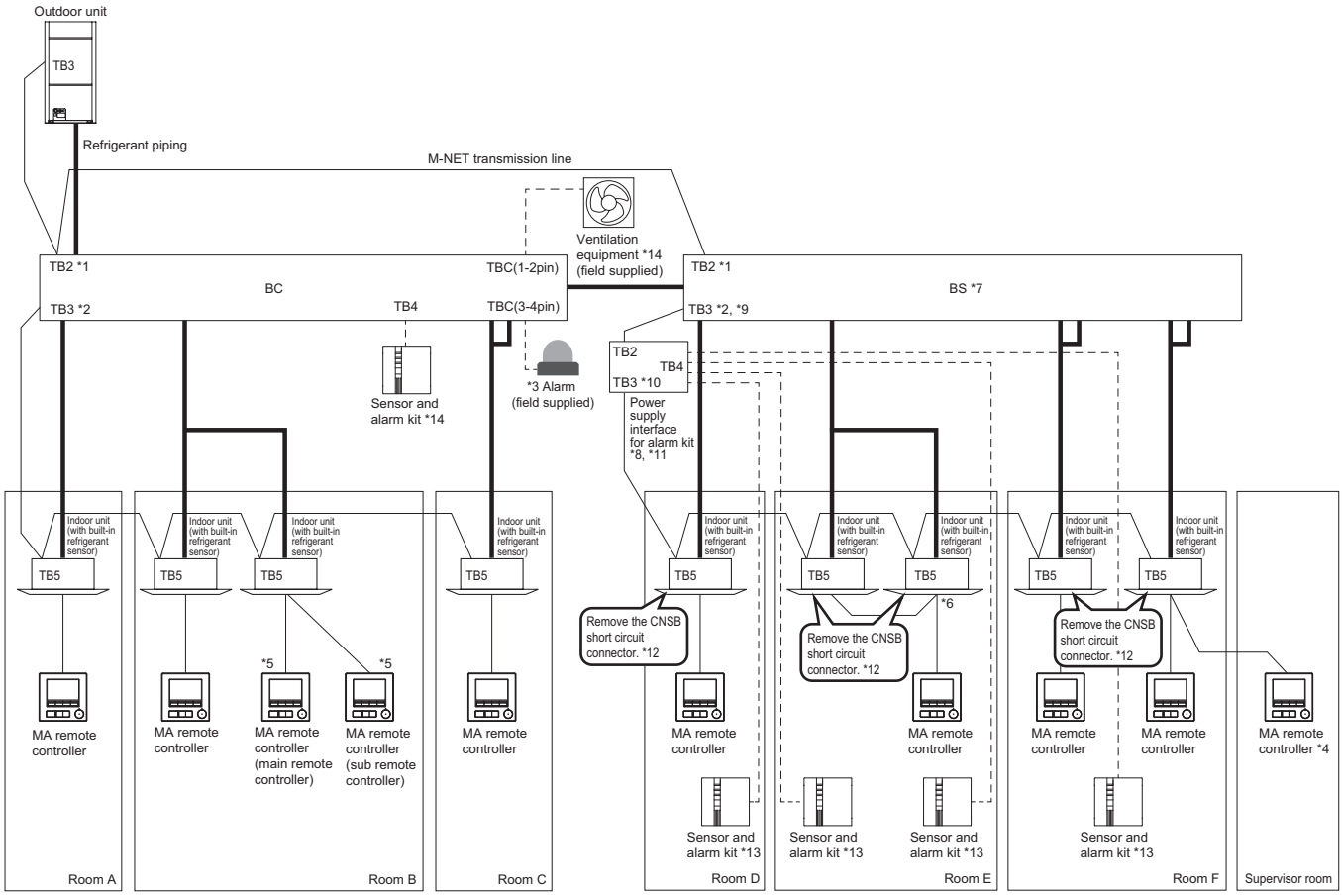
■City Multi R2-Series
<Safety measure selection flow>



*1 For details, refer to **3-4-2. "[1] BC controller installation requirements"**.
*2 For details, refer to **3-4-2. "[2] Branch piping length requirements for indoor units controlled by BC controller with a built-in shut off valve"**.
* Regardless of whether an air conditioning system is installed in the lowest basement or not, ensure that the total refrigerant amount of the air conditioning system with the highest refrigerant amount in the building, when divided by the volume of the lowest basement, does not exceed the LFL. For details, refer to **3-3. "Refrigerant leakage prevention for the lowest basement"**.
* Installation requirements may be defined by the New Design Tool Software of Mitsubishi Electric Corporation.
* If any safety measure is used, either a built-in refrigerant sensor in the indoor unit or a sensor and alarm kit is required.

<System diagram>

When using BC controller with a built-in shut off valve (with sensor and alarm kit)



Room A: One indoor unit is connected to one branch port of the BC controller.

Room B: Two or more indoor units are connected to one branch port of the BC controller.

Room C: One indoor unit is connected to two branch ports of the BC controller.
(If the total capacity of downstream indoor units is 81 or above, two branch ports must be used. For details, refer to the Installation Manual of BC controller.)

Room D-F: Indoor units are connected to the sub BC controllers. (Connection restrictions are the same as when connected to the main BC controller.)
The sensor and alarm kit (S/A kit) is used as a safety measure for these rooms.

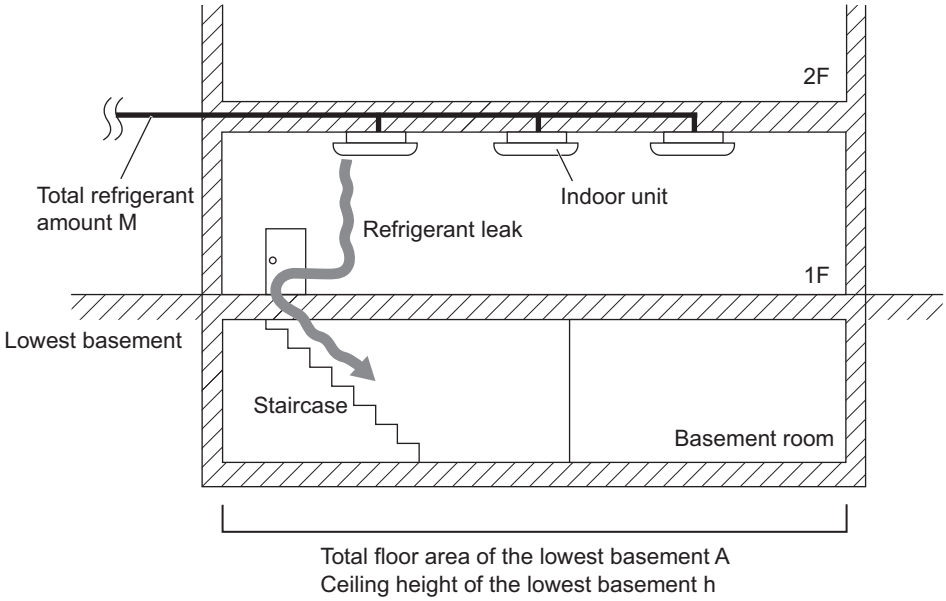
*1 Connect an outdoor unit or another BC controller to TB2 of the BC controller.
*2 Connect an indoor unit controlled by the BC controller to TB3 of the same BC controller.
*3 A field-supplied building-wide alarm can be installed in case an indoor unit detects a refrigerant leak. For the setup, refer to the Installation Manual for the BC controller.
*4 When using a supervisor remote controller, connect two MA remote controllers (PAR-42MAAB or later), and set one as the main controller and the other as the supervisor remote controller using the main/sub setting. The main remote controller cannot be used as an a supervisor remote controller. A supervisor remote controller can be connected to any indoor unit.
*5 For requirements for pairing MA remote controllers, refer to **[3-6. Precautions for installing alarm device (MA remote controller, model name: PAR-42MAAB or later)]**.
*6 For requirements for grouping indoor units, refer to **[3-6. Precautions for installing alarm device (MA remote controller, model name: PAR-42MAAB or later)]**.
*7 Up to 11 sub BC controllers can be connected.
*8 When using the sensor and alarm kit (S/A kit) as a safety measure for a room, connect the power supply interface for alarm kit (I/F kit).
*9 Connect the I/F kit to TB3 of the BC controller.
*10 When detecting refrigerant leaks from the indoor unit using the S/A kit, connect the indoor unit to TB3 on the I/F kit.
*11 For one I/F kit, the maximum connectable S/A kits and indoor units are both 8.
*12 When using the S/A kit, remove the CNSB short circuit connector on the indoor unit circuit board to disable the built-in refrigerant sensor in the indoor unit. For the conditions for removing the CNSB short circuit connector, refer to **[3-5. [2] Enable/disable settings for refrigerant sensor (CNSB short circuit connector)].**
*13 When using the S/A kit, pairing it with each indoor unit allows safety operation settings to be configured for each room. (As a safety measure, even if the above pairing setting is not configured, all indoor units connected to TB3 on the I/F kit will stop when any S/A kit detects a refrigerant leak, because every S/A kit is linked to all indoor units.) For pairing settings, refer to **[3-6-1. Procedures for pairing the sensor and alarm kit (S/A kit) with indoor unit(s)].**
*14 To use mechanical ventilation with the BC controller, connect the S/A kit to the BC controller. Mechanical ventilation equipment must be procured locally. When using the mechanical ventilation equipment, comply with IEC60335-2-40 GG8.3.3. For instructions on connecting the ventilation equipment, refer to the Installation Manual of the BC controller.

3-3. Refrigerant leakage prevention for the lowest basement

Regardless of whether an air conditioning system is installed in the lowest basement or not, ensure that the total refrigerant amount of the air conditioning system with the highest refrigerant amount in the building, when divided by the volume of the lowest basement, does not exceed the LFL × CF.

$$\frac{M}{A \times h} \leq LFL \times CF$$

M : Total refrigerant amount (kg)
A : Total floor area of the lowest basement (m^2)
h : Ceiling height of the lowest basement (m)
LFL : Lower Flammability Limit (kg/m^3), 0.307 (kg/m^3) for R32
CF : Concentration factor, 1 in this clause



*If the calculated result exceeds the LFL × CF, additional safety measures should be implemented according to the local building code.

3-4. Precautions for shut off devices (Shut off valve kit [CMR-M100KT-E] and BC controller [CMB-M-V-MA/MB-SV(-TR)])

Installation of shut off devices may be required if the concentration factor (CF) exceeds the concentration limit.
Read through the following and consider the necessity and installation location of the shut off valve kit, installation location of the BC controller, and length of branch piping.

3-4-1. Additional safety measure for Y-series

[1] Determining the necessity of the additional safety measure

Determine whether the additional safety measure is required in each room using the formula below.

Necessity of the additional safety measure

CF = mc/(A × LFL × Hr) …Equation 1
mc: Amount of refrigerant charge in the system
Hr: Leakage height
A: Floor area of the indoor unit installation space
LFL: Lower Flammability Limit (R32)
(Refer to IEC60335-2-40 Ed.7.)

Fig. 3.4.1.1

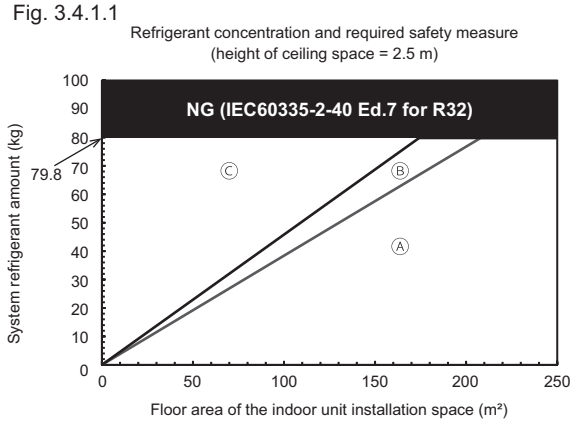


Table 1
Refrigerant concentration and required safety measure

	CF	Lowest underground floor of the building	Spaces except lowest underground floor of the building
Ⓐ	CF ≤ 0.5	No additional safety measures	No additional safety measures
Ⓑ	0.5 < CF ≤ 0.597	One additional safety measure (Alarm or shut off valve kit)*	No additional safety measures
Ⓒ	0.597 < CF	Shut off valve kit	Shut off valve kit

*A safety alarm alone shall not be considered as an appropriate measure where people are restricted in their movement.
In all conditions where safety alarms are used, the safety alarm shall also install at a supervised location (such as the night porter's room) for the rooms listed below.

– rooms, parts of buildings, building where sleeping facilities are provided (e.g., hotel rooms),
– rooms, parts of buildings, building where people are restricted in their movement (e.g., prison cells),
– rooms, parts of buildings, building where an uncontrolled number of people are present (e.g., stations), or
– rooms, parts of buildings, building to which any person has access without being personally acquainted with the necessary safety precautions (e.g., retail stores).

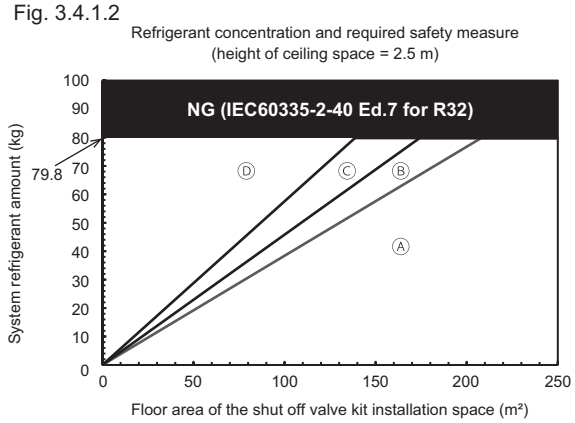
[2] Shut off valve kit installation requirements

⚠WARNING

- When installing the unit in the ceiling space, the floor area of the room under the unit is referenced. For more detailed information, refer to the Data Book.
- The unit shall be installed, operated and stored in a room with a floor area according to the following figure.
- When installing a shut off valve kit, implement safety measures for the installation space based on the concentration factor (CF) obtained from Equation 2 or by referring to Table 2. If the shut off valve kit is installed at a height of 1.8 m or less from the floor, an air circulation system must always be in operation on site in accordance with IEC60335-2-40 GG10.4.
- If the installation height of the shut off valve kit is not 2.5 m, install the shut off valve kit according to Equation 2.
- If the floor area A of the shut off valve kit installation space exceeds 250 m^2, use A=250 m^2 for calculations.

CF = mc/(A × LFL × Hr) …Equation 2
mc: Amount of refrigerant charge in the system
Hr: Height from the floor to the shut off valve kit
A: Floor area of the shut off valve kit installation space
LFL: Lower Flammability Limit (R32)
(Refer to IEC60335-2-40 Ed.7.)

Fig. 3.4.1.2



- Please be aware that this product does not have built-in safety measures for installation.
- The product is CB-Listed for the ETRS (ENHANCED TIGHTNESS REFRIGERATING SYSTEM). Therefore, please note that the installation requirements indicated in Fig. 3.4.1.2 are mitigated compared to local building code.
- For safety reasons, do not install a shut off valve kit of other manufacturers in the refrigerant circuit to prevent equipment failure.

Note

- For the amount of additional charge of R32 and its maximum amount within the system, refer to the outdoor unit manual.
- Be sure to protect pipings from physical damage.
- Do not open the control box cover when charging refrigerant.
  - Doing so may cause sparks, resulting in fire.
- All field joints shall be accessible for inspection prior to being covered or enclosed.

■Restrictions on piping length

For details, refer to the Data Book.

- If the releasable charge, m_{rl}, has been determined, minimum room area of air-conditioned space or adjusted minimum room area is based on the releasable charge and is not related to refrigerant charge of the total system.
- Depending on the total refrigerant amount of the system and the minimum room area of the air-conditioned space, this unit may not be necessary.

Table 2
Refrigerant concentration and required safety measure

	CF	Lowest underground floor of the building	Spaces except lowest underground floor of the building
Ⓐ	CF ≤ 0.5	No additional safety measures	No additional safety measures
Ⓑ	0.5 < CF ≤ 0.597	One additional safety measure	No additional safety measures
Ⓒ	0.597 < CF ≤ 0.75	Ventilation	Ventilation
Ⓓ	CF > 0.75	NG	Alarm + Ventilation

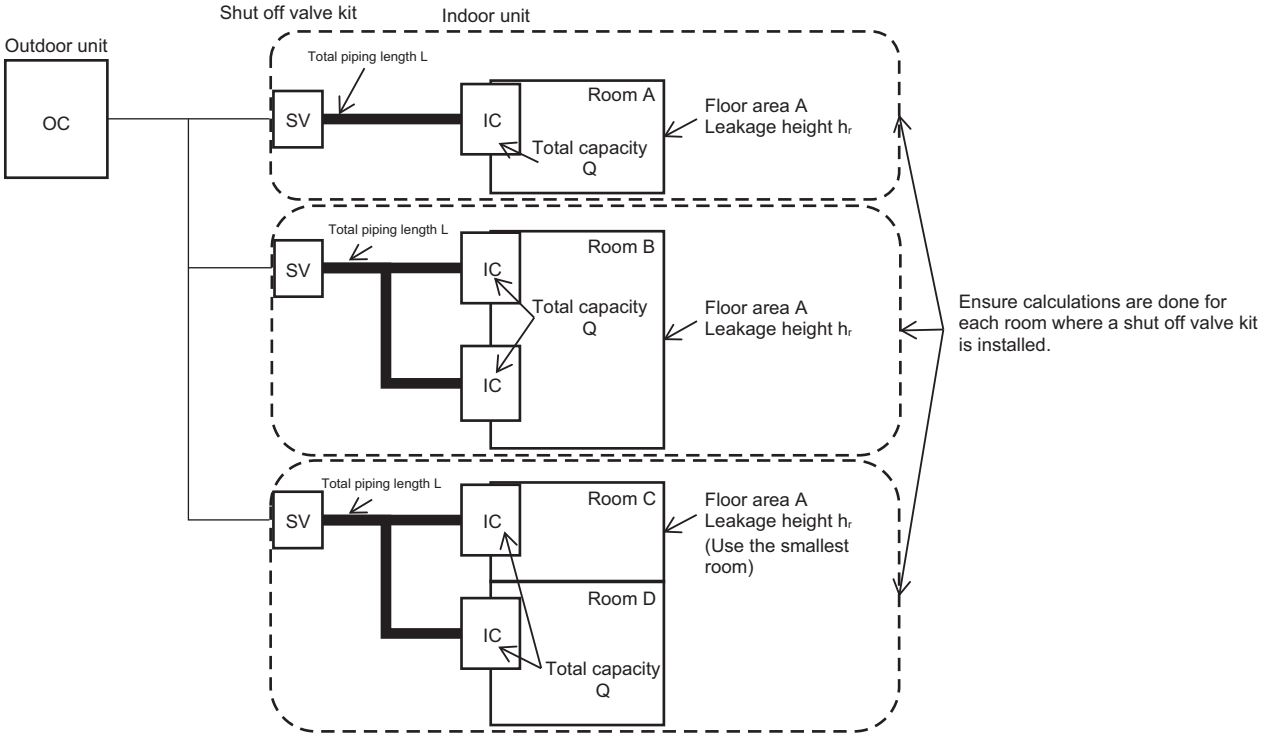
[3] Shut off valve kit installation requirements (for piping length)

If the concentration factor (CF) exceeds the concentration limit and a shut off valve kit is to be installed, the shut off valve kit must be installed in a location where the concentration of the refrigerant after shutoff does not exceed 0.597 × LFL. Therefore, install the shut off valve kit within the total piping length L as shown in the illustrations below.

*For the selection of indoor or outdoor units and requirements on the total piping length and furthest piping length for the systems, refer to the Data Book.

*Installation requirements are defined by the New Design Tool Software of Mitsubishi Electric Corporation.

<System diagram>



L : Total piping length (m)
→ Total piping length between the shut off valve kit and each indoor unit

Q : Total capacity
→ The total capacity and quantity of indoor units connected to a shut off valve kit are as follows: the total maximum capacity is 250, and the total quantity is 8.

A : Floor area (m^2)
→ In the actual calculation, use the room, of which volume obtained by multiplying the floor area by the leakage height is the smallest.

h_r : Leakage height (m)

[4] Equivalent piping length of shut off valve kit

When shut off valve kit is used in a system, the equivalent piping length of the shut off valve kit should be added to the equivalent piping length calculation. For details, refer to the **"Piping Design"** section of the Data Book.

3-4-2. Shut off device for R2-series (BC controller)

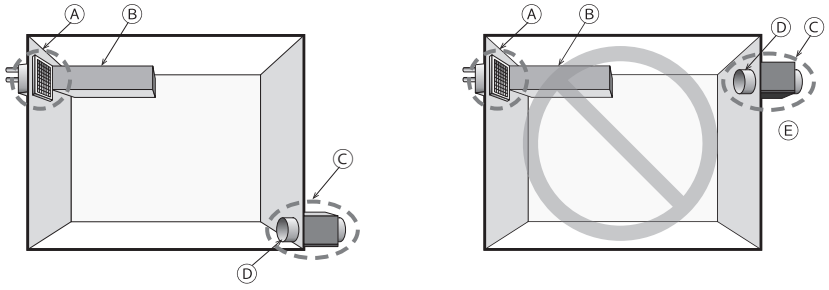
[1] BC controller installation requirements

Check that the difference of elevation between indoor and outdoor units and the length of refrigerant piping are within the limitations provided by Data Book.

⚠WARNING

- Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.
- The unit shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater.)
- Do not pierce or burn.
- Be aware that refrigerants may not contain an odour.
- The unit shall be installed, operated and stored in a room with a floor area according to the following figure.
- When installing a BC controller, take safety measures in accordance with the European Standard, based on the system refrigerant amount and the floor area as shown in the figure below.
- For safety reasons, do not install any third-party shut off valves in the refrigerant circuit to prevent equipment failure.
- When taking safety measures through mechanical ventilation, install a ventilation device in accordance with IEC60335-2-40 GG11 and ensure that the air volume is set to at least 131 m^3/h.
- Comply with IEC60335-2-40 GG8.3.3 when using mechanical ventilation as a safety measure.
  - the lower edge of openings extracting air from the room shall not be more than 100 mm above the floor.
  - The openings extracting air from the room shall be positioned relative to the openings supplying air to the room such that the supplied makeup air mixes with the leaked refrigerant.
  - The openings exhausting air from the room shall be positioned relative to the intake openings supplying air to the room to prevent re-circulation back to the room.
  - Do not block the intake vent and exhaust vent of the ventilation device.

Fig. 3.4.2.1

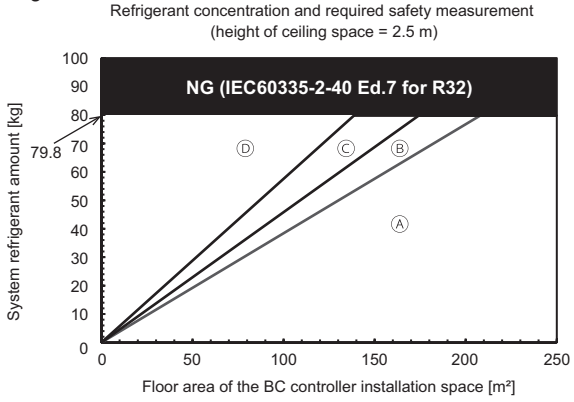


Ⓐ Supply
Ⓑ Unit
Ⓒ Mechanical ventilation
Ⓓ Exhaust
Ⓔ The mechanical ventilation must not be installed in the higher position in the room.

- When installing the BC controller, implement safety measures for the installation space based on the concentration factor (CF) obtained from Equation 3 or by referring to Table 3. If the floor area A of the BC controller installation space exceeds 250 m^2, use A = 250 m^2 for calculations.
  If the BC controller is installed at a height of 1.8 m or less from the floor, an air circulation system must always be in operation on site in accordance with IEC60335-2-40 GG10.4.
- If the BC controller is installed above the ceiling, and the boundary with the living space is unclear, use the floor area of the room directly below the BC controller and the height from the floor of that room to the ceiling for the calculation. Refer to the Data Book for the details.
- Comply with IEC60335-2-40 GG.13 when installing an alarm as a safety measure.

CF = mc/(A × LFL × Hr) …Equation 3
mc: Amount of refrigerant charge in the system
Hr: Height from the floor to the BC controller (minimum 1.8 m)
A: Floor area of the BC controller installation space
LFL: Lower Flammability Limit (R32)
(Refer to IEC60335-2-40 Ed.7.)

Fig.3.4.2.2



Note

- Be sure to protect pipings from physical damage.
- Do not open the control box cover when charging refrigerant.
  - Doing so may cause sparks, resulting in fire.
- Check that the difference of elevation between indoor and outdoor units and the length of refrigerant piping are within the limitations provided by Data Book.
- The product is CB-Listed for the ETRS (Enhanced Tightness Refrigerating System). Therefore, please note that the installation requirements indicated in Fig.3.4.2.2 are mitigated compared to local building code.

Table 3
Refrigerant concentration and required safety measure

	CF	Lowest underground floor of the building	Spaces except lowest underground floor of the building
Ⓐ	CF ≤ 0.5	No additional safety measures	No additional safety measures
Ⓑ	0.5 < CF ≤ 0.597	One additional safety measure	No additional safety measures
Ⓒ	0.597 < CF ≤ 0.75	Ventilation	Ventilation
Ⓓ	CF > 0.75	NG	Alarm + Ventilation

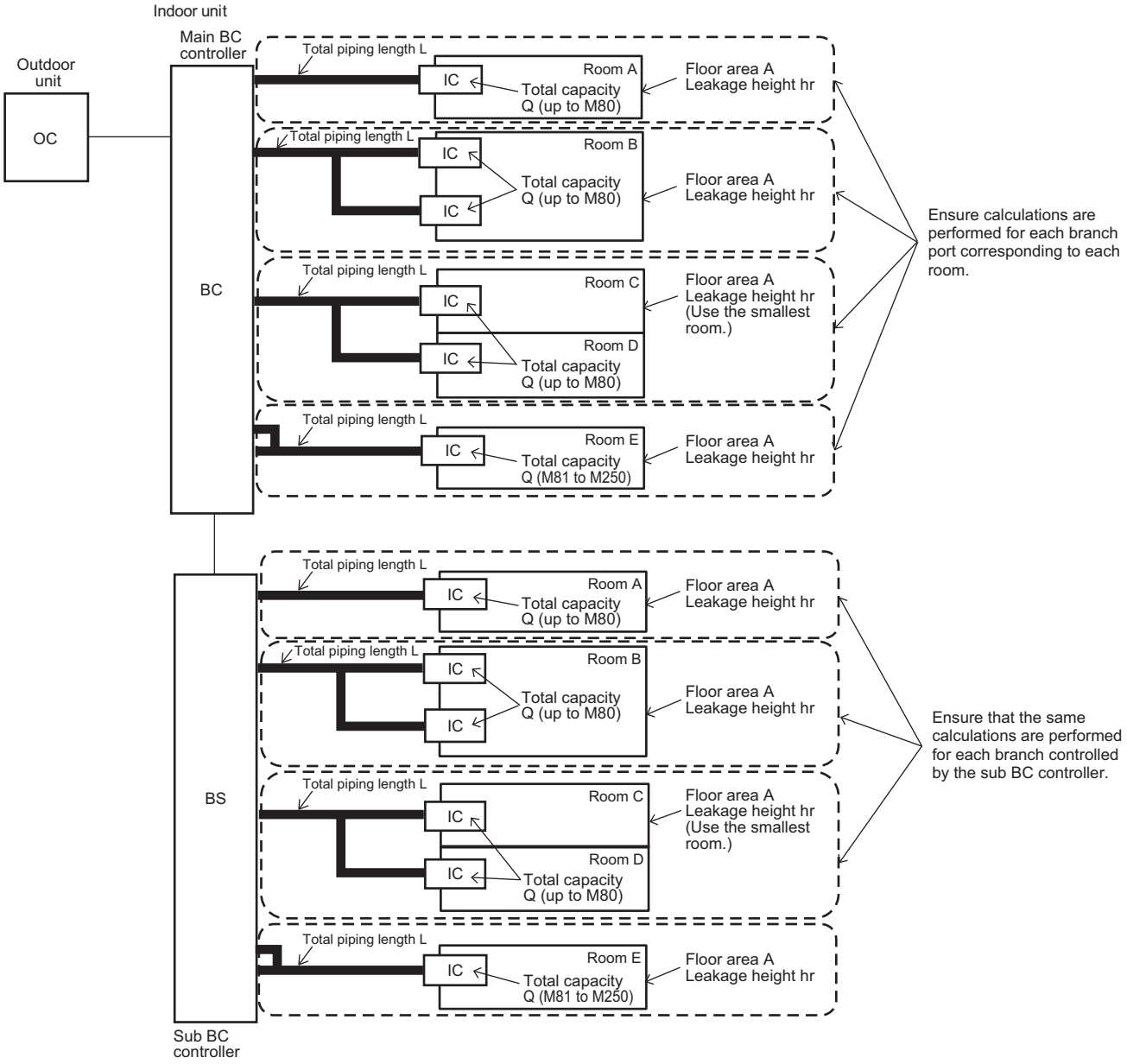
[2] Branch piping length requirements for indoor units controlled by BC controller with a built-in shut off valve

The BC controller with a built-in shut off valve is equipped with an internal shut off valve. The length of the branch pipe running from the shut off valve must meet the requirements to ensure that the maximum refrigerant concentration after shutoff does not exceed 0.597 of the LFL.

*For the selection of indoor or outdoor units and requirements on the total piping length and furthest piping length for the systems, refer to the Data Book.

*Installation requirements are defined by the New Design Tool Software of Mitsubishi Electric Corporation.

<System diagram>



L : Total piping length (m)
→ Total piping length between each branch of the BC controller and each indoor unit

Q : Total capacity
→ The total capacity and quantity of the indoor units connected to each branch of the BC controller are as follows: the total maximum capacity is 80(*), and the total quantity is 3.

A : Floor area (m^2)
→ In the actual calculation, use the room, of which volume obtained by multiplying the floor area by the leakage height is the smallest.

h_r : Leakage height (m)

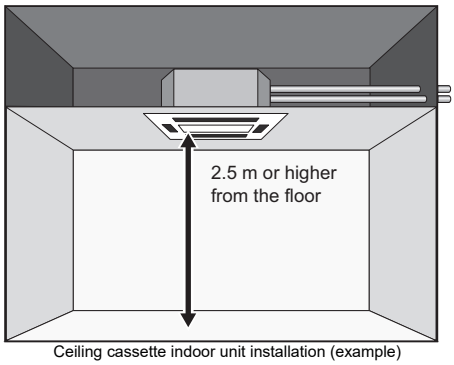
* When using indoor units with a total capacity of 81-250, connect them to 2 branch ports. Indoor units M100, M125, M140 can be connected to 1 branch. (In this case, cooling capacity decreases a little.) For details, refer to the Data Book.

3-5. Precautions for installing indoor units

[1] Indoor unit installation location

- Do not use gas appliances or spray products near the unit.
  The refrigerant sensor may be triggered by propane, butane, and fluorinated gases contained in spray products, acetone and ethanol in drug or antiseptic solutions, dichloromethane in paint, and smoke from charcoal. In such cases, the sensor may need to be replaced.
- Install the indoor unit at a height of 2.5 m or higher from the floor, as shown in the figure on the right. (This height requirement applies to ceiling cassette and ceiling suspended types. For other models, please refer to 3-2-1. "For indoor leakage height".)
  For duct installation, the requirements below must be satisfied.
  *Ceiling height must comply with building codes.

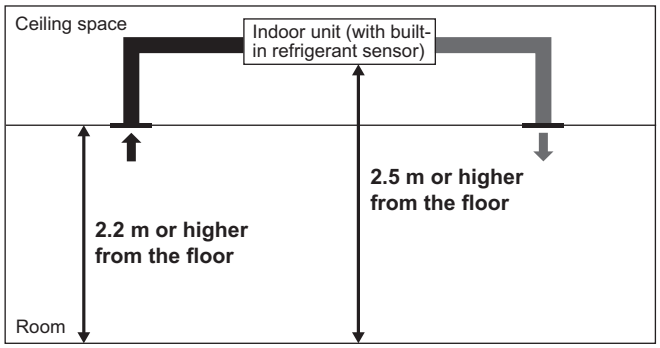
  For details, refer to the Installation Manual for the indoor unit.



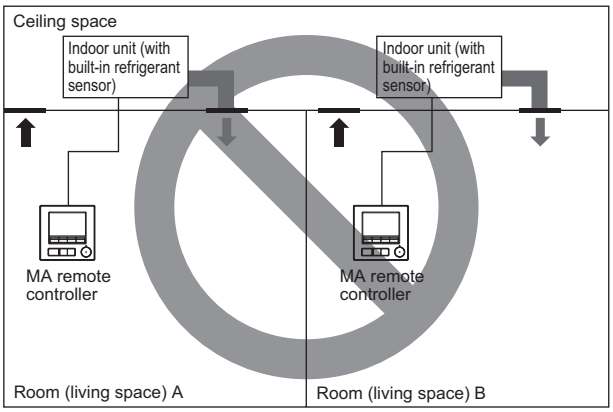
Ceiling cassette indoor unit installation (example)

■Duct installation requirements for ceiling concealed model

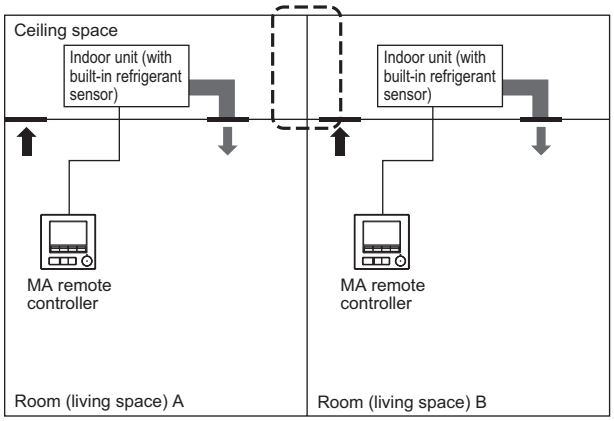
- Install the indoor unit at a height of 2.5 m or higher.
- Ensure the ceiling height (duct opening) is 2.2 m or higher.



♦If two different rooms share the same space above the ceiling from which the indoor unit draws air, install a partition above the ceiling or install a sensor and alarm kit in the room.

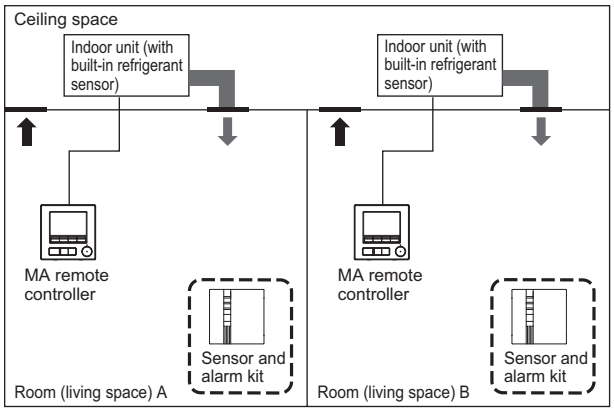


Partition the ceiling space into two for Rooms A and B.

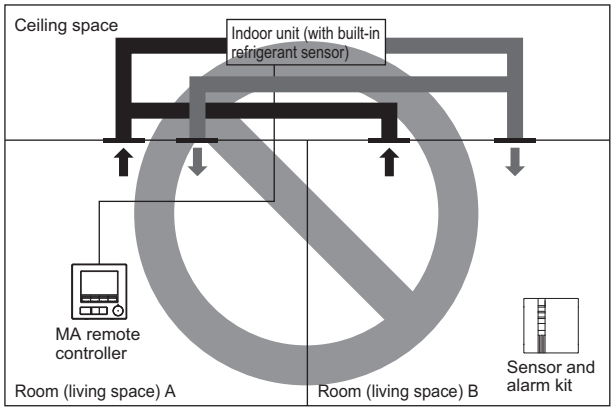


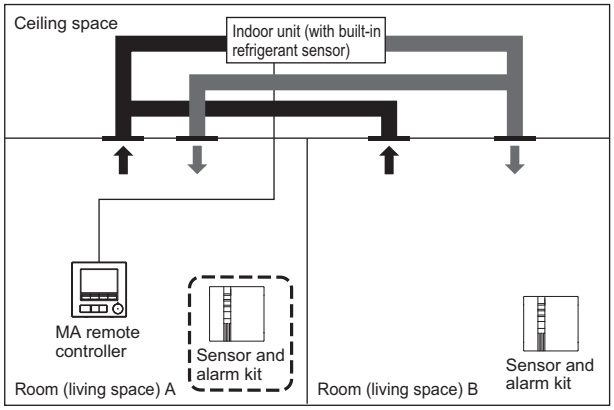
*Install the partition in accordance with building codes.

Install a sensor and alarm kit in Rooms A and B.



♦When air is supplied to and returned from multiple rooms via ducts, install sensor and alarm kits in all rooms to which both supply air ducts and return air ducts are routed.





[2] Enable/disable settings for refrigerant sensor (CNSB short circuit connector)

If the following condition is met, remove the CNSB short circuit connector from the indoor unit to disable the built-in refrigerant sensor. (Models that are not equipped with a built-in refrigerant sensor do not have the CNSB short circuit connector.)

Conditions for removal of the CNSB short circuit connector

Condition	Indoor unit
Safety device is not required (in large space). or Sensor and alarm kit is used.	Remove the CNSB short circuit connector.*1
(For reference) Built-in refrigerant sensor on the indoor unit is used.	Do not remove the CNSB short circuit connector.

*1 Removing the CNSB short circuit connector will disable the built-in refrigerant sensor on the indoor unit.

3-6. Precautions for installing alarm device (MA remote controller, model name: PAR-42MAAB or later)

[1] Installation location

Install the MA remote controller as an alarm device in a location where a facility manager works, such as a supervisor room or any room that requires safety devices. (This is not mandatory.)

*If the MA remote controller is used in a supervisor room, set the remote controller as a supervisor remote controller using the Main/Sub setting. For details, refer to the MA remote controller Installation Manual.

[2] Behavior of alarm device

Once the MA remote controller detects a refrigerant leak, it will issue an alarm and sound, and the operation lamp and backlight will blink.

[3] Connection of alarm device

Connect one MA remote controller (PAR-42MAAB or later) to one indoor unit.

A table below shows the requirements for grouping of indoor units and connecting of multiple remote controllers to a group.

<MA remote controller (PAR-42MAAB or later)>

Applicable system	Grouping of indoor units	Connection of multiple remote controllers to a group
R32 indoor units equipped with built-in refrigerant sensors	Allowed (*1) (*2) (*3)	Allowed *Do not use a sub remote controller as an alarm device. *Up to two remote controllers can be connected.
R32 indoor units equipped with Sensor and alarm kit	Allowed (*1) (*4)	
R32 indoor units set for large spaces	Allowed (*1)	
R410A indoor units	Allowed	Allowed

*1 Grouping connections between different refrigerant systems or between different system configurations are not allowed.

*2 Grouping connections across rooms are not allowed.

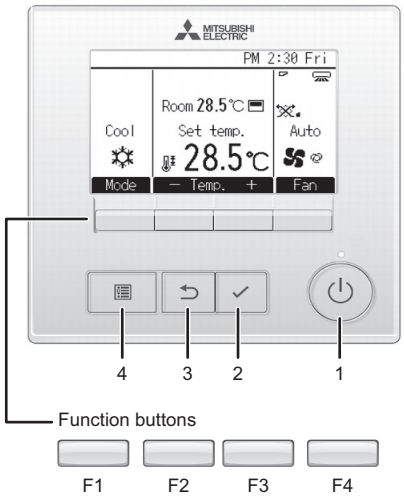
*3 The supervisor remote controller cannot be connected to grouped indoor units.

*4 The supervisor remote controller cannot be connected to indoor units that are grouped using different shut off valve kits or sensor and alarm kits.

3-6-1. Procedures for pairing the sensor and alarm kit (S/A kit) with indoor unit(s)

[1] Procedure for pairing an S/A kit with an indoor unit (using the MA remote controller)

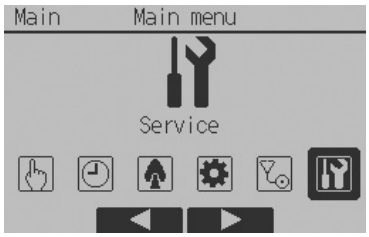
1) Press the [Menu] button while the main screen is displayed.
The Main menu screen is displayed.



1. [ON/OFF] button
   Press to turn ON/OFF the indoor unit.
2. [Select] button
   Press to save the setting.
3. [Return] button
   Press to return to the previous screen.
4. [Menu] button
   Press to open the main menu.

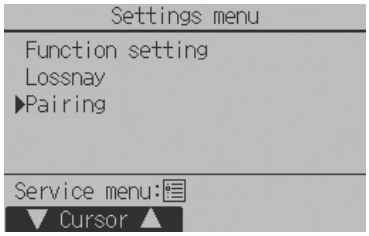
2) Press the [F2] or [F3] button to select an item.
Press the [F2] button to move the cursor left, and the [F3] button to move it right.

3) Select the service menu icon with the cursor and press the [Select] button.
Each menu item is displayed.



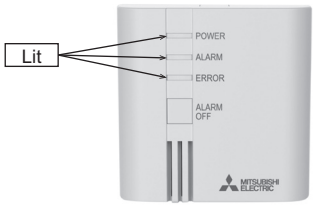
4) Select "Settings" with the cursor and press the [Select] button.

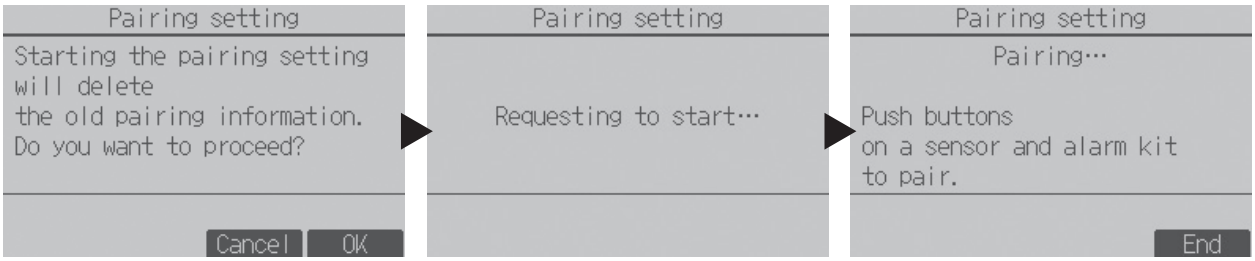
5) Select "Pairing" with the cursor and press the [Select] button.



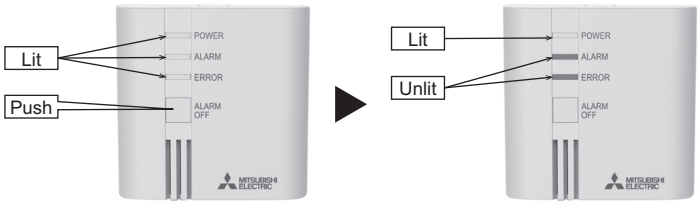
6) Select "Pairing setting" with the cursor and press the [Select] button.

7) When the Pairing setting screen appears, press [F4 (OK)].
→The pairing in progress screen is displayed and all LEDs on the S/A kit will turn on. (The kit is on standby for pairing.)

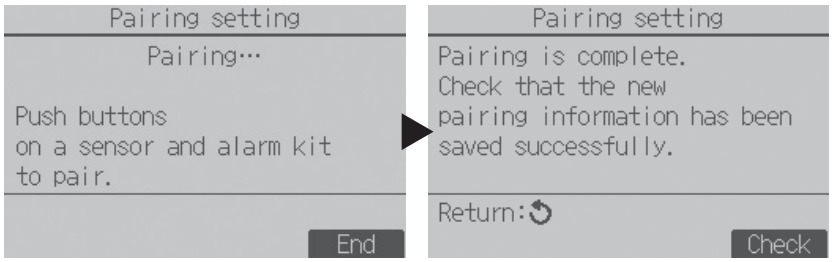




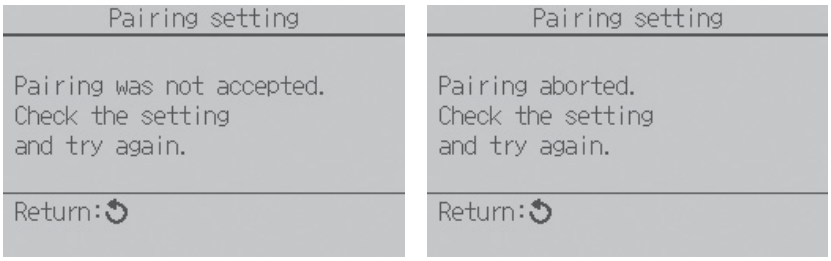
8) Press and hold the button on the S/A kit to pair for about three seconds.
→The LEDs will then return to their previous state.



9) While the Pairing setting screen is displayed, press [F4 (End)].
→When the pairing complete screen appears, press the [Return] button to exit pairing.

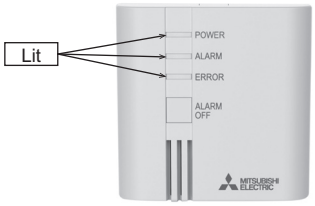


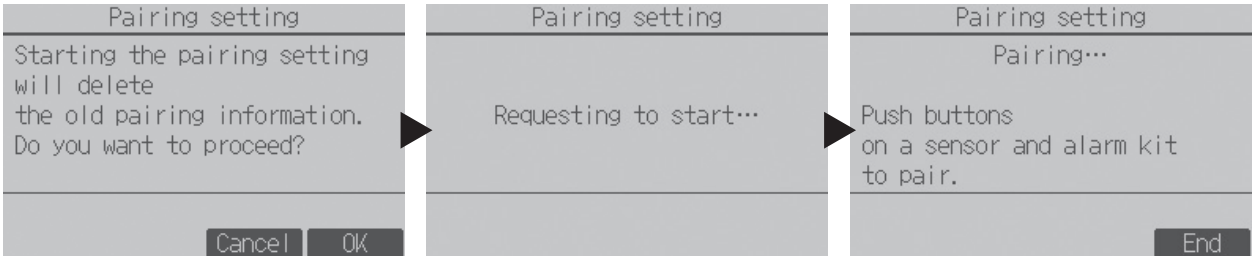
Note
After completing the pairing setting, check that the indoor unit is paired with the intended S/A kit. For the procedure to check the S/A kit paired with the indoor unit, refer to section [4].
If an error occurs during pairing, such as a communication interruption or power failure, pairing will fail and the following screen will appear. After resolving the error, try pairing again.



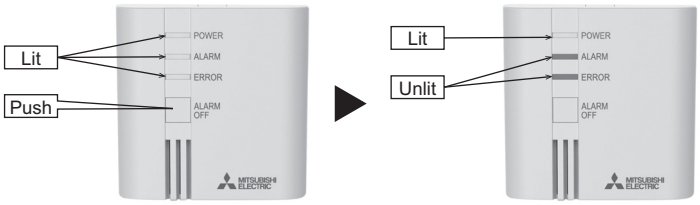
[2] Procedure for pairing multiple S/A kits with an indoor unit (using the MA remote controller)

1) Perform steps 1 through 7 in section [1] to display the Pairing setting screen and turn on all LEDs on the S/A kit. (The kit is on standby for pairing.)

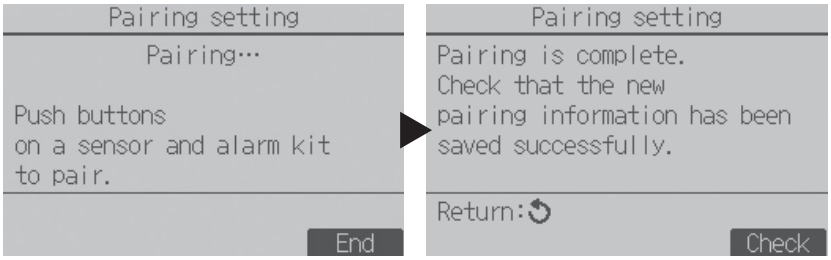




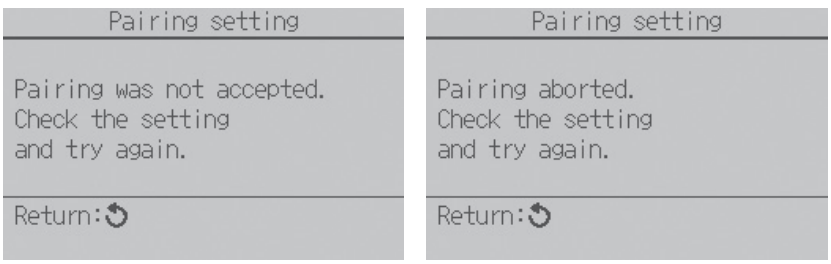
2) Press and hold the buttons on all S/A kits that you want to pair for about three seconds.
→ The LEDs will then return to their previous state.



3) While the Pairing setting screen is displayed, press [F4 (End)].
→When the pairing complete screen appears, press the [Return] button to exit pairing.

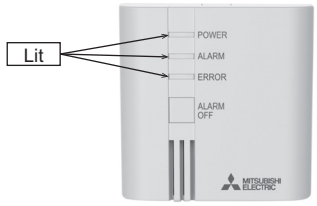


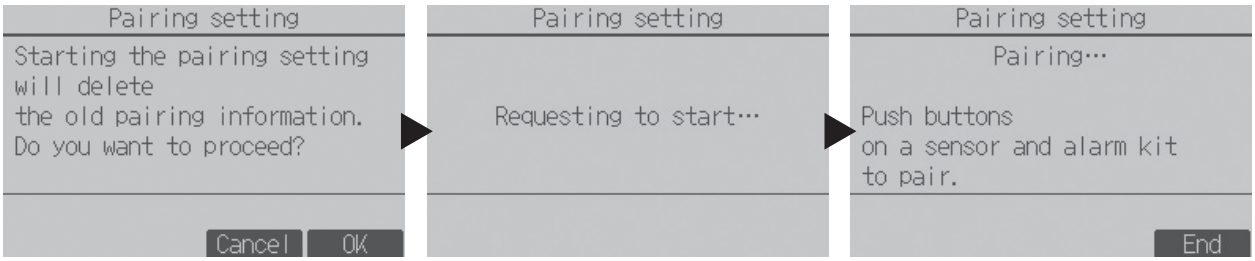
Note
After completing the pairing setting, check that the indoor unit is paired with the intended S/A kit. For the procedure to check the S/A kit paired with the indoor unit, refer to section [4].
If an error occurs during pairing, such as a communication interruption or power failure, pairing will fail and the following screen will appear. After resolving the error, try pairing again.



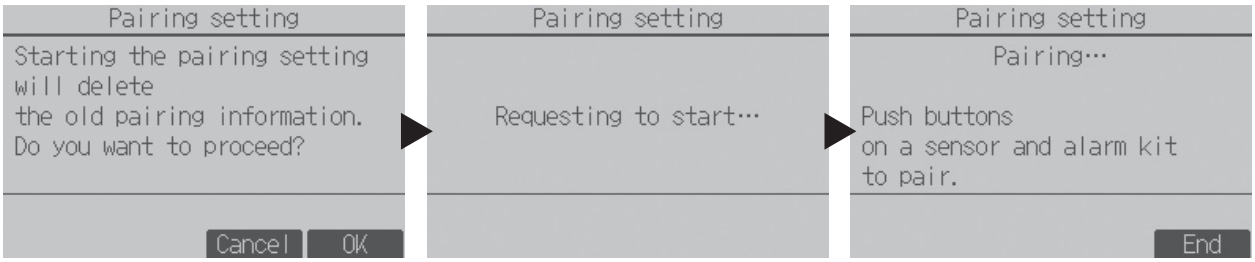
[3] Procedure for pairing an S/A kit with multiple indoor units (using the MA remote controller)

1) Perform steps 1 through 7 in section [1] to display the Pairing setting screen and turn on all LEDs on the S/A kit. (The kit is on standby for pairing.)

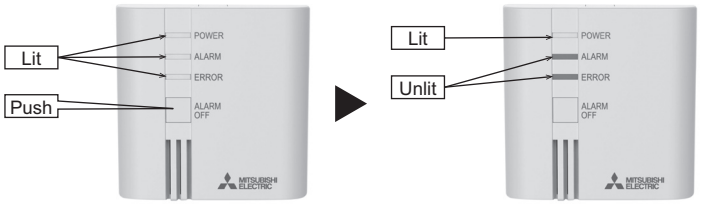




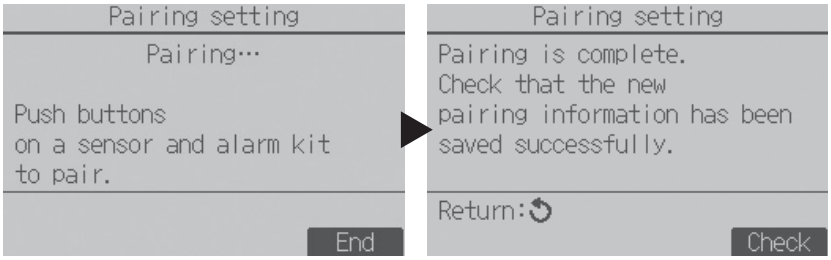
2) On the MA remote controllers of the other indoor units you want to pair, perform steps 1 through 7 in section [1] to display the Pairing setting screen.



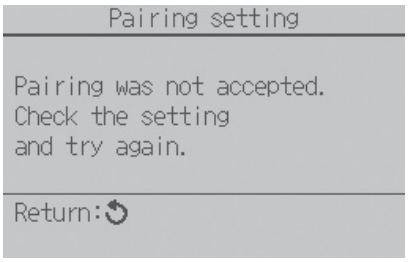
3) Check that all the remote controllers of the indoor units to be paired show the Pairing setting screen, press and hold the button on the S/A kit that you want to pair with for about three seconds.
→ The LEDs will then return to their previous state.

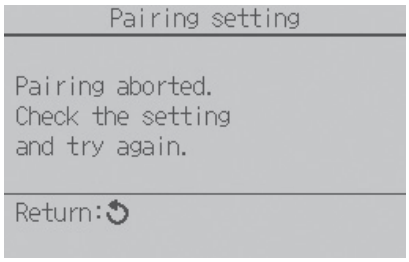


4) While the Pairing setting screen is displayed on each MA remote controller for the paired indoor units, press [F4 (End)].
→ When the pairing complete screen appears, press the [Return] button to exit pairing.



Note
After completing the pairing setting, check that the indoor unit is paired with the intended S/A kit. For the procedure to check the S/A kit paired with the indoor unit, refer to section [4].
If an error occurs during pairing, such as a communication interruption or power failure, pairing will fail and the following screen will appear. After resolving the error, try pairing again.





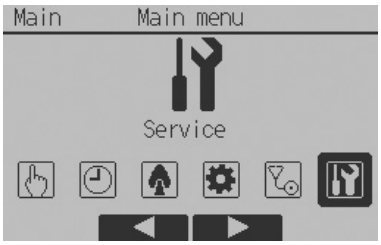
[4] Other

(1) Procedure for checking the S/A kit(s) paired with indoor unit(s) (using the MA remote controller)

1) While the main screen is displayed on the MA remote controller for the indoor unit to be checked, press the [Menu] button.
The Main menu screen will appear.

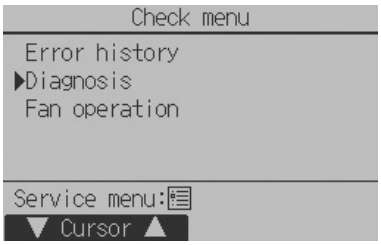
2) Press the [F2] or [F3] button to select an item.
Press the [F2] button to move the cursor left, and the [F3] button to move it right.

3) Select the service menu icon with the cursor and press the [Select] button.
Each menu item is displayed.

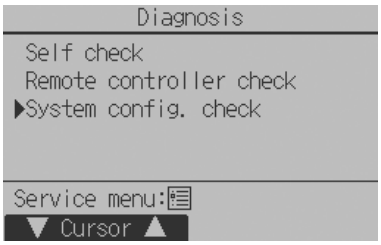


4) Select “Check” with the cursor and press the [Select] button.
The check menu is displayed.

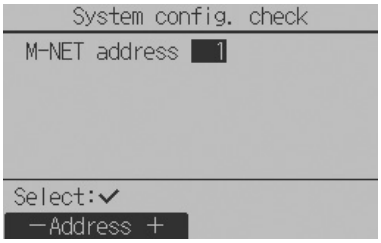
5) Select “Diagnosis” with the cursor and press the [Select] button.
The diagnosis menu is displayed.



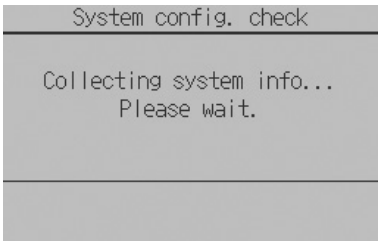
6) Select “System config. check” with the cursor and press the [Select] button.



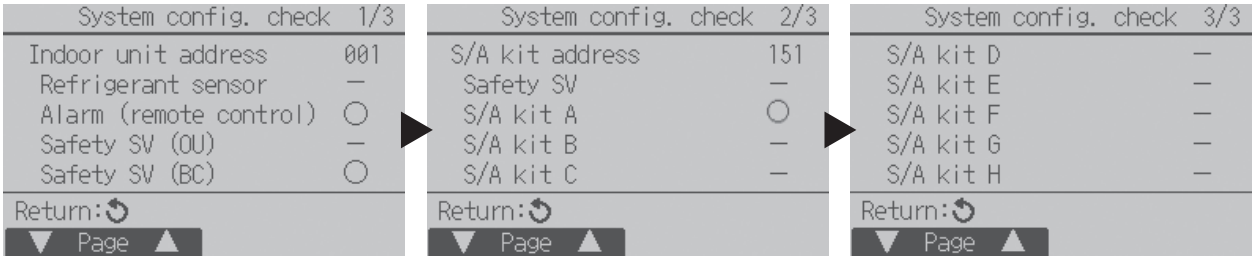
7) Check the system configuration check screen and press the [Select] button.
Check the indoor unit address.



8) The system configuration information collection starts.



9) When the information collection ends, the following system configuration check screens are displayed.
Note that the screens to be displayed differ according to the system configuration.
Check that the paired S/A kit is marked with ○.



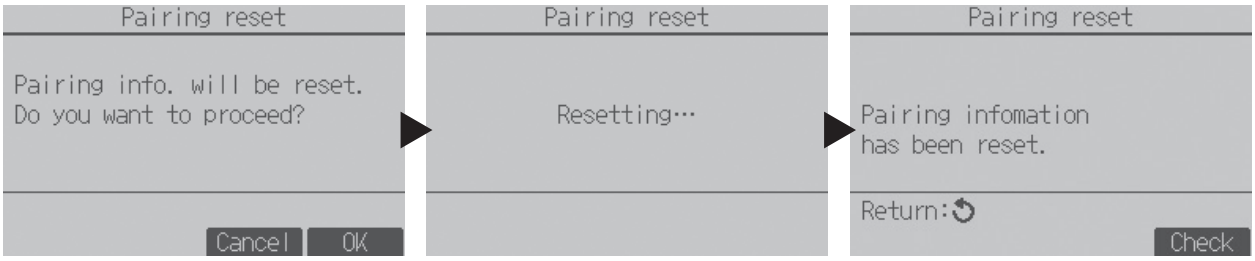
Note
Changes in the system configuration settings, such as pairing settings, may take some time to be reflected on the system configuration check screen. If an error occurs, check the system configuration again.

(2) Procedure for resetting the pairing information of indoor units (using the MA remote controller)

1) Perform steps 1 through 5 in section [1] to display the Pairing settings screen on the MA remote controller for the indoor unit whose pairing information is to be reset.

2) Select "Pairing reset" with the cursor and press the [Select] button.

3) When the Pairing reset screen appears, press [F4 (OK)].
→ The pairing reset will start. When the completion screen appears, press [F4 (Check)] to exit the pairing reset.



Note
Once the pairing information of the indoor units is reset, the indoor units will be linked to all S/A kits that are under the connected power supply interface for the alarm kit (I/F kit). (If any S/A kit detects a refrigerant leak, it will stop all indoor units connected to TB3 on the I/F kit and start the safety operation.)
If an error occurs during resetting the pairing information, such as a communication interruption or power failure, the pairing reset will fail and the following screen will appear. After resolving the error, try pairing again.

3-7. Setting up an independent power supply for the sensor and alarm kit (PAC-SL72SA-E) — EN378 requirement

To provide the sensor and alarm kit (S/A kit) with an independent power supply, connect and configure the devices as described below.

[1] Device and power connections

(1) For Y series

1. Connect an independent power supply to the shut off valve kit.
2. Connect the S/A kit to the shut off valve kit, and then configure the system.

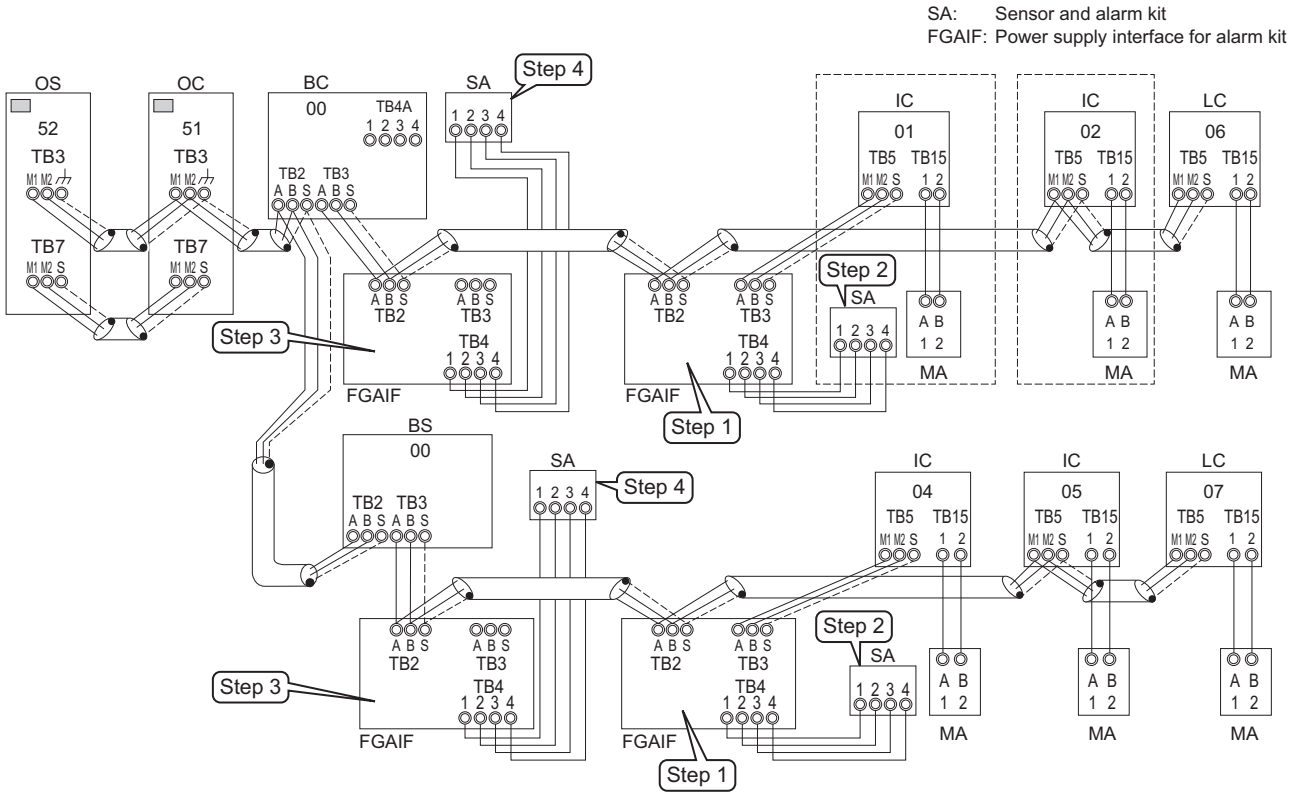
(2) For R2 series

When the S/A kit is used to detect leaks from the indoor unit:

1. Install the power supply interface for alarm kit (I/F kit, PAC-SL73IF(L)-E) and connect an independent power supply to the kit.
2. Connect the S/A kit to TB4 on the I/F kit installed in step 1, and then configure the system.

When the S/A kit is used to detect leaks from the BC controller:

3. Install an additional I/F kit and connect an independent power supply to the kit.
   Do not use TB3 on this I/F kit.
4. Connect the S/A kit to TB4 on the I/F kit installed in step 3, and then configure the system.



[2] Configuration (common to Y and R2 series)

- Enable function setting No. 962 on the outdoor unit. For details, refer to the Installation Manual for the outdoor unit.

Make function settings by setting the dipswitches SW4 and SW6 on the main board.
Write down the switch settings on the electrical wiring diagram label on the control box front panel for future reference when the control box needs to be replaced.

♦Take the following steps to make EN 378-compliant setting.

1) Set the 10th bit of SW6 to ON.
2) Set SW4 as shown in the table below to select the setting items. (The setting item No. will be displayed on LD301.)
3) Press SWP3 for two seconds or longer to change the settings. (The settings can be checked on LD3.)

	Setting item No.	SW4 0: OFF, 1: ON *1										Setting (LD3 display) *2	
		1	2	3	4	5	6	7	8	9	10	Unlit	Lit
EN 378-compliant setting *3	962	0	1	0	0	0	0	1	1	1	1	Disabled	Enabled

*1 Make the SW4 setting after the unit is energized.
*2 This will blink while the system is starting up.
*3 When using combined units, make the setting for OC only.
The setting is disabled by default.

♦Configure the dipswitch for the S/A kit. For details, refer to its Installation Manual.

Be sure to set the switches according to the installation place after the installation.

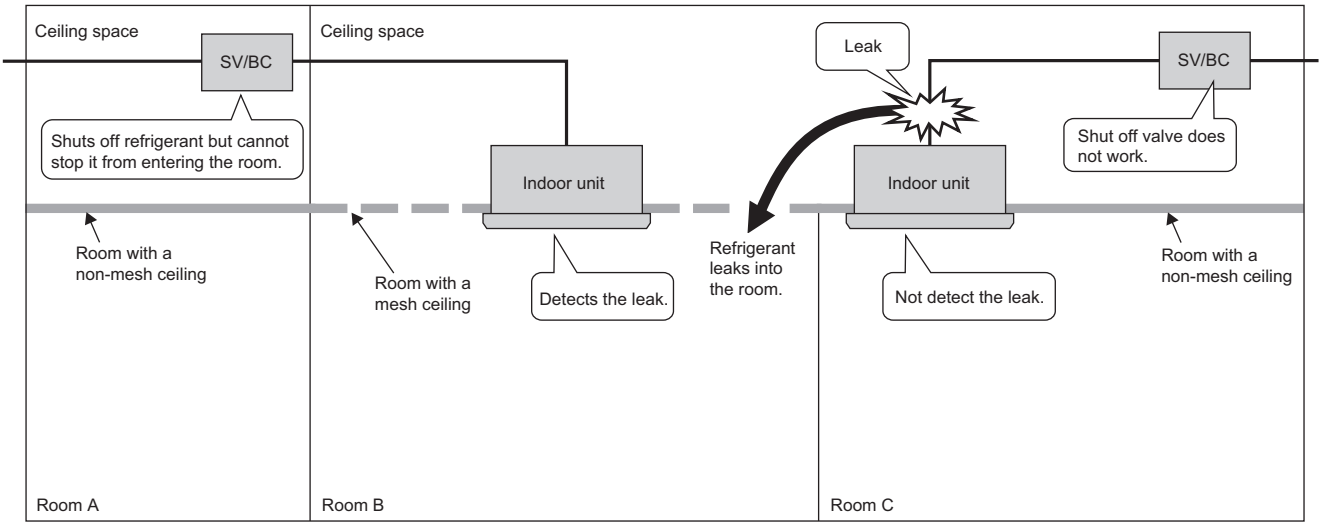
Mode name	Installation place	Switch setting
-	Initial setting (Not work)	
Sensor and alarm mode (EN378)	Room	

* The S/A kit behavior with an independent power supply — EN378 requirement
If the sensor fails, the S/A kit operates in the same way as during a refrigerant leak: it activates the shut off valve, sounds an alarm, blinks the indicator lamp, and displays error codes on the remote controller.

3-8. Precautions for mesh ceiling

For rooms with a mesh ceiling, note the following points for unit selection and determination of pipe locations.

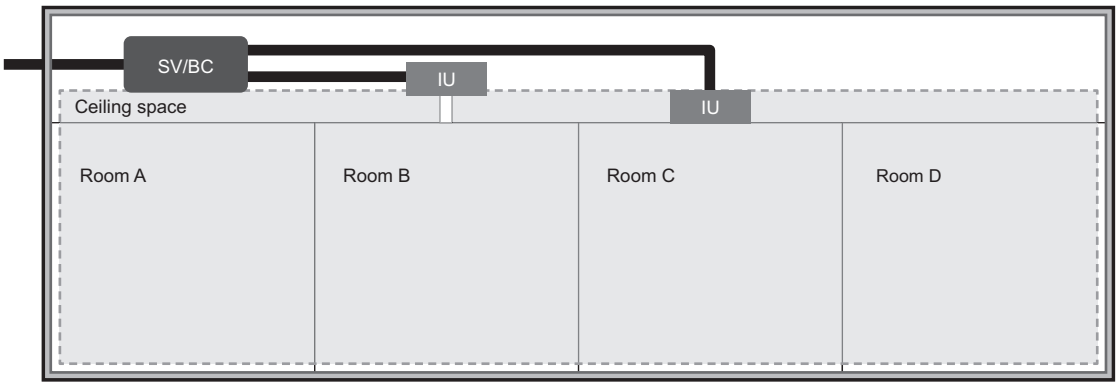
- If refrigerant leaks from the unit or pipe above the ceiling, it may enter the room through the mesh ceiling.
- In the case shown below, if refrigerant leaks, the leak may be detected in a room with the mesh ceiling, but the shut off valve kit cannot stop the refrigerant leak.



When the unit in which refrigerant flows is installed in a ceiling space, refrigerant may leak from the unit or the refrigerant pipe in the ceiling space to adjacent rooms where a unit is not installed. In such a case, calculate room volume by adding the volumes of spaces that share the ceiling space as shown in Figure 1.

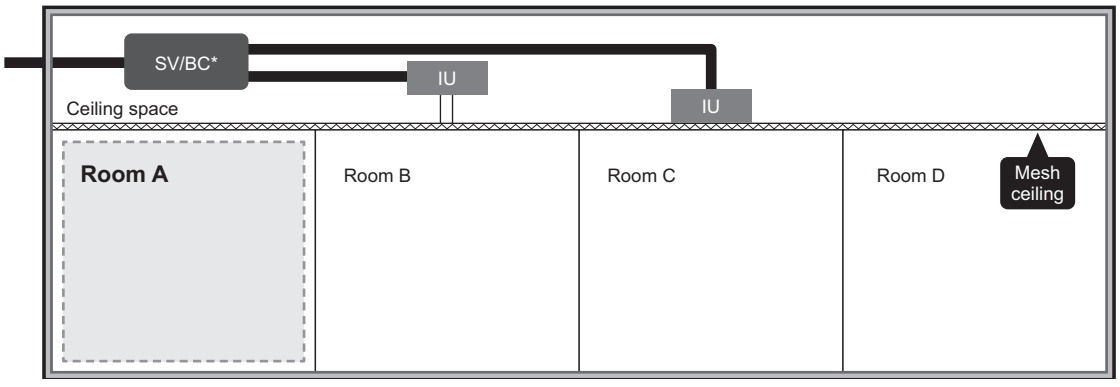
* Avoid using breathable ceiling materials (e.g., mesh ceiling). If such materials are used, calculate the room volume based only on the volume of the room located directly below the SV/BC as shown in Figure 2, because refrigerant is most likely to leak to the room located directly below than to adjacent rooms.

Figure 1 Shared-ceiling area (room volume = [ ] area)



* Since the refrigerant may leak not only from the unit but also to rooms that are not directly connected to the duct (e.g. Room A or Room D), calculate the entire shared-ceiling space.

Figure 2 Using breathable ceiling materials (room volume = [ ] area)



* In a system with a SV/BC, refrigerant pipes run above the rooms. Calculate the volume of each of the rooms with connections to indoor units.

- When the unit is installed in a ceiling space, calculate the room volume of the room located directly below the unit.

3-9. Restrictions on installation environment of outdoor units

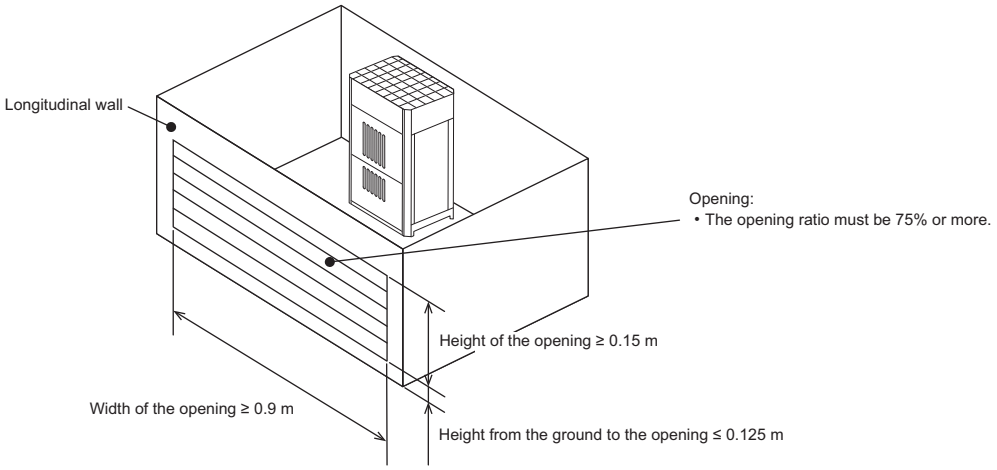
If the outdoor unit is installed in a place where the refrigerant easily stagnates, the refrigerant may burn in the case of refrigerant leakage. Be sure to follow the installation restrictions below.
When installing the outdoor units in such places, do not install combustion appliances such as boilers together. Leaked refrigerant may catch fire.

3-9-1. Restrictions when installing outdoor units in a machine room

If the outdoor unit is installed in a machine room, refer to the latest ISO 5149 and install the unit in accordance with IEC60335-2-40 (Seventh Edition) GG.5.

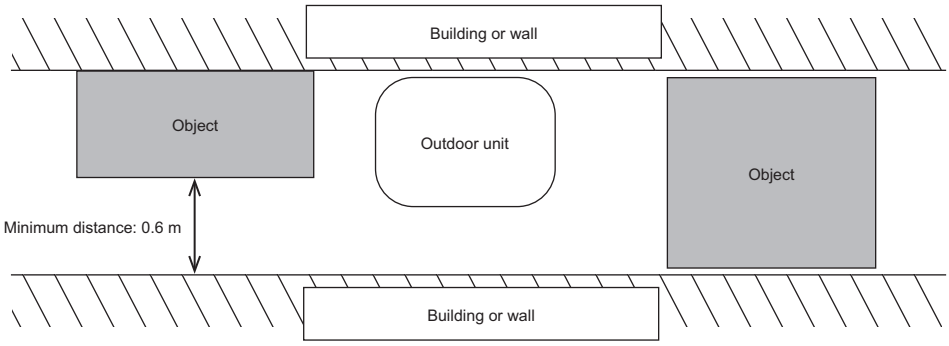
3-9-2. Restrictions when installing outdoor units in louvered space

When installing the outdoor unit in louvered space as shown in the figure below, follow the conditions for the openings described in the figure.



3-9-3. Restrictions when installing outdoor units in a confined space

When installing the outdoor unit in a confined space as shown in the figure below, be sure to leave a clearance of at least 0.6 m to prevent the stagnating refrigerant from reaching a high concentration and becoming flammable.
Refer to the Installation Manual or the Data Book of the outdoor unit for details on the required surrounding space for the outdoor unit.



3-9-4. Restrictions when installing outdoor units in locations where refrigerant can stagnate

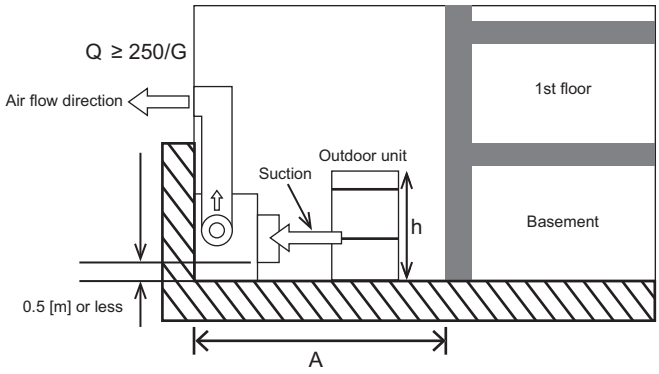
When installing the outdoor unit in locations where refrigerant can stagnate (e.g., walled-in areas or semi-basements), in addition to the locations mentioned in sections 3-9-1 to 3-9-3, install mechanical ventilation devices. If the following equation is satisfied, install the mechanical ventilation device as shown in the figure below.
The outdoor unit is not equipped with a refrigerant leak sensor or an agitation function to activate the fan in the event of a refrigerant leak.

$$m > 0.5 \times G \times A \times h_e$$

- m : Total amount of refrigerant [kg]
- G : LFL (lower flammability limit) = 0.307 [kg/m³]
- A : Recessed area (excluding the area of the building) [m²]
- h : Product height [m]
- h_e : Value obtained by multiplying the product height h by 0.8 [m]

* If this expression is satisfied, install the ventilation device shown below.

* Use a detector suitable for the refrigerant being used and interlock it with a mechanical ventilation device, or use a mechanical ventilation device that operates continuously.



- Q : Ventilation flow rate [m³/h]
- G : LFL (lower flammability limit) = 0.307 [kg/m³]

However, the height of the bottom of the duct must be 0.5 [m] or less.

*Do not install any devices that could be an ignition source inside the duct.

If there are applicable local rules or regulations, compare them with the restrictions mentioned above and take the safer measures when installing the outdoor units.

⚠Warning

■ Do not use refrigerant other than the type indicated in the manuals provided with the unit and on the nameplate.
- Doing so may cause the unit or pipes to burst, or result in explosion or fire during use, repair, or at the time of disposal of the unit.
- It may also be in violation of applicable laws.
- MITSUBISHI ELECTRIC CORPORATION cannot be held responsible for malfunctions or accidents resulting from the use of the wrong type of refrigerant.

■ Our air conditioning equipment and heat pumps contain a fluorinated greenhouse gas, R32.

MITSUBISHI ELECTRIC CORPORATION

www.MitsubishiElectric.com

MEES25K080

New publication effective Mar. 2026
Specifications are subject to change without notice