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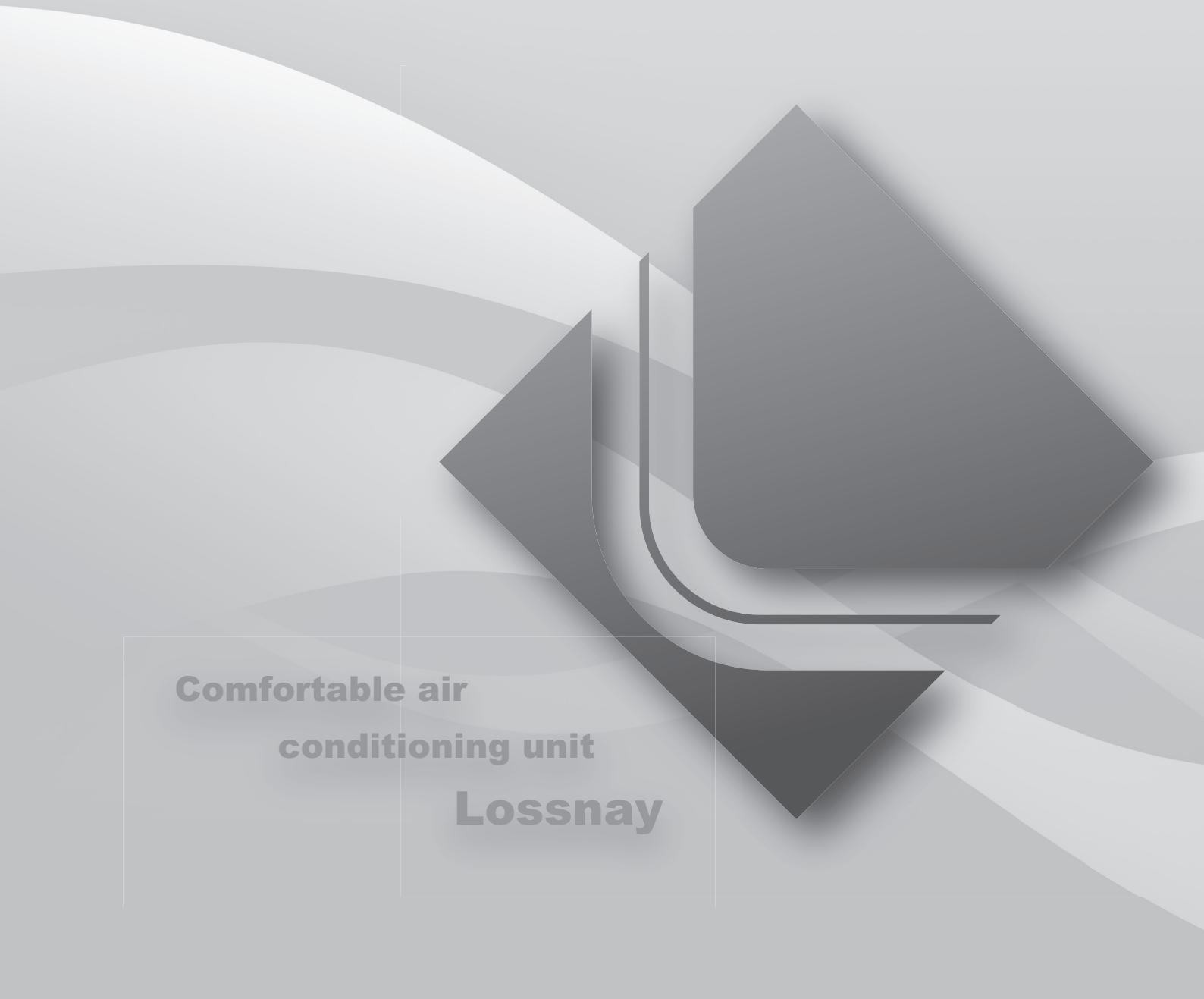
January. 2015

Lossnay

TECHNICAL MANUAL

Model : LGH-RVX-E



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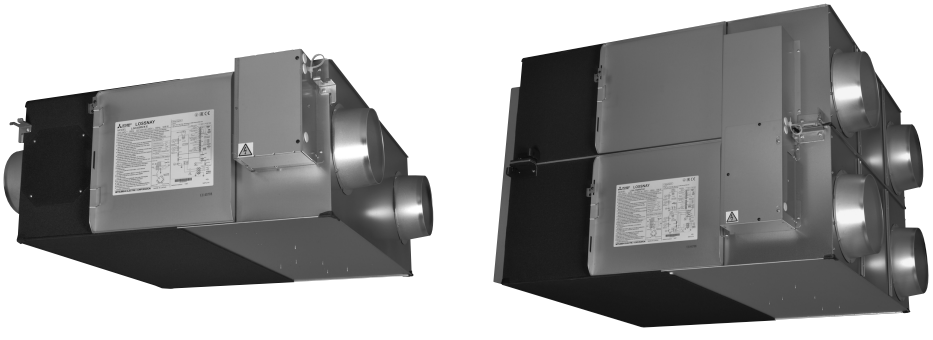
— Lossnay Unit —



CHAPTER 1

Ventilation for Healthy Living

Ventilation air must be introduced constantly at a set ratio in an air-conditioning system. The ventilation air introduced is to be mixed with the return air to adjust the temperature and humidity, supply oxygen, reduce odors, remove tobacco smoke, and to increase the air cleanliness.
The standard ventilation (outdoor air intake) volume is determined according to the type of application, estimated number of persons in the room, room area, and relevant regulations. Systems that accurately facilitate these requirements are increasingly being required in buildings.

1. Necessity of Ventilation

The purpose of ventilation is basically divided into "oxygen supply", "air cleanliness", "temperature control" and "humidity control". Air cleanliness includes eliminating "odors", "gases", "dust" and "bacteria". Ventilation needs are divided into "personal comfort", "optimum environment for animals and plants", and "optimum environment for machinery and constructed materials".
In Japan ventilation regulations are detailed in the "Building Standard Law Enforcement Ordinance" and the "Building Management Law" for upholding a sanitary environment in buildings. These are similar to regulations in other countries.

1.1 Room Air Environment in Buildings

In Japan, the "Building Management Law", a law concerning the sanitary environment in buildings, designates 11 applications including offices, shops, and schools with a total floor area of 3,000m^2 or more, as buildings. Law maintenance and ventilation, water supply, discharge management according to the Environmental Sanitation Management Standards is obligatory.

The following table gives a specific account of buildings in Tokyo.
(Tokyo Food and Environment Guidance Center Report)

Specific Account of Buildings in Tokyo (March, 2003)

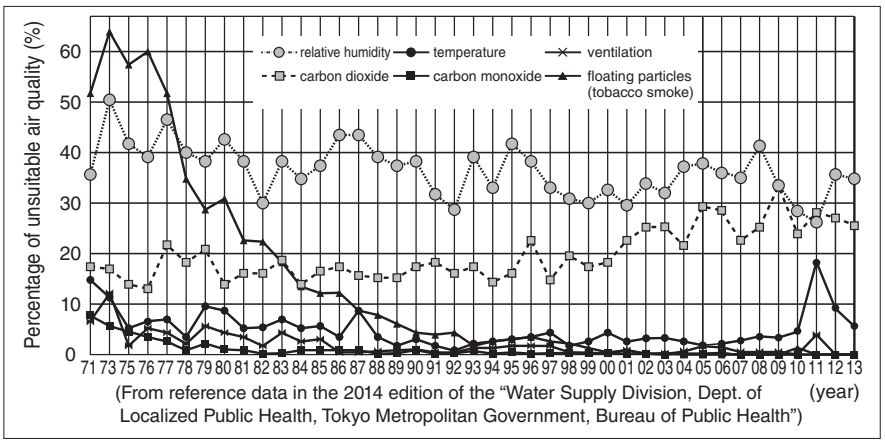
	Number of Buildings	%
Offices	1,467	56.7
Shops	309	22.0
Department Stores	63	2.4
Schools	418	16.2
Inns	123	4.8
Theaters	86	3.3
Libraries	12	0.5
Museums	11	0.4
Assembly Halls	63	2.4
Art Museums	8	0.3
Amusement Centers	27	1.0
Total	2,587	100.0

Note: Excludes buildings with an expanded floor space of 3,000 to 5,000m^2 in particular areas.

Results of the air quality measurement public inspection and the standard values that were not met (percentage of unsuitability) for the approximately 500 buildings examined in 1980 are shown in the chart at the right.

There was a large decrease in high percentages of floating particles, but there was almost no change in temperature and carbon dioxide. The highest percentage of unsuitability in 2006 is relative humidity with 36%, followed by carbon dioxide at 28%.

Percentage Unsuitable Air Quality by Year



(From reference data in the 2014 edition of the "Water Supply Division, Dept. of Localized Public Health, Tokyo Metropolitan Government, Bureau of Public Health")

In Japan, an Instruction Guideline based on these regulations has been issued, and unified guidance is followed. Part of the Instruction Guideline regarding ventilation is shown below.

- The ventilation air intake should be at least 10m from ground level, and be located at an appropriate distance from the exhaust air outlet. (Neighbouring buildings should also be considered.)
- The ventilation air intake volume should be 25 to 30 m^3/h·person.
- An air volume measurement access hole should be installed at an appropriate position to measure the treated air volume of the ventilating device.
- Select the position and shape of the supply diffuser and return grille to evenly distribute the ventilation air in the room.

1.2 Effect of Air Contamination

Effect of Oxygen (O_2) Concentration

Concentration (%)	Standards and Effect of Concentration Changes
Approx. 21	Standard atmosphere.
20.5	Ventilation air volume standard is a guideline where concentration does not decrease more than 0.5% from normal value. (The Building Standard Law of Japan)
20 - 19	Oxygen deficiency of this amount does not directly endanger life in a normal air pressure, but if there is a combustion device in the area, the generation of CO will increase rapidly due to incomplete combustion.
18	Industrial Safety and Health Act. (Hypoxia prevention regulations.)
16	Normal concentration in exhaled air.
16 - 12	Increase in pulse and breathing; resulting in dizziness and headaches.
15	Flame in combustion devices will extinguish.
12	Short term threat to life.
7	Fatal

Effect of Carbon Monoxide (CO) 10,000 ppm = 1%

Concentration (ppm)	Effect of Concentration Changes	
0.01 - 0.2	Standard atmosphere.	
5	Tolerable long-term value.	Approx. 5 ppm is the annual average value in city environments. This value may exceed 100 ppm near roads, in tunnels and parking areas.
10	The Building Standard Law of Japan, Law for Maintenance of Sanitation in Buildings. Environmental standard for a 24-hour average.	
20	Considered to be the tolerable short-term value. Environmental standard for an 8-hour average.	
50	Tolerable concentration for working environment. (Japan Industrial Sanitation Association)	
100	No effect for 3 hours. Effect noticed after 6 hours. Headache, illness after 9 hours; harmful for long-term but not fatal.	
200	Light headache in the frontal lobe in 2 to 3 hours.	
400	Headache in the temporal lobe, nausea in 1 to 2 hours; headache in the back of head in 2.5 to 3 hours.	
800	Headache, dizziness, nausea, convulsions in 45 minutes. Comatose in 2 hours.	
1,600	Headache, dizziness in 20 minutes. Death in 2 hours.	
3,200	Headache, dizziness in 5 to 10 minutes. Death in 30 minutes.	
6,400	Death in 10 to 15 minutes.	
12,800	Death in 1 to 3 minutes.	
Several 10,000 ppm (Several %)	Level may be found in automobile exhaust.	

Effect of Carbon Dioxide (CO_2)

Concentration (%)	Effect of Concentration Changes	
0.03 (0.04)	Standard atmosphere.	
0.04 - 0.06	City air.	
0.07	Tolerable concentration when many occupants stay in the space for long time.	There is no toxic level in CO_2 alone. However, these tolerable concentrations are a guideline of the contamination estimated when the physical and chemical properties of the air deteriorate in proportion to the increase of CO_2.
0.10	General tolerable concentration. The "Building Standard Law" of Japan, "Law for Maintenance of Sanitation in Buildings".	
0.15	Tolerable concentration used for ventilation calculations.	
0.2 - 0.5	Relatively poor.	
0.5 or more	Very poor.	
0.5	Long-term safety limits (U.S. Labor Sanitation) ACGIH, regulation of working offices.	
2	Depth of breathing and inhalation volume increases 30%.	
3	Work and physical functions deteriorate, increase breathing doubles.	
4	Normal exhalation concentration.	
4 - 5	The respiratory center is stimulated; depth and times of breathing increases. Dangerous if inhaled for a long period. If an O_2 deficiency also occurs, conditions will rapidly deteriorate and become dangerous.	
8	When inhaled for 10 minutes, breathing difficulties, redness in the face and headaches will occur. Conditions will worsen when there is also an O_2 deficiency .	
18 or more	Fatal	

Note: According to Facility Check List published by Kagekuni-sha.

1.3 Effect of Air Contamination in Buildings

- Dirtiness of interior
  New ceilings, walls and ornaments will turn yellow from dust and tobacco smoke tar in 1 to 2 years.

2. Ventilation Standards

The legal standards for ventilation differ according to each country. Please follow the standards established in your country. In Japan, regulations are set in the "The Building Standard Law of Japan Enforcement Ordinance", the so-called "Building Management Law" for securing a sanitary buildings environment. According to the "Building Standards Law", a minimum of 20 m^3/h per person of ventilation air is required.

3. Ventilation Method

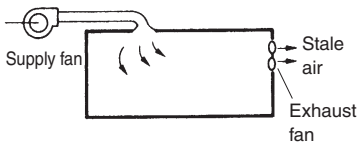
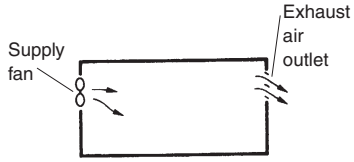
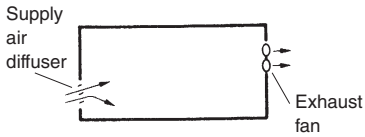
3.1 Ventilation Class and Selection Points

An appropriate ventilation method must be selected according to the purpose of the space.
Ventilation is composed of "Supply air" and "Exhaust air". These functions are classified according to natural flow or mechanical ventilation using a fan (forced ventilation).

Ventilation Classification in Japan (According to Building Standards Law)

	Supply	Exhaust	Ventilation Volume	Room Pressure
Class 1	Mechanical	Mechanical	Random (constant)	Random
Class 2	Mechanical	Natural	Random (constant)	Positive pressure
Class 3	Natural	Mechanical	Random (constant)	Negative pressure
Class 4	Natural	Mechanical & natural	Limited (inconstant)	Negative pressure

Mechanical Ventilation Classification

	Ex. of Application	System Effect	Design and Construction Properties	Selection Points
1. Class 1 Ventilation Ventilation air is mechanically brought in and simultaneously, the stale air in the room is mechanically discharged. 	• Ventilation of air conditioned rooms. (buildings, hospitals, etc.) • Ventilation of room not facing an exterior wall. (basement, etc.) • Ventilation of large rooms. (office, large conference room, hall, etc.)	By changing the balance of the supply fan and exhaust fan's air volumes, the pressure in the room can be balanced, without restrictions, and the interrelation with neighboring spaces can be set without restrictions.	• An ideal design in which the supply air diffuser and exhaust air outlet position relation and air volume, etc., can be set. • A system that adjusts the temperature and humidity of the supply air diffuser flow to the room environment can be incorporated. • The supply and exhaust volume can be set according to the changes in conditions.	• Accurate supply air diffuser can be maintained. • The room pressure balance can be maintained. • The supply air diffuser temperature and humidity can be adjusted and dust treatment is possible.
2. Class 2 Ventilation Ventilation air is mechanically brought in and the exhaust air is discharged from the exhaust air outlet (natural). 	• Surgery theater. • Cleanrooms. • Food processing factories.	As the room is pressurized, odors and dust, etc., from neighboring areas can be prevented from entering.	• The position and shape of the supply air diffuser can be set. • The temperature and humidity of the supply air diffuser flow can be set accordingly, and dust can be removed as required.	• The pressure is positive. • The supply air diffuser temperature and humidity can be adjusted, and dust treatment is possible. • The relation of the exhaust air outlet to the supply air diffuser is important.
3. Class 3 Ventilation The stale air in the room is mechanically discharged and simultaneously ventilation air is mechanically introduced from the supply air diffuser (natural). 	• Local ventilation in kitchens. • Ventilation of hot exhaust air from machine rooms, etc. • Ventilation of humid exhaust air from indoor pools, bath-rooms, etc. • General ventilation.	The exhaust air is removed from an area in the room, and dispersing of the stale air can be prevented by applying negative pressure.	• Effective exhausting of dispersed stale air is possible from an exhaust air outlet. • Ventilation in which the air flow is not detected is possible with the supply air diffuser setting method.	• The room pressure is negative. • Local exhaust is possible. • Ventilation without dispersing stale air is possible. • Ventilation with reduced air flow is possible. • The relation of the exhaust air outlet to the supply air diffuser is important.

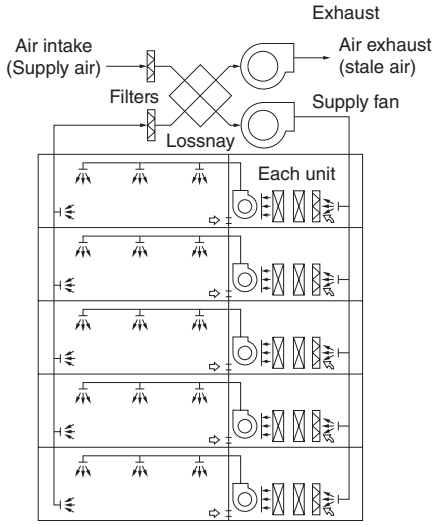
3.2 Comparing of Ventilation Methods

There are two main types of ventilation methods.

Centralized Ventilation Method
Mainly used in large buildings, with the ventilation air intake being installed in one machine room. For this method, primary treatment of the ventilation air, such as energy recovery to the intake air and dust removal, is performed via distribution to the building by ducts.

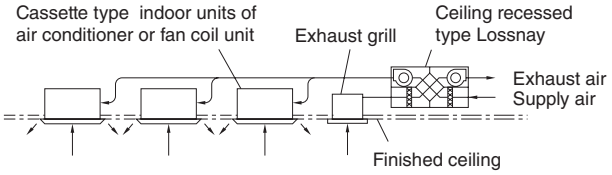
Independent Zoned Ventilation Method
Mainly used in small to medium sized buildings, with areas being ventilated using ventilation air intake via independent ventilation devices. The use of this method has recently increased as independent control is becoming more feasible.

Centralized Ventilation Method

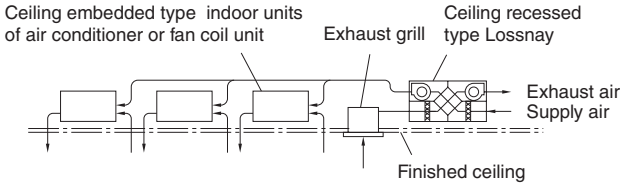


Independent Zoned Ventilation Method

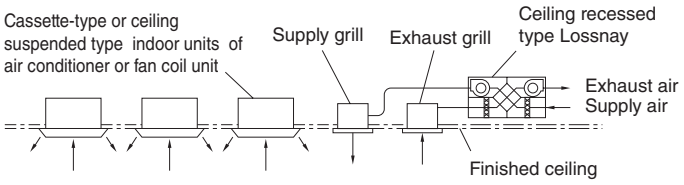
1) System operation with cassette type indoor units of air conditioner



2) System operation with ceiling embedded type indoor units of air conditioner



3) Independent operation with ceiling suspended type indoor units of air conditioner



Comparing Centralized Ventilation and Independent Zoned Ventilation Methods

		Centralized Ventilation Method	Independent Zoned Ventilation Method
System Flexibility	Fan Power	The air transfer distance is long, thus requiring much fan power.	As the air transfer distance is short, the fan power is small.
	Installation Area	• Independent equipment room is required. • Duct space is required. • Penetration of floors with vertical shaft is not recommended in terms of fire prevention.	• Independent equipment room is not required. • Piping space is required only above the ceiling.
	Zoning	Generalized per system.	Can be used for any one area.
	Design	• Design of outer wall is not lost. • The indoor supply air diffuser and return grille can be selected without restrictions for an appropriate design.	• The number of intakes and exhaust air outlets on an outside wall will increase; design must be considered. • The design will be fixed due to installation fittings, so the design of the intakes and exhaust air outlets must be considered.
Control		• As the usage set time and ventilation volume control, etc., are performed in a central monitoring room, the user's needs may not be met appropriately. • A large amount of ventilation is required even for a few occupants.	• The user in each zone can operate the ventilator without restrictions. • The ventilator can be operated even during off-peak hours.
Comfort		• An ideal supply air diffuser and return grille position can be selected as the supply air diffuser and return grille can be positioned without restrictions. • The only noise in the room is the sound of air movement. • Antivibration measures must be taken as the fan in the equipment room is large.	• Consideration must be made because of the noise from the main unit. • Antivibration measures are often not required as the unit is compact and any generated vibration can be dispersed.
System Management	Maintenance and Management	• Centralized management is easy as it can be performed in the equipment room. • The equipment can be inspected at any time.	• Work efficiency is poor because the equipment is not centrally located. • An individual unit can be inspected only when the room it serves is vacant.
	Trouble influence	• The entire system is affected. • Immediate inspection can be performed in the equipment room.	• Limited as only independent units are affected. • Consultation with the tenant is required prior to inspection of an individual unit.
	Costs	Because there are many common-use areas, if the building is a tenant building, an accurate assessment of operating cost is difficult.	Invoicing for each zone separately is possible, even in a tenant building.

4. Ventilation Performance

The ventilation performance is largely affected by the installation conditions. Optimum performance may not be achieved unless the model and usage methods are selected according to the conditions.
Generally, the ventilation performance is expressed by “air volume” and “wind pressure (static pressure)”.

4.1 Air Volume

Air volume equals the volume of air exhausted (or supplied) by the unit in a given period, and is expressed in m^3/h (hour).

4.2 Wind Pressure

When a piece of paper is placed in front of a fan then released, the piece of paper will be blown away. The force that blows the paper away is called wind pressure and is normally expressed in Pa. units. Wind pressure is divided into the following three types:

4.2.1 Static Pressure

The force that effects the surroundings when the air is contained such as in an automobile tyre or rubber balloon. For example, in a water gun, the hydraulic pressure increases when pressed by a piston. If there is a small hole, the water is forced out of that opening. The pressure of the water is equivalent to air static pressure. The higher the pressure, the farther the water (air) can be forced out.

4.2.2 Dynamic Pressure

The speed at which air flows; for example, the force at which a typhoon presses against a building.

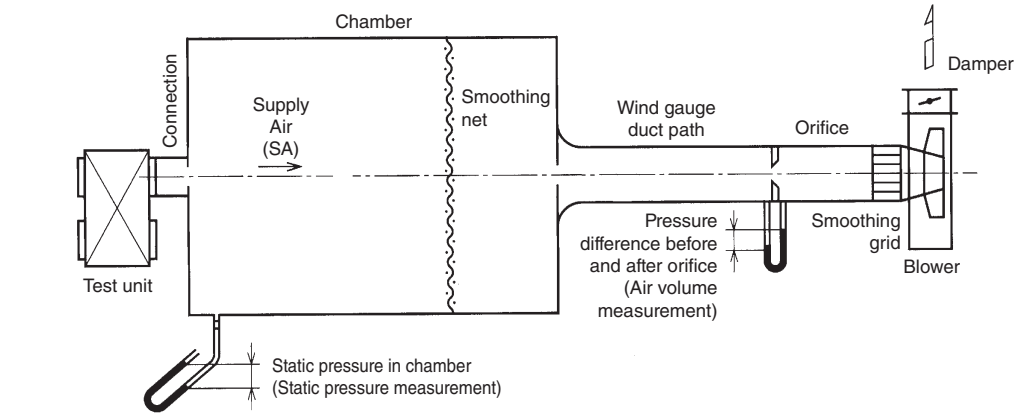
4.2.3 Total Pressure

The total force that wind has, and is the sum of the static pressure and dynamic pressure.

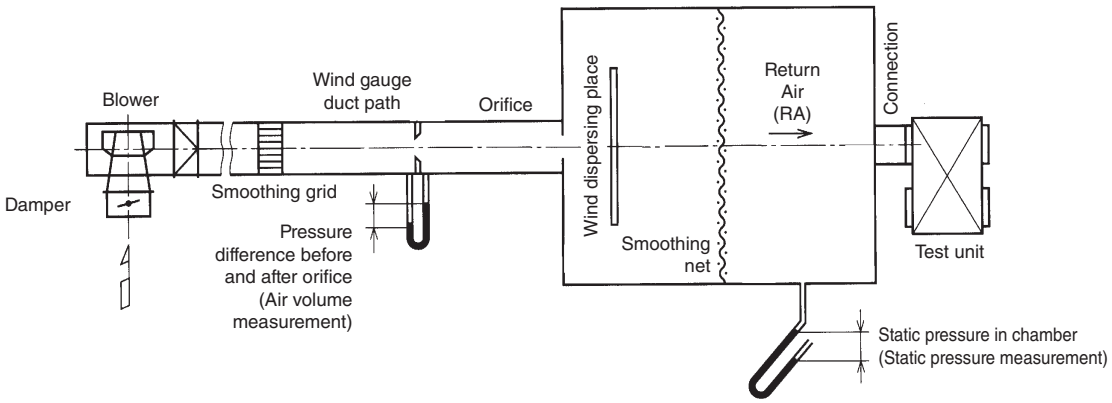
4.3 Measuring the Air Volume and Static Pressure

Mitsubishi Electric measures the Lossnay's air volume and static pressure with a device as shown below according to Japan Industrial Standards (JIS B 8628).

Measuring Device Using Orifice (JIS B 8628 Standards)



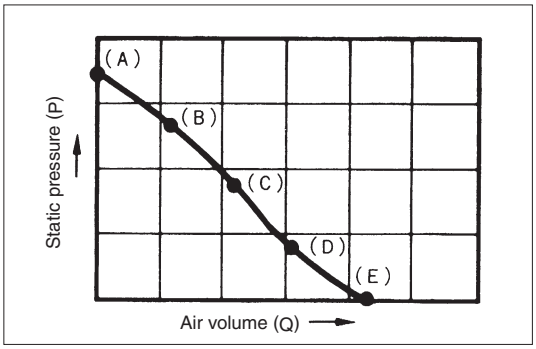
A) When measuring the supply air volume (with the orifice plate)



B) When measuring the return air volume (with the orifice plate)

Measurement Method

The unit is operated with the throttle device fully closed. There is no air flow at this time, and the air volume is 0. The maximum point of the static pressure (Point A, the static pressure at this point is called the totally closed pressure) can be obtained. Next, the throttle device is gradually opened, the auxiliary fan is operated, and the median points (Points B, C and D) are obtained. Finally, the throttle device is completely opened, and the auxiliary fan is operated until the static pressure in the chamber reaches 0. The maximum point of the air volume (Point E, the air volume at this point is called the fully opened air volume) is obtained. The points are connected as shown below, and are expressed as air volume, static pressure curves (P-Q curve).



5. Ventilation Load

5.1 How to Calculate Each Approximate Load

The ventilation air load can be calculated with the following formula if the required ventilation intake volume "Q m^3/h" is known:

(Ventilation air load) = $\gamma \cdot Q_F \cdot (i_O - i_R)$
= γ [kg/m^3] × S [m^2] × k × n [$person/m^2$] × Vf [$m^3/h \cdot persons$] × (i_O - i_R)

γ : Specific air gravity - 1.2 kg/m^3
S : Building's air-conditioned area
k : Thermal coefficient; generally 0.7 - 0.8.
n : The average population concentration is the inverse of the occupancy area per person. If the number of persons in the room is unclear, refer to the Floor space per person table below.
Vf : Ventilation air intake volume per person
Refer to the Required ventilation air intake volume per person table below.
i_O : Outdoor air enthalpy - kJ/kg (DA)
i_R : Indoor enthalpy - kJ/kg (DA)

Floor Space per Person (m^2)
(According to the Japan Federation of Architects and Building Engineers Associations)

	Office Building	Department Store, Shop			Restaurant	Theater or Cinema Hall
		Average	Crowded	Empty		
General Design	4 - 7	0.5 - 2	0.5 - 2	5 - 8	1 - 2	0.4 - 0.6
Value	5	3.0	1.0	6.0	1.5	0.5

Required Ventilation Air Intake Volume Per Person ($m^3/h \cdot person$)

Amount of Cigarette Smoking	Application Example	Required Ventilation Volume	
		Recommended	Minimum
Extremely Heavy	Broker's office Newspaper editing room Conference room	85	51
Quite Heavy	Bar Cabaret	51	42.5
Heavy	Office Restaurant	25.5	17 20
Light	Shop Department store	25.5	17
None	Theater Hospital room	25.5 34	17 25.5

⚠ Caution

The amount of smoking that could be present in each type of room must be carefully considered when obtaining the required ventilation volume shown in the table above.

See below for Calculation examples of determining ventilation load during both cooling and heating.

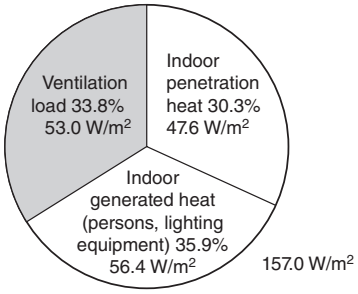
5.2 Ventilation Load During Cooling (In an Office Building)

● Cooling Load Classifications

	Class	Heat Load
(a)	Indoor penetration heat	Heat generated from walls (q_{WS}) Heat generated from glass { from direct sunlight (q_{GS}) / from conduction and convection (q_{GS}) } Accumulated heat load in walls (q_{SS})
(b)	Indoor generated heat	Generated heat from occupants { Sensible heat (q_{HS}) / Latent heat (q_{HL}) } Generated heat from electrical equipment { Sensible heat (q_{ES}) / Latent heat (q_{EL}) }
(c)	Reheating load	(q_{RL})
(d)	Ventilation load	{ Sensible heat (q_{FS}) / Latent heat (q_{FL}) }

(a) The heat penetrating into the room is often 30 to 40% of the total cooling load.
(b) It applies only when heat generated in the room.
(c) It applies only when reheating is necessary.

Typical Load Values During Cooling



Load Type		Load
Ventilation Load		53.0 W/m^2
Indoor Generated Heat	Persons	26.4 W/m^2
	Lighting Equipment	30.0 W/m^2
Indoor Penetration Heat		47.6 W/m^2
Total		157.0 W/m^2

Conditions: Middle south-facing floor of a typical office building.

Cooling Load Per Unit Area

When the volume of ventilation air per persons is 25 m^3/h, and the number of persons per 1 m^2 is 0.2, the cooling load will be approximately 157.0 W/m^2.

● Ventilation Load

Standard design air conditions in Tokyo

		Dry Bulb Temp.	Relative Humidity	Wet Bulb Temp.	Enthalpy	Enthalpy Difference
Cooling	Outdoor Air	33 °C	63%	27 °C	85 kJ/kg (DA)	31.8 kJ/kg (DA)
	Indoor Air	26 °C	50%	18.7 °C	53.2 kJ/kg (DA)	

When the load per 1 m^2 with a ventilation volume of 25 m^3/h·person is calculated with the air conditions detailed above, the following is obtained:

Ventilation load = 1.2 kg/m^3 (Specific gravity of air) × 0.2 person/m^2 (number of persons per 1 m^2) × 25 m^3/h·persons (ventilation air volume) × 31.8 kJ/kg (DA) (air enthalpy difference indoor/outdoor) = 190.8 kJ/h·m^2 (53.0 W/m^2)

The Lossnay recuperates approximately 70% of ventilation load and saves approximately 20% of the total cooling load.

● Determining Internal Heat Gain

When classifying loads, the internal heat gain (indoor generated heat + indoor penetration heat) is the ventilation air load subtracted from the approximate cooling load when it is assumed that there is no reheating load.

(Internal heat gain)
= 157.0 W/m^2 – 53.0 W/m^2 = 104.0 W/m^2

- The value of internal heat gain is based on assumptions for typical loads. To determine individual levels of internal heat gain, the following is suggested:

● Indoor Generated Heat

(1) Heat generated from persons
Heat generation design value per person in the office:

Sensible heat (SH) = 63.0 W·person
Latent heat (LH) = 69.0 W·person
Total heat (TH) = 132.0 W·person

The heat generated per 1 m^2 of floor space:

Heat generated from persons = 132.0 W·person × 0.2 person/m^2 = 26.4 W/m^2

(2) Heat generated from electrical equipment (lighting)
The approximate value of the lighting and power required for a general office with lighting of 300 - 350 Lux, is 20 - 30 W/m^2.

Heat generated from electrical equipment (lighting) = 30 W/m^2

● Indoor Penetration Heat

The heat that penetrates into the building from outside, which can be determined by subtracting the amount of heat generated by persons and lighting from the internal heat gain.

(Indoor infiltration heat)
= 104.0 – (26.4 + 30.0) = 47.6 W/m^2

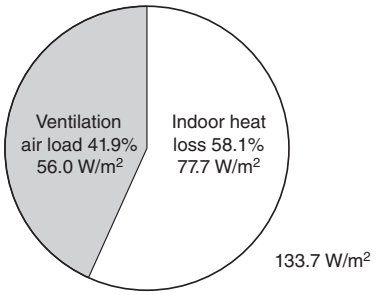
5.3 Ventilation Load During Heating

● Classification of Heating Load

	Class	Heat Load
(a)	Indoor heat loss	Heat escaping from walls (q_{WS}) Heat escaping from glass (q_{GS}) Heat loss from conduction and convection (q_{GS}) Accumulated heat load in walls (q_{SS})
(b)	Ventilation load	Sensible heat (q_{FS}) Latent heat (q_{FL})

During heating, the heat generated by persons and electrical equipment in the room can be subtracted from the heating load. If the warming-up time at the start of heating is short, however, the generated heat may be ignored in some cases.

Percentage of Load



Type of Load	Load
Ventilation Air Load	56.0 W/m²
Internal Heat	77.7 W/m²
Total	133.7 W/m²

Conditions: Middle south-facing floor of a typical office building.

● Heating Load Per Unit Area

When the ventilation air volume per person is 25 m^3/h, and the number of persons per 1 m^2 is 0.2, the heating load will be approximately 133.7 W/m^2.

● Internal Heat Loss

In terms of load classification, the internal heat loss is the value of the ventilation air load subtracted from the approximate heating load.
Internal heat loss = 133.7 W/m^2 – 56.0 W/m^2 = 77.7 W/m^2

● Ventilation Load

Standard design air conditions in Tokyo

		Dry Bulb Temp.	Relative Humidity	Wet Bulb Temp.	Enthalpy	Enthalpy Difference
Heating	Outdoor Air	0 °C	50%	–3 °C	5.0 kJ/kg (DA)	33.5 kJ/kg (DA)
	Indoor Air	20 °C	50%	13.7 °C	38.5 kJ/kg (DA)	

When the load per 1 m^2 of floor area with a ventilation volume of 25 $m^3/h \cdot$person is calculated with the air conditions detailed above, the following is obtained:

Ventilation air load = 1.2 kg/m^3 × 0.2 persons/m^2 × 25 $m^3/h \cdot$person × 33.5 kJ/kg (DA) = 201.0 $kJ/h \cdot m^2$ (56 W/m^2)

The Lossnay recuperates approximately 70% of the ventilation load and saves on approximately 30% of the total load.

CHAPTER 2

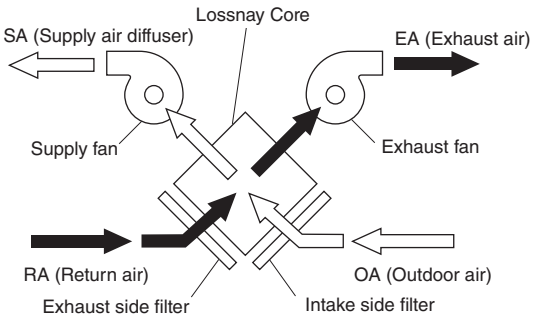
Lossnay Construction and Technology

1. Construction and Features

● Construction

Lossnay is constructed so that the exhaust air passage from the indoor side to the outdoor side (RA → EA) and the ventilation air passage from the outdoor side to the indoor side (OA → SA) cross. The Lossnay Core is located at this crosspoint, and recovers the heat by conduction through the separating medium between these airflows. This enables the heat loss during exhaust to be greatly reduced.

* RA : Return Air
EA : Exhaust Air
OA : Outdoor Air
SA : Supply Air



Note: The dust inlet and outlet are linear in the actual product.

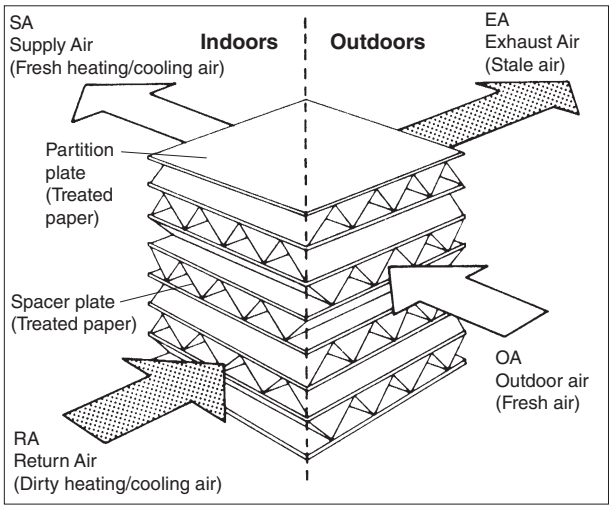
Main Features

(1) Cooling and heating maintenance fees are reduced while ventilating.
(2) The system size of Heating/cooling system and cooling/heating load can be reduced.
(3) Dehumidifying during summer and humidifying during winter is possible.
(4) Comfortable ventilation is possible with the outdoor air can be adjusted to parallel the room temperature.
(5) Sound can be reduced.

2. Lossnay Core Construction and Technology

● Simple Construction

The Lossnay core is a cross-air passage total energy recovery unit constructed from specially treated paper with a corrugated structure.
The fresh air and exhaust air passages are totally separated allowing the fresh air to be introduced without mixing with the exhaust air.



● Principle

The Lossnay Core uses the heat transfer properties and moisture permeability of the treated paper. Total heat (sensible heat plus latent heat) is transferred from the stale exhaust air to the ventilation air being introduced into the system when they pass through the Lossnay.

● Treated Paper

The paper partition plates are treated with special chemicals so that the Lossnay Core is an appropriate energy recovery unit for the ventilator.

The membrane has many unique properties:

(1) Incombustible and strong.
(2) Has selective hydroscopicity and moisture permeability that permits the passage of only water vapor (including some water-soluble gases).
(3) Has gas barrier properties that does not permit gases such as CO_2 from entering the conditioned space.

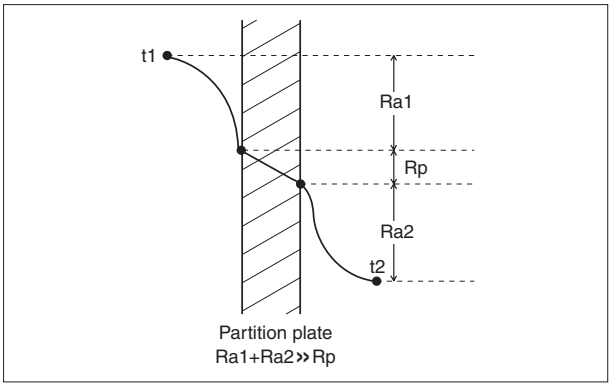
● Total Energy Recovery Mechanism

Sensible Heat and Latent Heat

The heat that enters and leaves in accordance with rising or falling temperatures is called sensible heat. The heat that enters and leaves due to the changes in a matter's physical properties (evaporation, condensation) is called latent heat.

(1)Temperature (Sensible Heat) Recovery

1) Heat conduction and heat passage is performed through a partition plate from the high temperature to low temperature side.
2) As shown in the diagram at right, the energy recovery efficiency is affected by the resistance of the partition plate. For Lossnay, there is little difference when compared to materials such as copper or aluminium that also have high thermal conductivity.

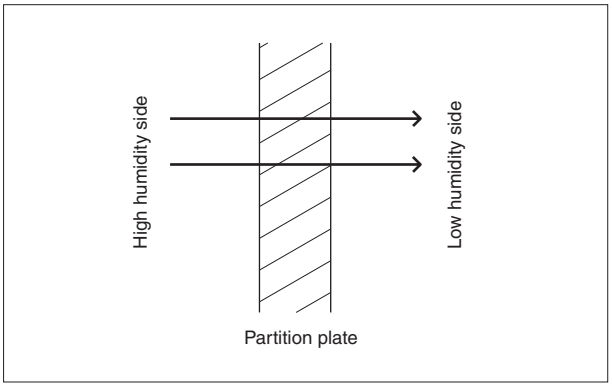


Heat Resistance Coefficients

	Treated Paper	Cu	Al
Ra_1	10	10	10
Rp	1	0.00036	0.0006
Ra_2	10	10	10
Total	21	20.00036	20.0006

(2)Humidity (Latent Heat) Recovery

- Water vapor travels through the partition plate from the high humidity to low humidity side via the differential pressure in the vapor.



3. Total Energy Recovery Efficiency Calculation

The Lossnay Core's energy recovery efficiency can be considered using the following three transfer rates:

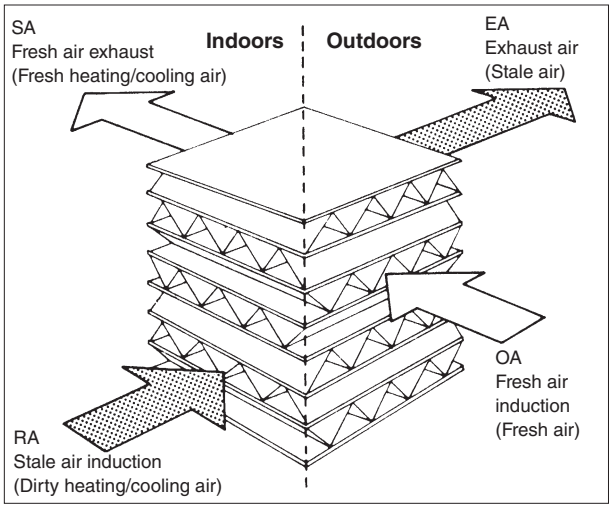
(1) Temperature (sensible heat) recovery efficiency

(2) Humidity (latent heat) recovery efficiency

(3) Enthalpy (total heat) recovery efficiency

The energy recovery effect can be calculated if two of the above efficiencies are known.

- Each energy efficiency can be calculated with the formulas in the table.
- When the supply and exhaust air volumes are equal, the energy recovery efficiencies on the supply and exhaust sides are the same.
- When the supply and exhaust air volumes are not equal, the total energy recovery efficiency is low if the exhaust volume is lower, and high if the exhaust volume is higher.



Item	Formula
Temperature recovery efficiency (%)	$\eta t = \left(\frac{t_{OA} - t_{SA}}{t_{OA} - t_{RA}}\right) \times 100$
Enthalpy recovery efficiency (%)	$\eta i = \left(\frac{i_{OA} - i_{SA}}{i_{OA} - i_{RA}}\right) \times 100$

η: Efficiency (%)

t : Dry bulb temperature (°C)

i : Enthalpy (kJ/kg (DA))

Calculation of Supply Air Condition After Passing Through Lossnay

If the Lossnay energy recovery efficiency and the conditions of the room and outdoor air are known, the conditions of the air entering the room and the air exhausted outdoors can be determined with the following formulas in the following table.

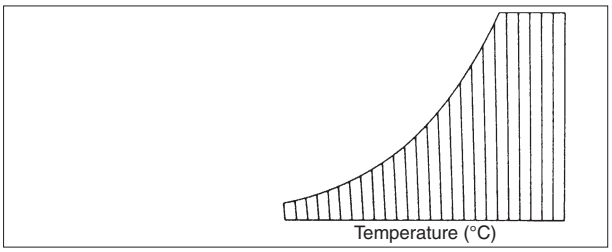
	Supply Side	Exhaust Side
Temperature	$t_{SA} = t_{OA} - (t_{OA} - t_{RA}) \times \eta t$	$t_{EA} = t_{RA} + (t_{OA} - t_{RA}) \times \eta t$
Enthalpy	$i_{SA} = i_{OA} - (i_{OA} - i_{RA}) \times \eta i$	$i_{EA} = i_{RA} + (i_{OA} - i_{RA}) \times \eta i$

4. What is a Psychrometric Chart?

A chart that shows the properties of humid air is called a psychrometric chart. The psychrometric chart can be used to find the (1) Dry bulb temperature, (2) Wet bulb temperature, (3) Absolute humidity, (4) Relative humidity, (5) Dew point and (6) Enthalpy (total heat) of a certain air condition. If two of these values are known, the other values can be found with the chart. Now air conditions will change when it is heated, cooled, humidified or dehumidified can also be seen easily on the chart.

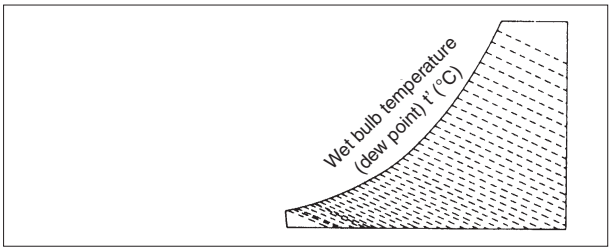
(1) Dry Bulb Temperature t (°C)

Generally referred to as standard temperature, the DB temperature is obtained by using a dry bulb thermometer (conventional thermometer).



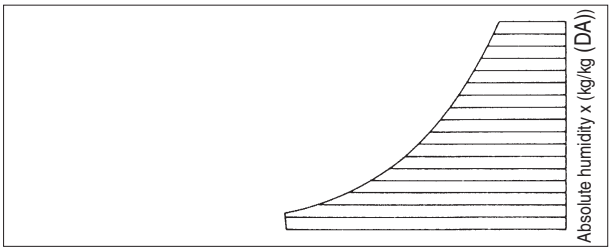
(2) Wet Bulb Temperature t' (°C)

When a dry bulb thermometer is wrapped in a piece of wet gauze and an ample air flow (3 m/s or more) is applied, the heat from the air and evaporating water vapor applied to the wet bulb will balance at an equal state and the wet bulb temperature is obtained.



(3) Absolute Humidity x (kg/kg (DA))

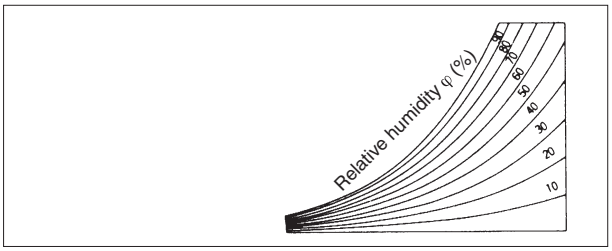
Weight (kg) of the water vapor that corresponds to the weight (kg) of the dry air in the humid air.



(4) Relative Humidity (%)

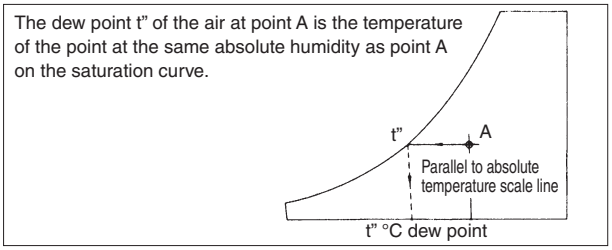
Ratio of the water vapor pressure Pw in the humid air and the water vapor pressure Pws in the saturated air at the same temperature. Relative humidity is obtained with the following formula:

$\varphi R = Pw/Pws \times 100$



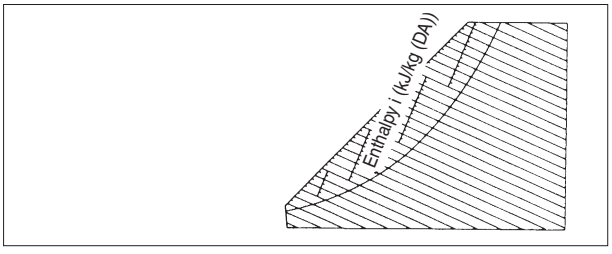
(5) Dew Point t" (°C)

Water content in the air will start to condense when air is cooled and the dry bulb temperature at that condition is the dew point.



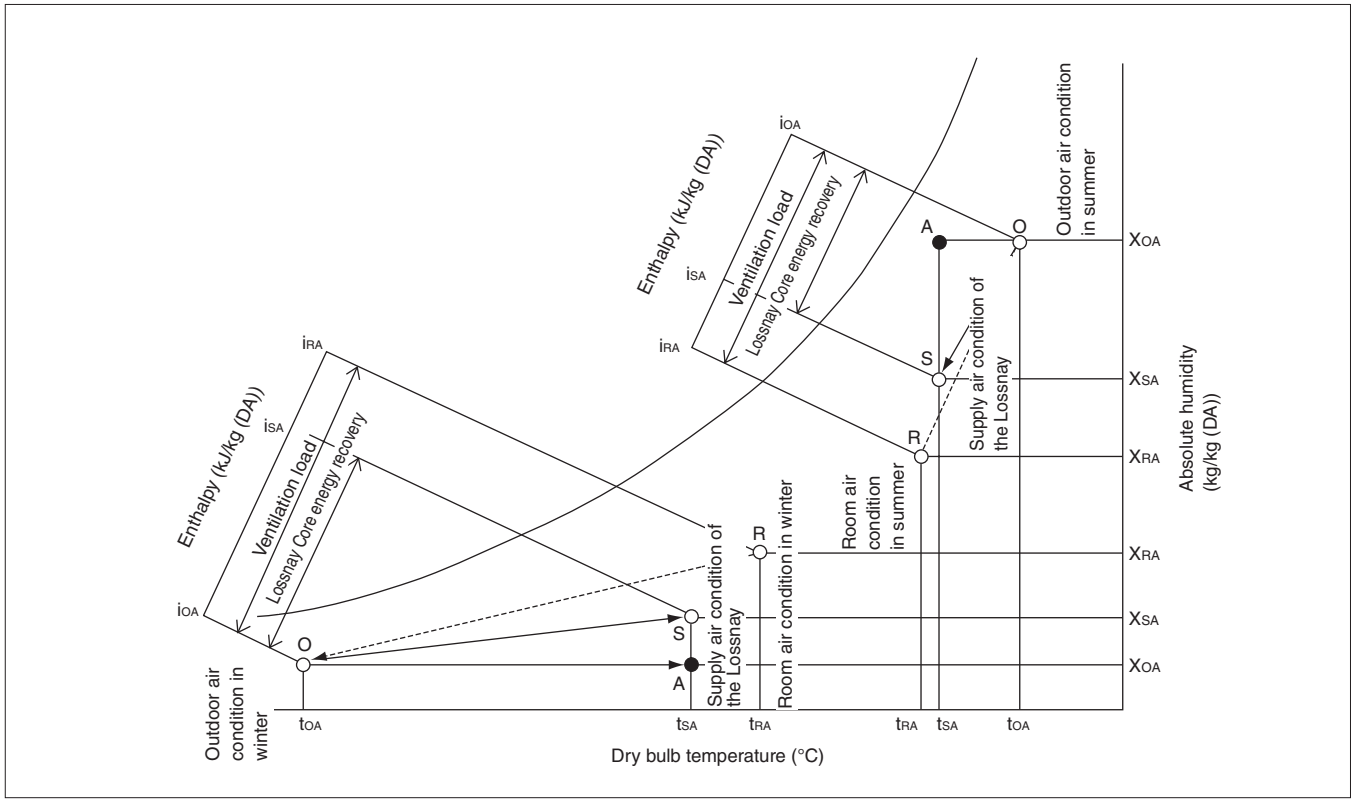
(6) Enthalpy i (kJ/kg (DA))

Physical matter has a set heat when it is at a certain temperature and state. The retained heat is called the enthalpy, with dry air at 0 °C being set at 0.



5. Lossnay Energy Recovery Calculation

The following diagram shows the various air conditions when ventilation air is introduced through the Lossnay Core. If a conventional sensible energy recovery unit is used alone and is assumed to have the same energy recovery efficiency as Lossnay, the condition of the air supplied to the room is expressed by Point A in the figure. Point A shows that the air is very humid in summer and very dry in winter.
The air supplied to the room with Lossnay is indicated by Point S in the figure. The air is precooled and dehumidified in the summer, and preheated and humidified in the winter before it is introduced to the room.



The quantity of heat recovered by using the Lossnay Core can be calculated with the formula below:

Total heat recovered: $q_T = \gamma \times Q \times (i_{OA} - i_{SA})$ [W]
$= \gamma \times Q \times (i_{OA} - i_{RA}) \times \eta i$

Where γ = Specific weight of the air under standard conditions 1.2 (kg/m^3)
Q = Treated air volume (m^3/h)
t = Temperature (°C)
x = Absolute humidity (kg/kg (DA))
i = Enthalpy (kJ/kg (DA))
η = Energy recovery efficiency (%)

OA : Outdoor air
RA : Return air
SA : Supply air

CHAPTER 3

General Technical Considerations

1. Lossnay Energy Recovery Effect

1.1 Comparing Ventilation Load of Various Ventilators

Examples of formulas that compare the energy recovered and ventilation load when ventilating with the Lossnay (total energy recovery unit), a sensible energy recovery ventilation unit (sensible HRV), and a conventional ventilator unit are shown below.

(1) Cooling During Summer

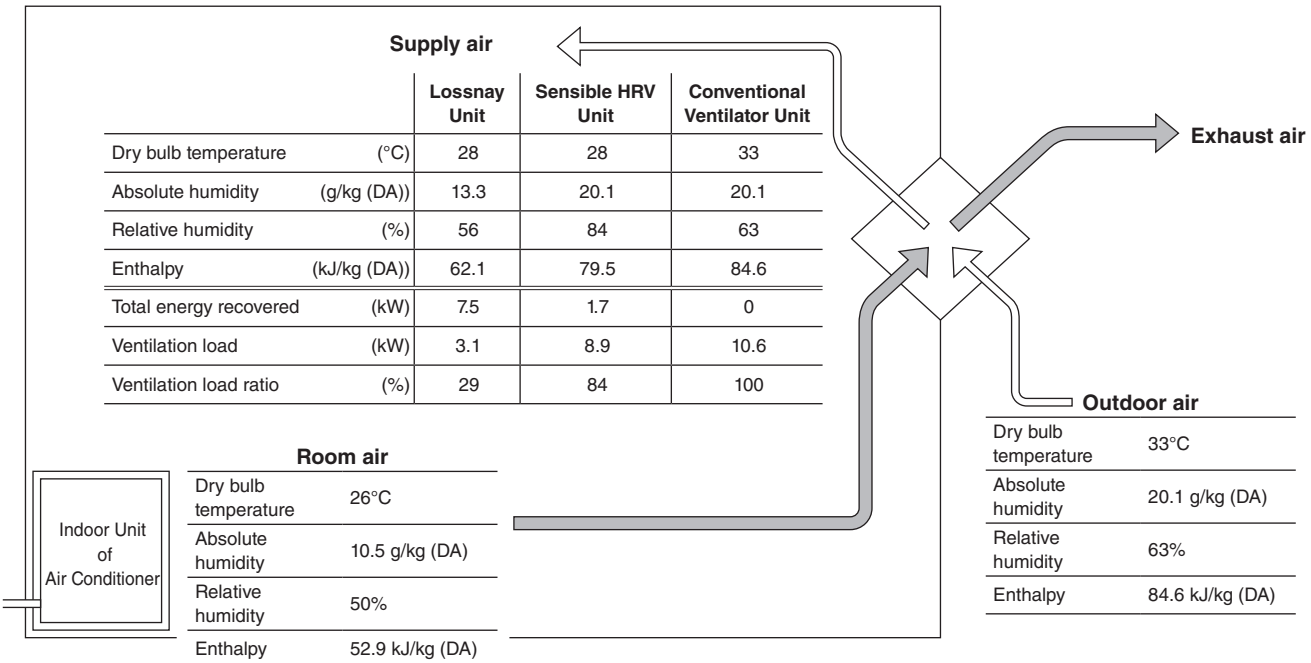
Conditions

- Model LGH-100RVX-E
- Ventilation rate: 1,000 m^3/h
  (specific gravity of air ρ = 1.2 kg/m^3)

- Energy recovery efficiency table (%)
  (For summer)

	Lossnay Unit	Sensible HRV Unit	Conventional Ventilator Unit
Temperature (Sensible Heat)	76	76	–
Enthalpy (Total Heat)	71	17*	–

* Calculated volume under conditions below.



		Lossnay Unit	Sensible HRV Unit	Conventional Ventilator Unit
Dry bulb temperature	(°C)	28	28	33
Absolute humidity	(g/kg (DA))	13.3	20.1	20.1
Relative humidity	(%)	56	84	63
Enthalpy	(kJ/kg (DA))	62.1	79.5	84.6
Total energy recovered	(kW)	7.5	1.7	0
Ventilation load	(kW)	3.1	8.9	10.6
Ventilation load ratio	(%)	29	84	100

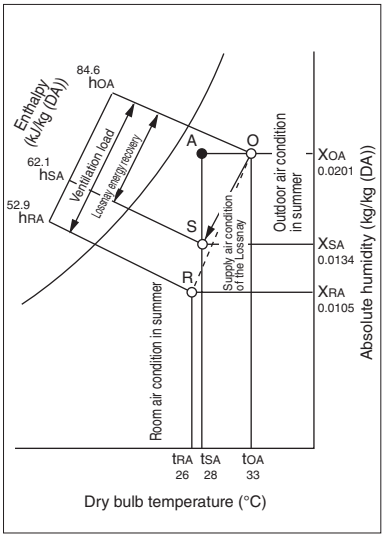
Outdoor air	
Dry bulb temperature	33°C
Absolute humidity	20.1 g/kg (DA)
Relative humidity	63%
Enthalpy	84.6 kJ/kg (DA)

Room air	
Dry bulb temperature	26°C
Absolute humidity	10.5 g/kg (DA)
Relative humidity	50%
Enthalpy	52.9 kJ/kg (DA)

Calculation Example

- Lossnay Unit
  (Supply air diffuser temperature) = 33°C – (33°C – 26°C) × 0.76 = 28°C
  (Supply air diffuser enthalpy) = 84.6 – (84.6 – 52.9) × 0.71 = 62.1 kJ/kg (DA)
  Heat recovered (84.6 – 62.1) × 1.2 × 1,000 ÷ 3,600 = 7.5 kW
  Ventilation load (62.1 – 52.9) × 1.2 × 1,000 ÷ 3,600 = 3.1 kW
- Sensible HRV Unit
  (Supply air diffuser temperature) = 33°C – (33°C – 26°C) × 0.76 = 28°C
  (Supply air diffuser enthalpy) h_{SA} = 79.5 kJ/kg (DA) (from psychrometric chart)
  Heat recovered (84.6 – 79.5) × 1.2 × 1,000 ÷ 3,600 = 1.7 kW
  Ventilation load (79.5 – 52.9) × 1.2 × 1,000 ÷ 3,600 = 8.9 kW
  [Calculated enthalpy recovery efficiency 1.7 ÷ (1.7 + 8.9) × 100 = 16%]
- Conventional Ventilator Unit
  If a conventional ventilator unit is used, the energy recovered will be 0 as the supply air diffuser is equal to the outdoor air.
  The ventilation load is:
  (84.6 – 52.9) × 1.2 × 1,000 ÷ 3,600 = 10.6 kW

Summer Conditions



(2) Heating During Winter

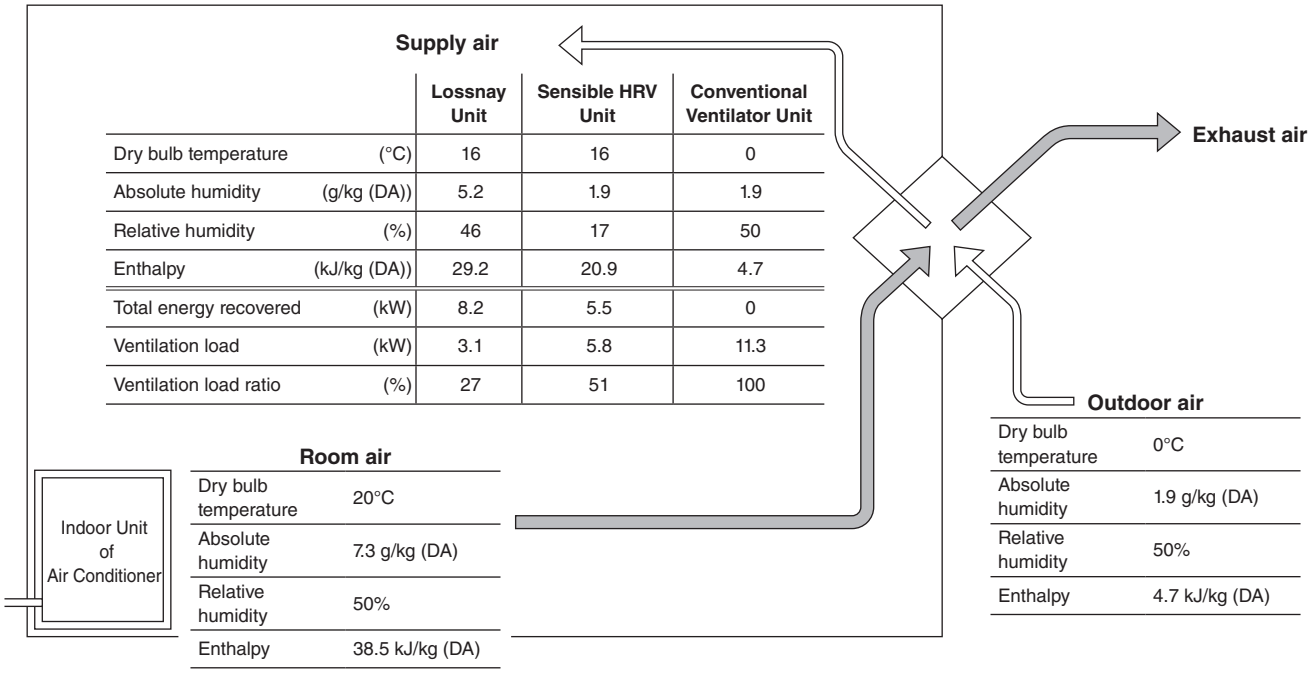
Conditions:

- Model LGH-100RVX-E
- Ventilation rate: 1,000 m^3/h
  (Specific gravity of air γ = 1.2 kg/m^3)

- Energy recovery efficiency table (%)
  (For winter)

	Lossnay Unit	Sensible HRV Unit	Conventional Ventilator Unit
Temperature (Sensible Heat)	80	80	–
Enthalpy (Total Heat)	72.5	49*	–

* Calculated volume under conditions below .



		Lossnay Unit	Sensible HRV Unit	Conventional Ventilator Unit
Dry bulb temperature	(°C)	16	16	0
Absolute humidity	(g/kg (DA))	5.2	1.9	1.9
Relative humidity	(%)	46	17	50
Enthalpy	(kJ/kg (DA))	29.2	20.9	4.7
Total energy recovered	(kW)	8.2	5.5	0
Ventilation load	(kW)	3.1	5.8	11.3
Ventilation load ratio	(%)	27	51	100

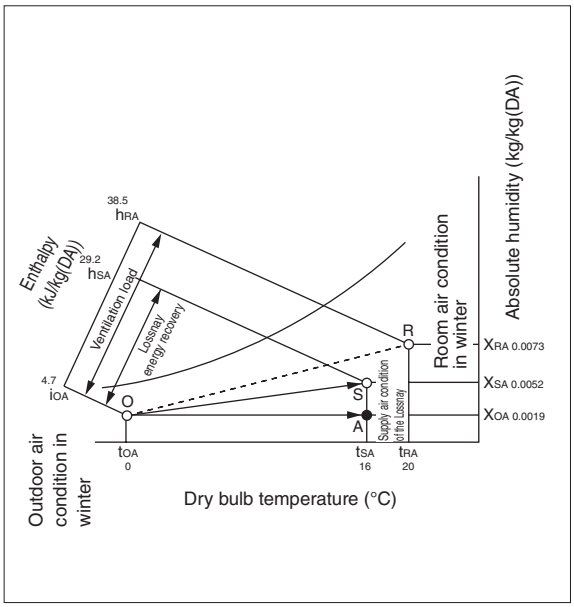
Outdoor air	
Dry bulb temperature	0°C
Absolute humidity	1.9 g/kg (DA)
Relative humidity	50%
Enthalpy	4.7 kJ/kg (DA)

Room air	
Dry bulb temperature	20°C
Absolute humidity	7.3 g/kg (DA)
Relative humidity	50%
Enthalpy	38.5 kJ/kg (DA)

Calculation Example

- Lossnay Unit
  (Supply air diffuser temperature) t_{SA} = (20°C – 0°C) × 0.8 + 0°C = 16°C
  (Supply air diffuser enthalpy) h_{SA} = (38.5 – 4.7) × 0.725 + 4.7
  = 29.2 kJ/kg (DA)
  Heat recovered (29.2 – 4.7) × 1.2 × 1,000 ÷ 3,600 = 8.2 kW
  Ventilation load (38.5 – 29.2) × 1.2 × 1,000 ÷ 3,600 = 3.1 kW
- Sensible HRV Unit
  (Supply air diffuser temperature) t_{SA} = (20°C – 0°C) × 0.8 + 0°C = 16°C
  (Supply air diffuser enthalpy) h_{SA} = 20.9 kJ/kg (DA)
  (from psychrometric chart)
  Heat recovered (20.9 – 4.7) × 1.2 × 1,000 ÷ 3,600 = 5.4 kW
  Ventilation load (38.5 – 20.9) × 1.2 × 1,000 ÷ 3,600 = 5.9 kW
  [Calculated enthalpy recovery efficiency 5.4 ÷ (5.4 + 5.9) × 100 = 48%]
- Conventional Ventilator Unit
  If a conventional ventilator is used, the supply air diffuser is the same as the outdoor air and the exhaust is the same as the room air.
  Thus the energy recovered is 0 kcal and the Ventilation load is
  (38.5 – 4.7) × 1.2 × 1,000 ÷ 3,600 = 11.3 kW

Winter Conditions



2. Calculating Lossnay Cost Savings

Use the following pages to assess the economical benefits of using the Lossnay in particular applications.

(1) Conditions

- Return air volume (RA) = m^3/h
- Outdoor air volume (OA) = m^3/h
- Air volume ratio (RA/OA) =
- Air conditions

Season	Winter Heating					Summer Cooling				
Item	Dry bulb temp. DB [°C]	Wet bulb temp. WB [°C]	Relative humidity RH [%]	Absolute humidity × [kg/kg (DA)]	Enthalpy i [kJ/kg (DA)]	Dry bulb temp. DB [°C]	Wet bulb temp. WB [°C]	Relative humidity RH [%]	Absolute humidity × [kg/kg (DA)]	Enthalpy i [kJ/kg (DA)]
Outdoors										
Indoors										

- Operation time: Heating = hours/day × days/month × months/year = hours/year
  Cooling = hours/day × days/month × months/year = hours/year
- Energy: Heating = Type: Electricity Cost: yen/kWh
  Cooling = Type: Electricity Cost: yen/kWh
  Power rates: Winter: yen/kWh Summer: yen/kWh

(2) Lossnay Model

- Model name:
- Processing air volume per unit RA = m^3/h, OA = m^3/h, Air volume ratio (RA/OA) =
- Energy recovery efficiency : Energy recovery efficiency = %,
  Enthalpy recovery efficiency (cooling) = %,
  Enthalpy recovery efficiency (heating) = %
- Static pressure loss (unit-type) RA= Pa OA = Pa (Note: Each with filters)
- Power consumption (pack-type) = none because of unit type

(3) Indoor Blow Air Conditions

	Heating	Cooling
Temperature [°C]	=(Indoor temperature – outdoor air temperature) × energy recovery efficiency + outdoor air temperature =	=Outdoor air temperature – (outdoor air temperature – indoor temperature) × energy recovery efficiency =
Enthalpy [kJ/kg (DA)]	=(Indoor enthalpy – outdoor air enthalpy) × enthalpy recovery efficiency + outdoor air enthalpy =	=Outdoor air enthalpy – (outdoor air enthalpy – indoor enthalpy) × enthalpy recovery efficiency =
Data obtained from above equation and psychometric chart	•Dry-bulb temperature = °C •Wet-bulb temperature = °C •Relative humidity = % •Absolute humidity = kg/kg (DA) •Enthalpy = kJ/kg (DA)	•Dry-bulb temperature = °C •Wet-bulb temperature = °C •Relative humidity = % •Absolute humidity = kg/kg (DA) •Enthalpy = kJ/kg (DA)

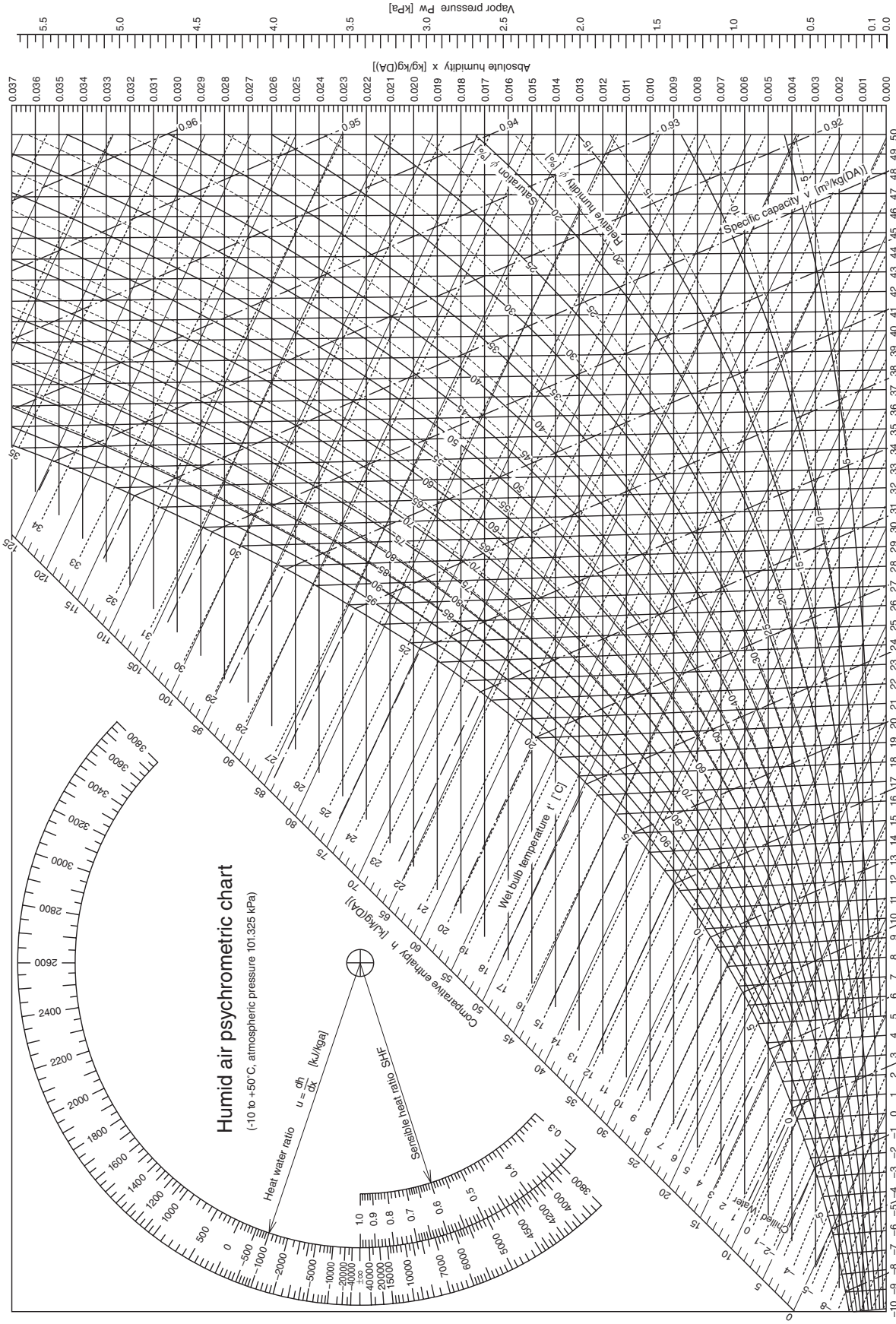
(4) Ventilation Load and Energy Recovery

	Heating	Cooling
Ventilation load without Lossnay (q_1)	=Air specific gravity × ventilation volume × (indoor enthalpy – outdoor air enthalpy) =	=Air specific gravity × ventilation volume × (outdoor air enthalpy – indoor enthalpy) =
Ventilation load with Lossnay (q_2)	=Ventilation load (q_1) × (1 – enthalpy recovery efficiency) = or =Air specific gravity × ventilation volume × (indoor enthalpy – indoor blow enthalpy)	=Ventilation load (q_1) × (1 – enthalpy recovery efficiency) = or =Air specific gravity × ventilation volume × (indoor blow enthalpy – indoor enthalpy)
Energy recovery (q_3)	=$q_1 - q_2$ = – = or =Ventilation load (q_1) × enthalpy recovery efficiency	=$q_1 - q_2$ = – = or =Ventilation load (q_1) × enthalpy recovery efficiency
Ventilation load (%)	●Ventilation load = W = % ●Ventilation load with Lossnay = W = % ●Energy recovered = W = %	●Ventilation load = W = % ●ventilation load with Lossnay = W = % ●Energy recovered = W = %

(5) Recovered Money (Power Rates)

	Heating	Cooling
Cost savings (yen)	=Energy recovered: kW × Unit price ¥/kWh × operation time Hr/year = kW × ¥/kWh × =Hr/year =	=Energy recovered: kW × Unit price ¥/kWh × operation time Hr/year = kW × ¥/kWh × =Hr/year =

3. Psychrometric Chart



4. Determining Lossnay Core Resistance to Bacterial Cross-Contamination and Molds

Test Report

(1) Object

To verify that there is no bacterial cross-contamination from the outlet air to the inlet air of the Lossnay Core.

(2) Client

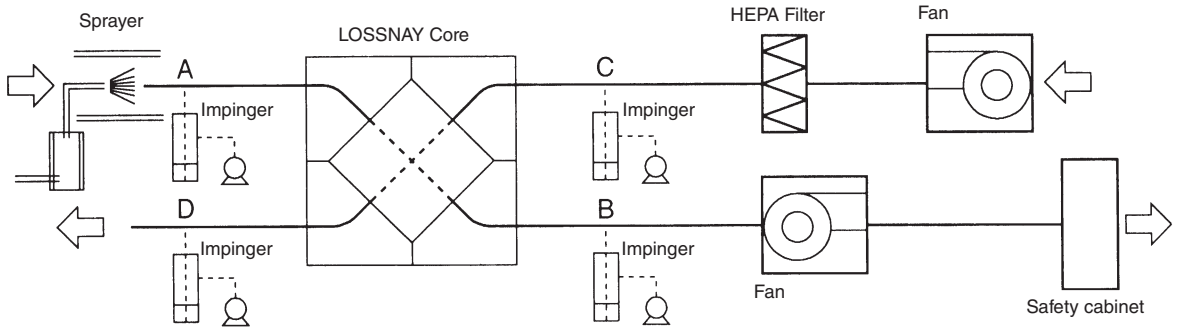
MITSUBISHI ELECTRIC CO. NAKATSUGAWA WORKS.

(3) Test Period

April 26, 1999 - May 28, 1999

(4) Test Method

The test bacteria suspension is sprayed in the outlet duct at a pressure of 1.5 kg/cm^2 with a sprayer whose dominant particle size is 0.3 - 0.5 µm. The air sampling tubes are installed at the center of Locations A, B, C, D (see diagram below), in the Lossnay inlet/outlet ducts so that the openings are directly against the air flow, and then connected to the impingers outside the ducts. The impingers are filled with 100 mL physiological salt solution. The airborne bacteria in the duct air are sampled at the rate of 10L air/minute for three minutes.



(5) Test Bacteria

The bacteria used in this test are as followed;

Bacillus subtilis: IFO 3134

Pseudomonas diminuta: IFO 14213 (JIS K 3835: Method of testing bacteria trapping capability of precision filtration film elements and modules; applicable to precision filtration film, etc. applied to air or liquid.)

(6) Test Result

The result of the test with Bacillus subtilis is shown in Table 1.

The result of the test with Pseudomonas diminuta is shown in Table 2.

Table 1 Test Results with Bacillus Subtilis (CFU/30L air)

No.	A	B	C	D
1	5.4×10^4	5.6×10^4	$< 10^3$	$< 10^3$
2	8.5×10^3	7.5×10^3	$< 10^3$	$< 10^3$
3	7.5×10^3	$< 10^3$	$< 10^3$	$< 10^3$
4	1.2×10^4	1.2×10^4	$< 10^3$	$< 10^3$
5	1.8×10^4	1.5×10^3	$< 10^3$	$< 10^3$
Average	2.0×10^4	1.5×10^4	$< 10^3$	$< 10^3$

Table 2 Test Results with *Pseudomonas Diminuta* (CFU/30L air)

No.	A	B	C	D
1	3.6×10^5	2.9×10^5	$< 10^3$	$< 10^3$
2	2.5×10^5	1.2×10^5	$< 10^3$	$< 10^3$
3	2.4×10^5	7.2×10^5	$< 10^3$	$< 10^3$
4	3.4×10^5	8.4×10^5	$< 10^3$	$< 10^3$
5	1.7×10^5	3.8×10^5	$< 10^3$	$< 10^3$
Average	2.7×10^5	4.7×10^5	$< 10^3$	$< 10^3$

(7) Considerations

Bacillus subtilis is commonly detected in the air and resistant to dry conditions. Pseudomonas diminuta is susceptible to dry conditions and only a few bacterium exists in the air; however, it is used to test filter performance because the particle size is small (Cell diameter: 0.5 µm; Cell length: 1.0 to 4.0 µm).

Both Bacillus subtilis and Pseudomonas diminuta are detected at Locations A and B in the outlet side duct where they are sprayed, but neither them are detected at Location C (in the air filtered by the HEPA filter) and Location D on the inlet side.

Because the number of bacteria in Location A is substantially equal to one in Location B, it is estimated that only a few bacteria are present in the Lossnay Core on the outlet side. Also, no test bacteria are detected at Location D. The conclusion is, therefore, that the bacteria present in the outlet side will not pass through the inlet side even after the energy is exchanged.

Shunji Okada
Manager, Biological Section
Kitasato Research Center of Environmental Sciences

5. Lossnay Core Fire : retardant property

The Lossnay Core was also tested at General Building Research Corporation of Japan according to the fire retardancy test methods of thin materials for construction as set forth by JIS A 1322. The material was evaluated as a Class 2 flame retardant.

ⅢC070036 (1) -2/3

JIS A 1322-1966 「Testing Method for Incombustibility of Thin Materials for Buildings」

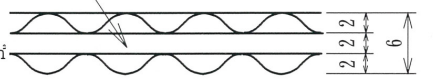
THE CERTIFICATE OF FLAME RETARDANT TEST

Test organization	General Building Research Corporation of Japan	Name of client	Mitsubishi Electric Corp.,Nakatsugawa Works		
Receipt No.	ⅢC－07－0036 (1)	Address of client	1-3, Komaba-cho, Nakatsugawa, Gifu		
Material(s) name	Three-layer single faced corrugated fibre board	Trade name	Lossnay Core(Total heat recovery unit)		
Shape	Flat board	Weight	0.27 kg/m²	Thickness	6 mm

The outline of the test specimen

Material composition of the test specimen (Unit : mm)

Three-layer single faced corrugated fibre board
…Thickness : 6㎜, Weight : 0.27kg/m²
(Single faced corrugated fibre board with 2㎜ cell size laminated alternately at right angle)
Composition
First layer : Single faced corrugated fibre board…Thickness : 2㎜, Weight : 85g/m²
Adhesive agent : Vinyl acetate resin…Weight : 7g/m²(Solid)
Second layer : Same as first layer
Adhesive agent : Vinyl acetate resin…Weight : 7g/m²(Solid)
Third layer : Same as first layer



The above description is based on client submission.

Specimen notation	Size (mm)	Weight (g)
No.1	296 (the long side) × 198 (the short side) × 6 (thickness)	16. 7
No.2	296 (the long side) × 198 (the short side) × 6 (thickness)	16. 6
No.3	296 (the long side) × 198 (the short side) × 6 (thickness)	16. 7

Test method

Test standard	Pretreatment of specimen	Heating time (min)	Heating surface and directionality	Remarks
JIS A 1322-1966 「Testing Method for Incombustibility of Thin Materials for Buildings」 (45° Meeker burner method)	Method A (Dry method)	3	Heating surface･･･The smooth face Directionality･････None	The smooth face of product was heated

Date of test	28th June, 2007	Examination room condition	Room temperature:24℃ Relative humidity:60%

Test results

Specimen notation	Remaining flame (sec)	Afterglow (1 minute after the heating end)	Length of carbonization (length×width) (cm)	Observation items
No.1	0	Nothing	9.2×5.5	Soon after the start of the test, the specimen surface changed to black and smoked. After about 15sec, the specimen back surface changed to black. After about 90sec, the flame passed throagh the specimen.
No.2	0	Nothing	8.5×5.4	Soon after the start of the test, the specimen surface changed to black and smoked. After about 14sec, the specimen back surface changed to black. After about 80sec, the flame passed throagh the specimen.
No.3	0	Nothing	9.0×5.0	Soon after the start of the test, the specimen surface changed to black and smoked. After about 15sec, the specimen back surface changed to black. After about 90sec, the flame passed throagh the specimen.

Judgment of test results	Satisfied JIS A 1322-1966 「Testing Method for Incombustibility of Thin Materials for Buildings」 Anti-flaming Grade2 (Heating time : 3 min)

Chief engineer	Tsuneto Tsuchihashi	Engineer	Tsuneto Tsuchihashi

General Building Research Corporation of Japan

6. Lossnay Core Sound Reducing Properties Test

Because the Lossnay Core is made of paper and the permeable holes are extremely small, the core has outstanding sound reducing properties and is appropriate for ventilation in soundproof rooms.
For example, LGH-100RX3-E has sound reducing characteristics of 35.0dB with a center frequency of 500Hz, which means that a sound source of 84.4dB can be shielded to 49.4dB.

Sound Reducing Effect Test Results

Test number		IVA-01-06
Client	**Name**	Mitsubishi Electric Corporation 1-3, Komaba-cho, Nakatsugawa-shi,
	Address	Gifu 508-8666, Japan
Test Specimen	**Trade name**	LGH-100RX3-E
	Main composition	Air-to-Air Energy Recovery Ventilator
	Manufacture date	May 18, 2001
	Size (unit : mm)	W1231 × H398 × D1521 (ANNEXED DRAWINGS No.1,2 show details.)
	Note	Joint adapter in the sound receiving room side (Portion A in ANNEXED DRAWING No.1) had been filled with oil clay and then covered with onefold aluminum tape, sound insulation sheet and glass wool around duct successively.

Test Method

Standard

Test method was determined according to JIS A 1416 : 1994 "Method for laboratory measurement of sound transmission loss" and Architectural Institute of Japan Standard "Measurement method on sound transmission loss of small building elements".

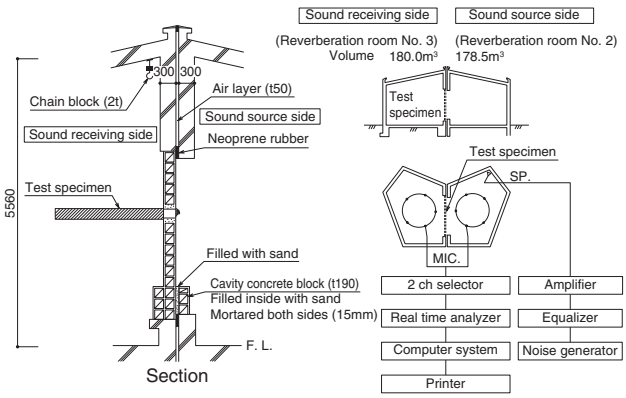


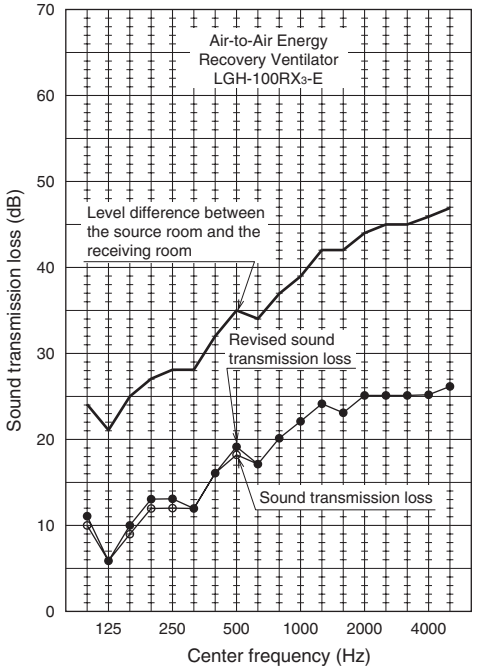
Fig. 1 Testing setup (Unit : mm)

Test Results

Date of test	May 18, 2001
Sound transmitting size	ϕ254 mm × 2
Air temperature, Relative humidity	22.0°C, 62%RH (Receiving room)

Center frequency (Hz)	Average sound pressure level (dB)			Equivalent absorption area in receiving room A (m²)	Sound transmission loss TL (dB)	Revised sound transmission loss TLc (dB)
	Source room Ls	Receiving room Lr	Level difference D			
100	83.3	59.3	24.0	2.65	10	11
125	83.8	62.8	21.0	3.21	6	6
160	85.5	61.0	24.5	3.69	9	10
200	86.0	58.7	27.3	3.48	12	13
250	86.1	58.3	27.8	3.54	12	13
315	85.0	57.0	28.0	3.96	12	12
400	86.2	54.3	31.9	4.40	16	16
500	84.4	49.4	35.0	4.62	18	19
630	84.7	50.7	34.0	4.80	17	17
800	85.5	48.7	36.8	5.06	20	20
1000	87.0	47.7	39.3	5.58	22	22
1250	89.2	47.7	41.5	6.26	24	24
1600	89.3	47.4	41.9	7.03	23	23
2000	90.7	47.0	43.7	7.57	25	25
2500	92.8	48.2	44.6	8.62	25	25
3150	83.4	48.2	45.2	10.19	25	25
4000	95.0	48.8	46.2	12.42	25	25
5000	95.0	47.6	47.4	15.51	26	26

Notes:
1. The graph shows level difference with (revised) sound transmission loss.
2. Test specimen area (Sound transmitting area) is:
   S = 0.10134m² (ϕ254mm × 2) for calculating (revised) sound transmission loss.
3. An arithmetic mean of revised sound transmission loss (1/3 octave, 125Hz - 4000Hz)....18.4dB



Test laboratory	Heat & Acoustics Laboratory, Building Physics Dept. General Building Research Corporation of Japan 5-8-1 Fujishirodai, Suita-shi, Osaka 565-0873, Japan
Responsible parties	Iwao Kurahashi (Head) Takao Waki (Section chief) Mitsuo Morimoto (Section chief)

7. Changes in the Lossnay Core

An example of a building with Lossnay units installed, that has been used as a case study to assess the changes in the units.

7.1 Building Where Lossnay is Installed

(1) Building : Meiji Seimei, Nagoya Office/shop building
1-1 Shinsakae-machi Naka-ku, Nagoya

(2) No. of Floors : 16 above ground, 2-story penthouse, 4 basement floors

(3) Total Floor Space : 38,893 m^2

(4) Reference Floor Space : 1,388 m^2

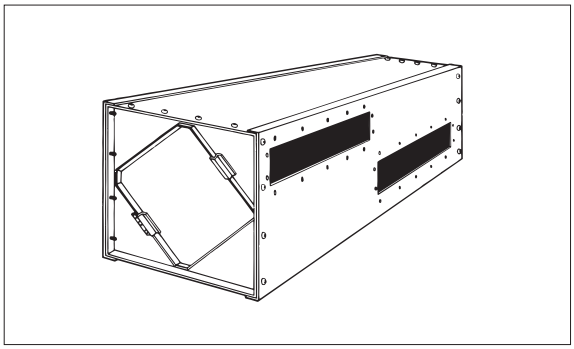
7.2 Specifications of Installed Ventilation Equipment

(1) Air Handling Method : 4 fan coil units (perimeter zone) per floor
Chilling Unit : Absorption-type 250 kT × 1 unit, turbo 250 kT × 2 units
Gas Direct Heating/Cooling Boiler : 340 kT, heating 1,630 kW

(2) Ventilation Method : Air - air total energy recovery unit "Lossnay"
LS-200 × 18 units installed in penthouse.
Outdoor air treatment volume: 46,231 m^3/h,
Exhaust air treatment volume: 54,335 m^3/h.

+

(3) Lossnay Units Used : LS-200* (with four Lossnay Cores)



Lossnay Duct System Diagram

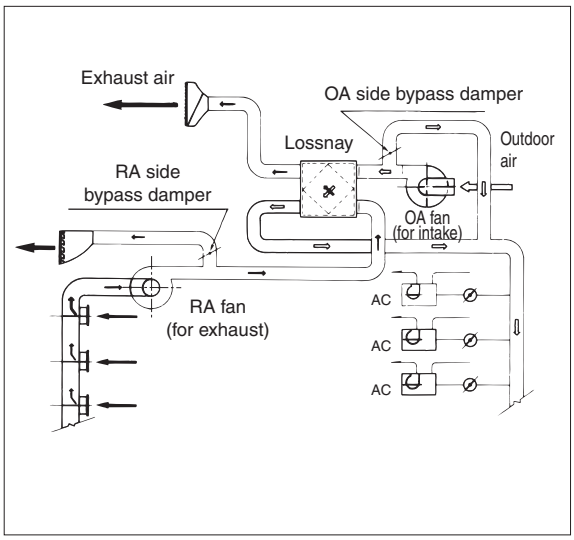
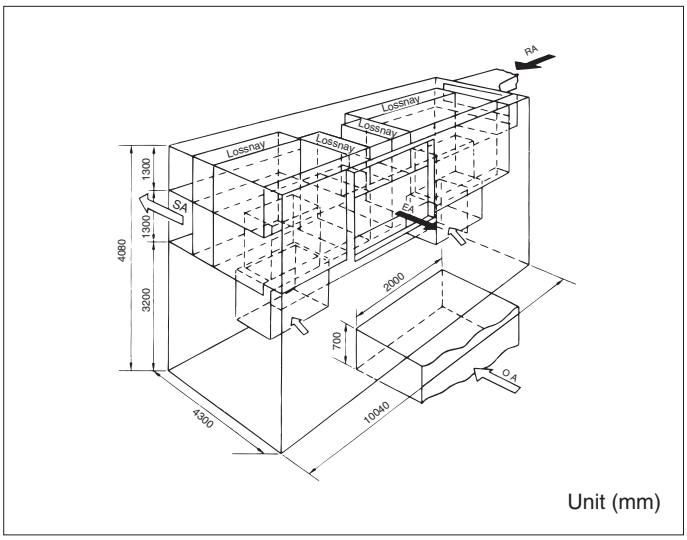


Diagram of Lossnay Penthouse Installation



Unit (mm)

7.3 Lossnay Operation

(1) Unit Operation Began : September 1972
Daily Operation Began : 7:00
Daily Operation Stops : 18:00
} Average daily operation: 11 hours

(2) Inspection Date : November 1983

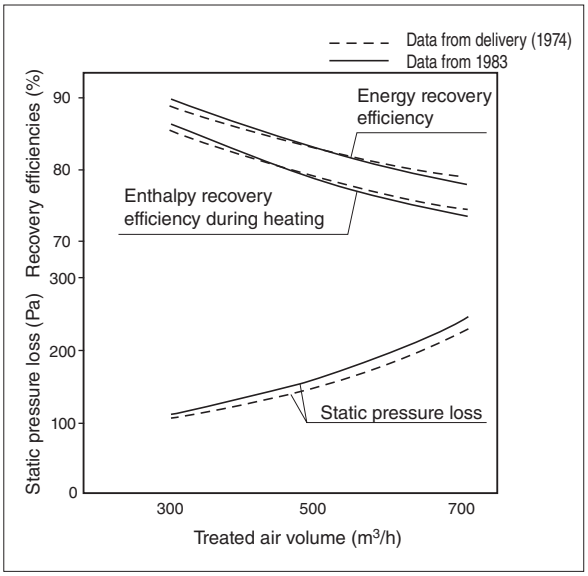
(3) Months When Units are in Bypass Operation : Three months of April, May, June

(4) Total Operation Time : (134 – 33) months × 25 days/month × 11 hours/day = 27,775 hours

7.4 Changes Detected in the Lossnay Core

Two Lossnay Cores were removed from the 18 Lossnay LS-200 installed, and static pressure loss and exchange efficiencies were measured. See chart on right that compares initial operation to same unit 11 years later. The appropriate air volume for one Lossnay Core was 500 m^3/h, and the measurement point was ±200 m^3/h of that value.

Changes Detected in the Lossnay Core



7.5 Conclusion

(1) Changes in the the Lossnay Core after approximately 11 years of use and an estimated 28,000 operation hours were not found.
The static pressure loss was 150 to 160 Pa at 500 m^3/h, which was a 10 Pa increase. The exchange efficiencies had decreased slightly to above 500 m^3/h, however, this is considered to be insignificant and remained in the measurement error range.

(2) The Core surface was black with dust, but there were no gaps, deformed areas, or mold that would pose problems during practical use.

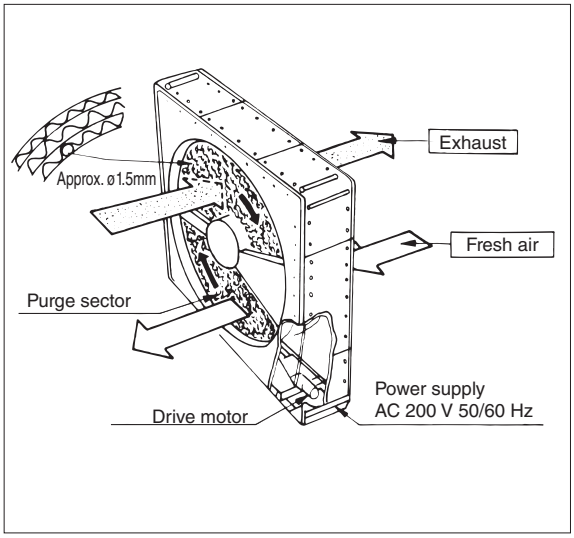
8. Comparing Energy Recovery Techniques

Basic Methods of Total Energy Exchangers

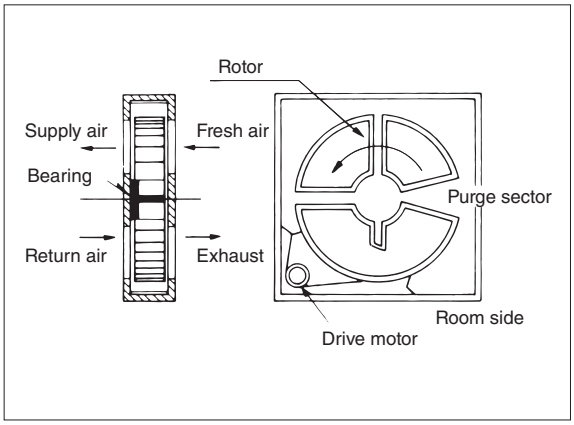
	Type	Method	Air flow	Country of development
Energy recovery principle	Static (Mitsubishi Lossnay)	Conductive transmission type	Cross-flow	Japan
	Rotary type	Heat accumulation/ humidity accumulation type	Counterflow	Sweden

8.1 Principle Construction of Rotary-type Energy Recovery Techniques

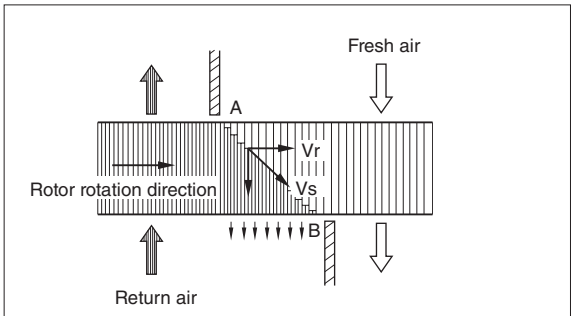
- Rotary-type energy recovery units have a rotor that has a layered honeycomb structure made of kraft paper, drive motor and housing.
  A large quantity of moisture absorbent material (lithium chloride, etc.) is applied onto the rotor, and humidity is transferred. The rotor rotates eight times a minute by the drive motor.



- Rotary-type energy recovery units, when cooling, the high temperature and high humidity ventilation air passes through the rotor, with the heat and humidity being absorbed by the rotor. When the rotor rotates, it moves into the exhaust air passage, and the heat and humidity is discharged to the outdoors because the exhaust is cool and has low humidity.
  The rotor rotates and returns to the ventilation air passage to absorb the heat and humidity again.



- Function of the purge sector
  There are two separation plates (purge sectors) in the front and back of the rotor to separate airflow. Because one of the plates is slightly shifted, part of the ventilation air always flows into the exhaust air passage to prevent the exhaust air and ventilation air from mixing. (A balanced pressure difference is required.)



When a purge sector is added, the exhaust air in the rotor going into the air on the supply side can be prevented.
Vr: Rotor speed, Vs: Air speed in relief section

8.2 Comparing Static-type and Rotary-type Energy Recovery Units

Specification	Static-type		Rotary-type	
Construction/ Principle	Conductive transmission-type: cross-flow Static-type transmission total energy recovery unit with orthogonally layered honeycomb-shaped treated paper formed into multiple layers. ● As the supply air and exhaust air pass through different passages (sequentially layered), the air passages are completely separated.		Heat accumulation/humidity accumulation-type: counterflow The rotor core has honeycomb-shaped kraft paper, etc., to which a moisture absorbent is applied (lithium chloride, etc.). The rotor rotates, and heat accumulation/humidity accumulation - heat discharge/humidity discharge of total energy exchange is performed by passing the exhaust and intake airflows into a honeycomb passage. × Supply air and exhaust airflows go into the same air passage because of the rotary-type construction.	
Moving Parts	● None Fixed core		× Rotor driven with belt by gear motor Rotor core (8 rpm)	
Material Quality	Treated paper		Treated paper, aluminum plates, etc.	
Prefilter	Required (periodic cleaning required)		Required (periodic cleaning required)	
Element Clogging	● Occurs (State where dirt adheres onto the element air passage surface; however, this is easily removed with a vacuum cleaner.)		× Occurs (Dust is smeared into element air passage filter.) (The dust adhered onto the core surface is smeared into the air passage by the purge sector packing. It cannot be removed easily and thus the air volume decreases.)	
Air Leakage Gas Transmission Rate	Approximately 2.5% air leak at standard fan position. Leaks found on the air supply side can be reduced to 0 by leaking the loss air volume (approx. 10%) on the exhaust side with the fan position to the core. ● Gas transmission (Ammonia : 28%, hydrogen sulfide : approx. 6.7%)		× Purged air volume occurs To prevent exhaust leaking to the air intake side, a purge air volume (6 to 14%) leak is created on the exhaust side. Thus, there are problems in the purge sector operation conditions (pressure difference, speed), and the air volume must be balanced. × Gas transmission (Ammonia : 45-57%, hydrogen sulfide : approx. 3.2-4%)	
Bacteria Transmission Rate	● Low (Because air intake/exhaust outlets are separate, transmission is low.)		× High (Because air intake/exhaust outlets are the same, transmission is high.)	
Operation During Off Seasons	Bypass circuit required (Permitted on one side of air intake and exhaust air outlet passage)		Bypass circuit required (Required on both air intake and exhaust air outlet sides) (In theory, operation is possible by stopping the rotation, but the core will over-absorb, and cause damage.)	
Maintenance	Core cleaning: More than once a year The core surface will clog with lint and dirt, but cleaning is easy with a vacuum cleaner. Only the two core air passage intakes need to be cleaned.		Core cleaning: Once every one to two years Cleaning is difficult as dust is smeared into core by the purge sector packing. × Gear motor for rotor drive : Periodic inspection × Rotor bearing, rotor drive belt : Periodic inspection	
Life	Core: Semi-permanent (10 years or more) Static-type units do not break.)		Core: Semi-permanent (10 years or more) (Periodic replacement is required because of the rotor bearings and the core clogging.) × Rotor drive belt : Periodic replacement × Drive motor, rotor bearing : Periodic replacement	
Model is Available	o Available from small to large. o Characteristic design of small and medium models are possible. Large models are easy to match to a machine room layout.	Example LU-1605	Large type only × Small models are difficult to design because of the rotor magnitude.	Example EV-1500
Standard Treatment Air Volume	40 to 25,000 m^3/h	8,000 m^3/h	o 100 to 63,000 m^3/h	8,000 m^3/h
Enthalpy Recovery Efficiency		Temperature: 77% Enthalpy Heating: 71% Cooling: 66%		74%
Pressure Loss		170 Pa		180 Pa
Installation Space (W × D × H) (mm)	Effective for small to medium capacity (Layout depends on combination chosen.)	600 × 2100 × 2540	Large capacity models are effective	320 × 1700 × 1700

Measure of useability ● : High o : Average × : Poor

CHAPTER 4

Characteristics

1. How to Read the Characteristic Curves

1.1 Obtaining Characteristics from Static Pressure Loss

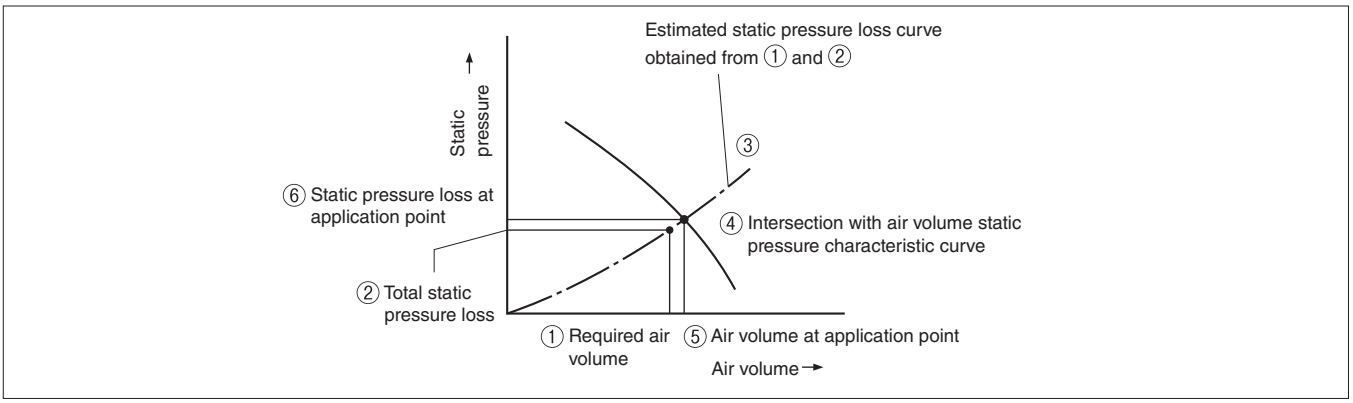
(1) Static pressure loss from a straight pipe duct length (at required air volume)

(2) Static pressure loss at a curved section (at required air volume)

(3) Static pressure loss of related parts (at required air volume)

⇩

Total static pressure loss

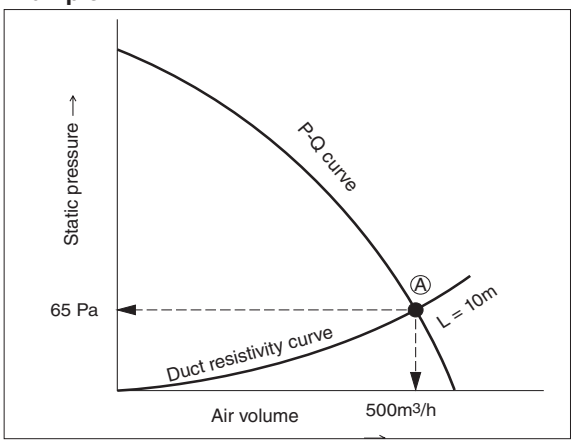


2. Calculating Static Pressure Loss

2.1 How to Read the Air Volume - Static Pressure Curve

It is important to know the amount of static pressure loss applied onto the Lossnay when using ducts for the air distribution. If the static pressure increases, the air volume will decrease. The air volume - static pressure curve (P-Q curve) example shows the percentage at the decrease. A static pressure of 65 Pa is applied to Point A, and the air volume is 500 m^3/h. The duct resistivity curve shows how the static pressure is applied when a duct is connected to the Lossnay. Thus, the L = 9.97 m duct resistivity curve in the diagram shows how the static pressure is applied when a 10 m duct is connected. Intersecting Point A on the Lossnay P-Q curve is the operation point.

Example

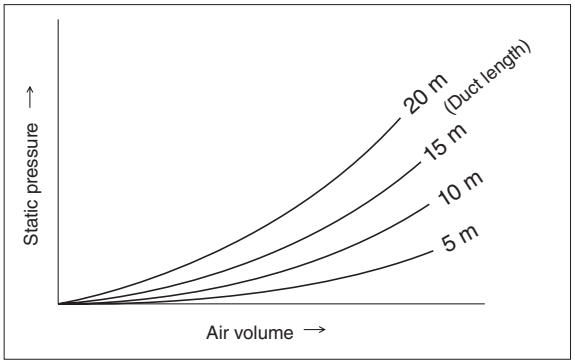


Duct Resistivity Curve

The duct resistivity curve shows how much static pressure a duct will apply on the Lossnay.

In general, the relation between the duct and static pressure is as follows:

Duct	Static Pressure
When duct is long	Increases
If length is the same but the air volume increases	Increases
If the duct diameter is narrow	Increases
If the duct inner surface is rough (such as a spiral)	Increases

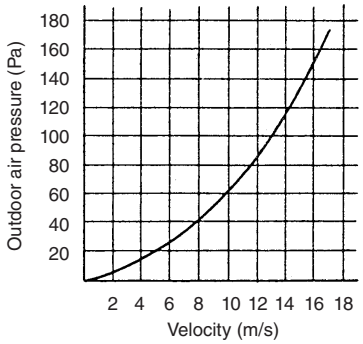


Reference

Pressure loss caused by velocity (Pa)

$$= \frac{\gamma}{2} \times v^2 = \frac{1.2}{2} \times (\text{Velocity})^2$$

γ : Specific air gravity 1.2 (kg/m^3)
v : Velocity (m/s)

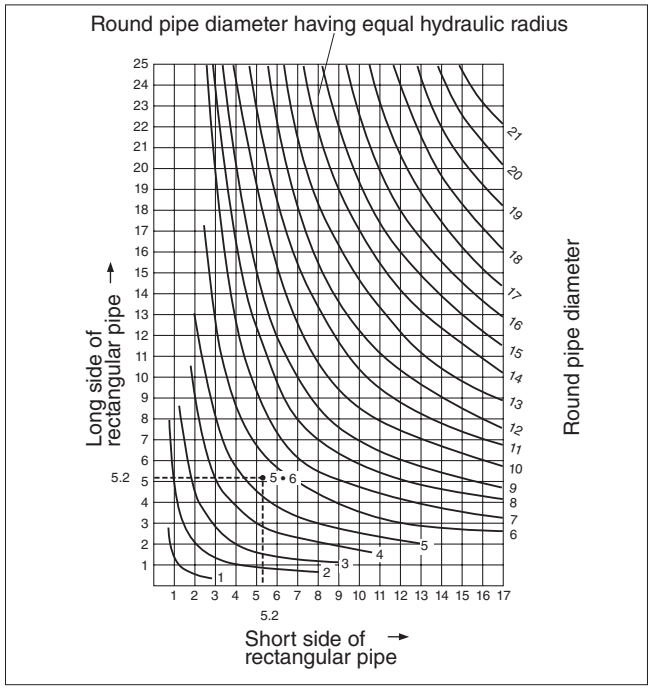


2.2 Calculating of Duct Pressure Loss

When selecting a model that is to be used with a duct, calculate the volumes according to Tables 3, 4, 5 and 6, and then select the unit according to the air volume and static pressure curve.

(1) Calculating a Rectangular Pipe

Table 3. Conversion Table from Rectangular Pipe to Round Pipe



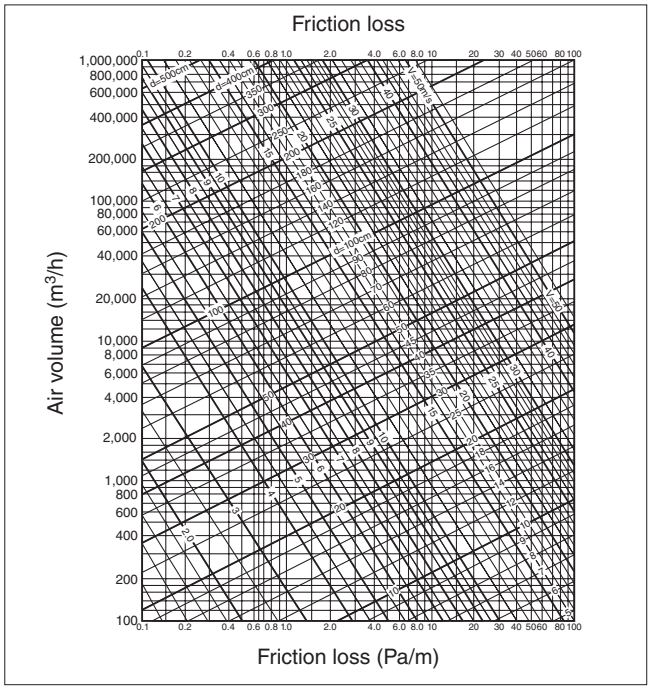
How to read Table 3

Convert a rectangular pipe (in this case, a square pipe: 520 mm each side, for example) to a round pipe in diameter, using this table.

The maximum value for the short side of rectangular pipe is 17 in the table, therefore divide 520 by 100 and it results in 5.2. The round pipe diameter 5.6 is shown by the cross-point of two lines: long side of rectangular pipe 5.2 and short side of rectangular pipe 5.2. Finally, multiply 5.6 by 100 and find that the rectangular (square) pipe is equal to the ø 560 mm round pipe.

(2) Obtaining the Duct Resistivity

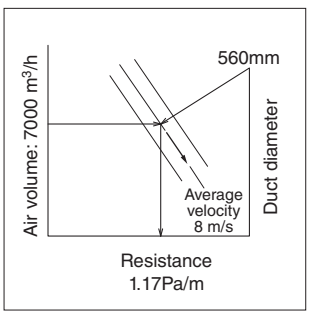
Table 4. Round Duct Friction Loss (steel plate duct, inner roughness ε = 0.18 mm)



How to read Table 4

The point where the line of the round duct diameter (left slanting line) and of the required air velocity (horizontal line) intersect is the pressure loss per 1 m of duct. The value of the slanted line on the lower right of the intersecting point is the average velocity.

(Outline of Table 4)



Data obtained from Table 4 must then be corrected for duct type at various velocities using Table 5 below.

Table 5. Friction Coefficient Compensation Table

Inside Surface of Duct	Example	Average Velocity (m/sec.)			
		5	10	15	20
Very Rough	Concrete Finish	1.7	1.8	1.85	1.9
Rough	Mortar Finish	1.3	1.35	1.35	1.37
Very Smooth	Drawn Steel Pipe, Vinyl Pipe	0.92	0.85	0.82	0.8

An alternative, more detailed method for determining the pressure loss in duct work uses the following formula:

Round pipe section pressure loss

$$\Delta p = \lambda \cdot \frac{\ell}{d} \cdot \frac{\gamma}{2} \cdot v^2 \text{ (Pa)}$$

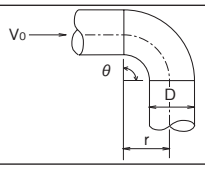
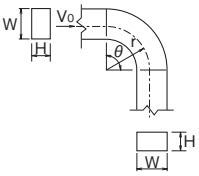
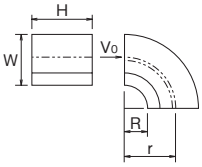
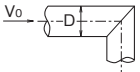
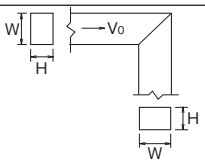
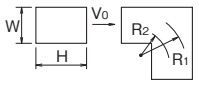
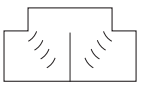
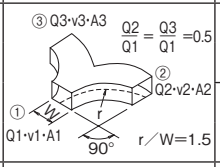
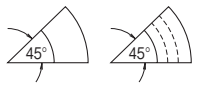
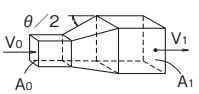
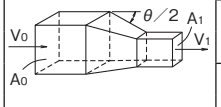
$$\Delta p = C \cdot \frac{\gamma}{2} \cdot v^2 \text{ (Pa)}$$

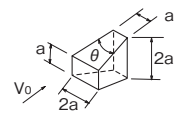
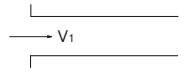
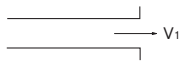
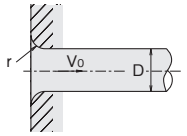
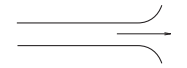
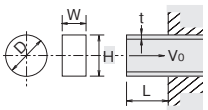
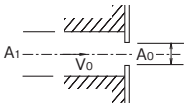
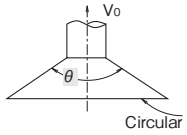
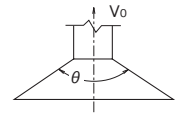
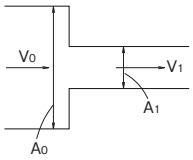
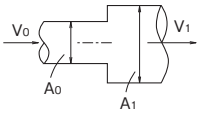
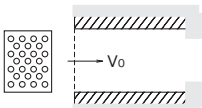
$$= 0.6\, C \cdot v^2$$

λ : Friction resistance coefficient (smooth pipe 0.025)
C : Local loss coefficient (refer to Table 6)
d : Duct diameter (m)
ℓ : Duct length (m)
γ : Specific air gravity (1.2 kg/m^2)
v : Wind velocity (m/s)

(3) How to Calculate Curved Sections in Ductwork

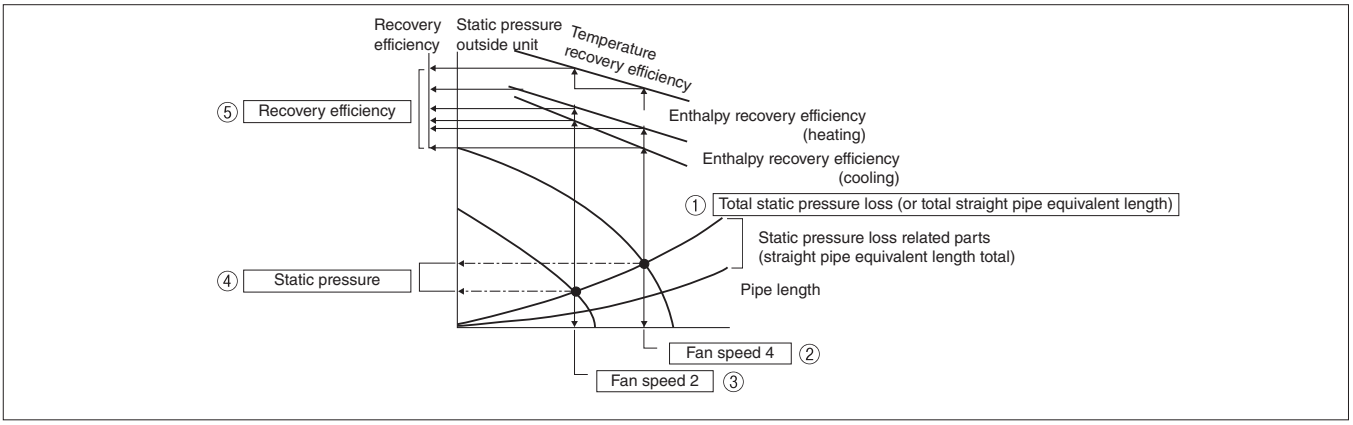
Table 6. Pressure Losses in Each Duct Area

No.	Duct Area	Outline Diagram	Conditions			ζ Value
1	90° Smooth Elbow		r/D = 0.5 = 0.75 = 1.0 = 1.5 = 2.0			0.71 0.33 0.22 0.15 0.13
2	Rectangular Radius Elbow		H/W	r/W		
			0.5	0.5 0.75 1.0 1.5		1.30 0.52 0.25 0.20
			1	0.5 0.75 1.0 1.5		1.2 0.44 0.21 0.17
3	Rectangular Vaned Radius Elbow		No. of vanes	R/W	H/W	
			1	0.5 (r/W =1.0)	0.5 1.0 1.5 2.0	0.06 0.05 0.05 0.04
			2	0.5 (r/W =1.0)	0.5 1.0 1.5 2.0	0.02 0.02 0.02 0.02
4	90° Miter Elbow					1.2
5	Rectangular Square Elbow		H/W=0.5 0.75 1.0 1.5			1.3 1.2 1.2 1.1
6	Rectangular Vaned Square Elbow		1			0.56
			2			0.44
7	Rectangular Vaned Square Junction		Same loss as circular duct. Velocity is based on inlet.			
8	Rectangular Vaned Radius Junction		Join	A3/A1 or A2/A1	0.5	0.23
					1.0	0.07
			Branch		0.5	0.30
					1.0	0.2
9	45° Smooth Elbow		With or without vanes, rectangular or round			0.6 times value for similar 90°
10	Expansion		A1/A0	θ		
			2	30		0.25
				60		0.31
			4	30		0.50
				60		0.61
11	Contraction		A0/A1	θ		
			2	15~40		0.05
				50~60		0.06
			4	15~40		0.04
				50~60		0.07

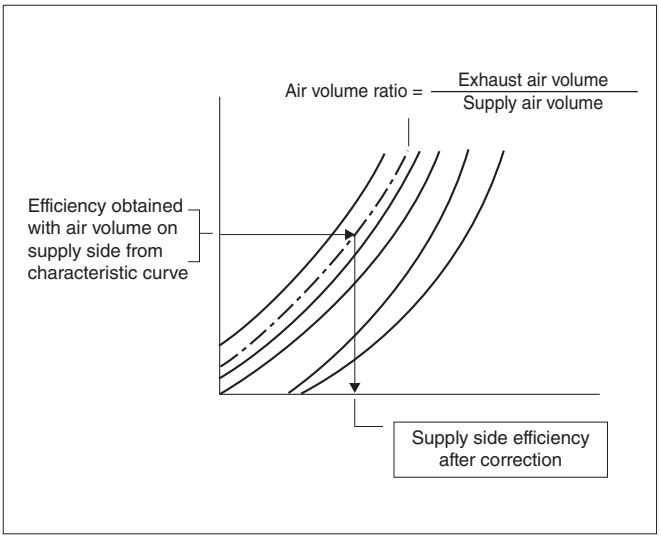
No.	Duct Area	Outline Diagram	Conditions			ζ Value
12	Transformer		θ < 14°			0.15
13	Short Entrance					0.50
14	Short Exit					1.0
15	Bell-shaped Entrance		r/D=0.02 0.04 0.06 0.08 0.1			0.36 0.26 0.20 0.15 0.12
16	Bell-shaped Exit					1.0
17	Re-entering inlet		t/D	L/D		
			< 0.02	0.025		0.80
				0.2		0.92
			> 0.02	0.05		0.55
				0.2		0.66
18	Sharp edge, round orifice		A0/A1=	0.5 0.6 0.8 1.0		7.76 4.65 1.95 1.0
19	Pipe inlet (with circular hood)		θ	20° 40° 60° 90°		0.02 0.03 0.05 0.11
20	Pipe inlet (with rectangular hood)		θ	20° 40° 60° 90°		0.13 0.08 0.12 0.19
21	Short contraction		A0/A1=	2 4 6 8		0.26 0.41 0.42 0.43
			Loss is for V1			
22	Short expansion		A1/A0=	2 4 6 8		0.26 0.57 0.69 0.81
			Loss is for V0			
23	Suction inlet (punched narrow plate)		Free are ratio	0.2 0.4 0.6 0.8		35.0 7.6 3.0 1.2

3. How to Obtain Efficiency from Characteristic Curves

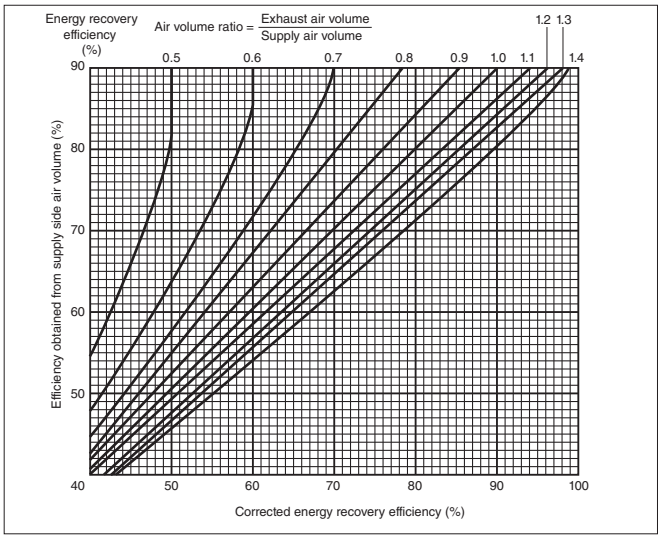
How to Read Characteristic Curve



- Obtaining the efficiency when supply air and exhaust air volumes are different.
  The efficiency obtained from the intake side air volume in each characteristic curve can be corrected with the air volume ratio in the bottom right chart.
  If the intake side and exhaust side duct lengths are greatly different or if a differential air volume is required, obtain the intake side efficiency from the bottom right chart.



Energy Recovery Efficiency Correction Curve



4. Sound

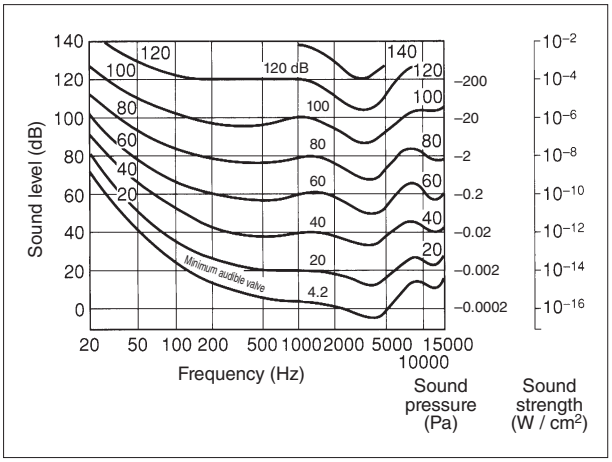
Sound is vibration transmitted through an object. The object that vibrates is called the sound source, and energy that is generated at the source is transmitted through the air to the human ear at certain frequencies.

4.1 Sound Levels and Auditory Perception

Sound level is the sound wave energy that passes through a unit area in a unit time, and is expressed in dB (decibel) units.
The sound heard by the human ear is different according to the strength of the sound and the frequency, and the relation to the tone (see chart on the right). The vertical line shows the strength of the sound and the horizontal line shows the frequency. For frequencies between 20 Hz to 15,000 Hz which can be detected by the human ear, the strength of sound that can be detected that is equivalent to a 1,000 Hz sound is obtained for each frequency. The point where these cross is the sound level curve, and a sound pressure level numerical value of 1,000 Hz is expressed. These are called units of phons; for example, the point on the 60 curve is perceived as 60 phons.

- On average, the human detects sounds that are less than 1,000 Hz as rather weak, and sounds between 2,000 to 5,000 Hz as strong.

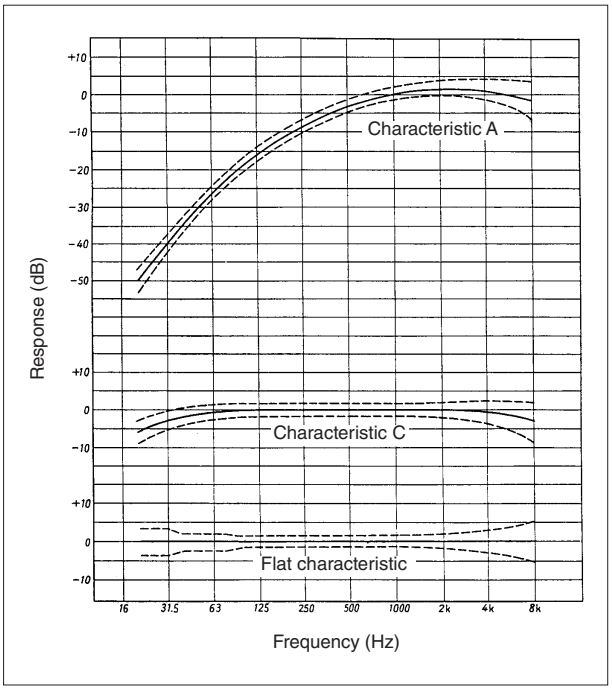
ISO Audio Perception Curve



4.2 How to Measure Sound Levels

A sound level meter (JIS C 1502, IEC 651) is used to measure sound levels and has three characteristics (A*1, C*2 and Flat) as shown on the right. These represent various sound wave characteristics. Generally, Characteristic A, which is the most similar to the human ear, is used. The value measured with the Lossnay unit operating includes noise caused by the unit and background noise*3.

*1. Characteristic A is a sound for which the low tones have been adjusted to be similar to the auditory perception of the human ear.
*2. Characteristic C is a sound for which the high and low tones have been adjusted slightly.
*3. Background noise: any sound present in the target location when no sound is being produced.

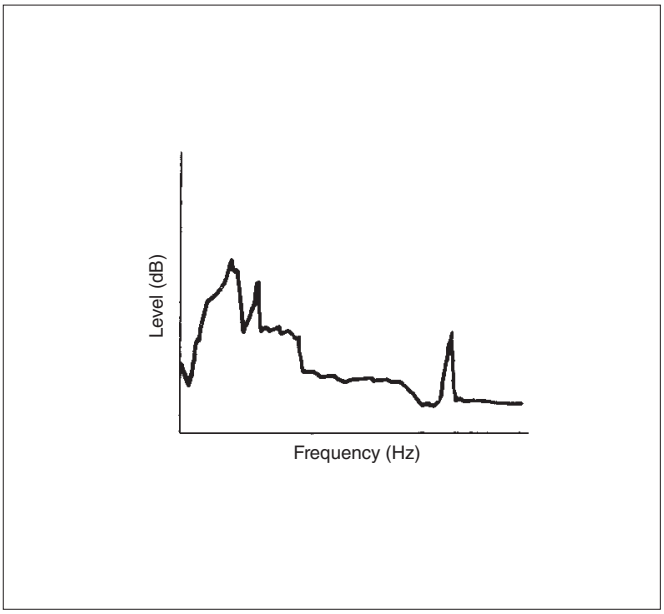


4.3 Sound Frequency Analysis

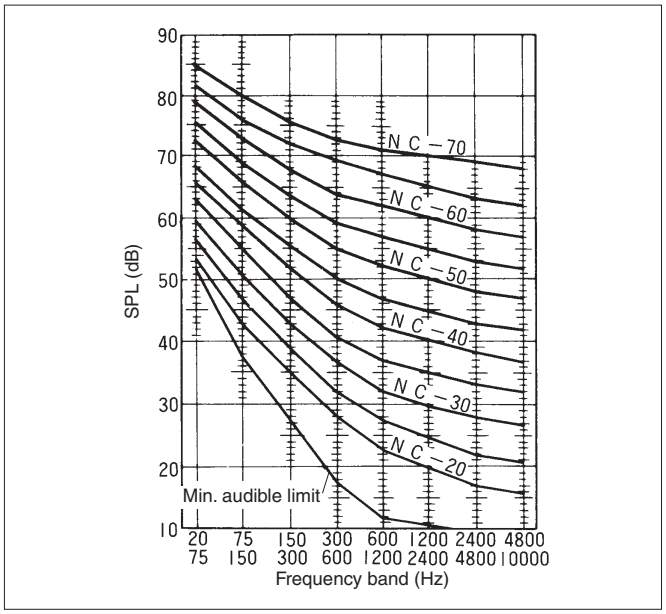
The human ear detects sound differently according to the frequency; however, the sound generated from vibrations is not limited to one frequency, but instead, various frequencies are generated at different levels. NC curve will show how the various frequencies are generated at different levels, which is determined according to the difficulty of detecting conversations.

- Even if the sound is a very low level, it can be detected if it has a specific and loud frequency.
  These sounds are low during product design stages, but sounds may become very disturbing if resonating on ceilings, walls, etc.

Example: Continuous Frequency Analysis



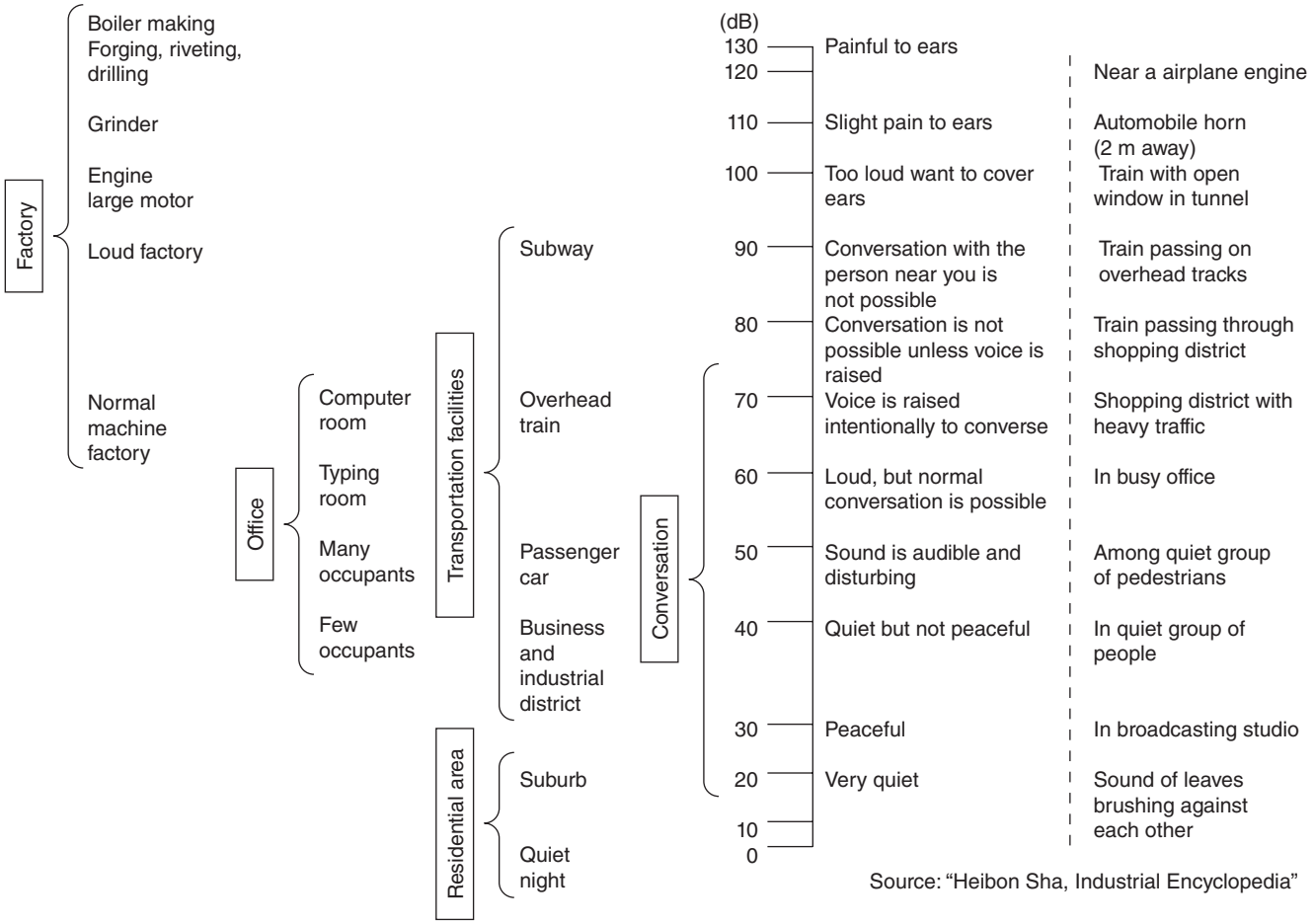
NC Curve



- **Tolerable Sound Levels and NC Values According to Room Application**

Room Application	dB	NC Value	Room Application	dB	NC Value
Broadcasting studio	25	15 - 20	Cinema	40	30
Music hall	30	20	Hospital	35	30
Theater (approx. 500 seats)	35	20 - 25	Library	40	30
Classroom	40	25	Small office	45	30 - 35
Conference room	40	25	Restaurant	50	45
Apartment	40	25 - 30	Gymnasium	55	50
Hotel	40	25 - 30	Large conference room	50	45
House (living room)	40	25 - 30	Factory	70	50 or more

* Approximate values of sound levels using practical examples
The following diagram shows typical everyday sounds.
Approximate degree of sound levels can be seen.
* Sound levels and perception



Source: "Heibon Sha, Industrial Encyclopedia"

4.4 Indoor Sounds

(1) Indoor Sounds Principles

1) Power Levels

The Power level of the sound source (PWL) must be understood when considering the effects of sound.
See formula below to obtain PWL from the measured sound pressure data in an anechoic chamber.

$$PWL = SPLo + 20 \log (ro) + 11 \text{ [dB]} \quad \ldots\ldots\ldots\ldots\ldots\ldots (I)$$

PWL : Sound source power level (dB)
SPLo : Measured sound pressure in anechoic chamber (dB)
ro : Distance from the unit to measuring point (m)

2) Principal Model

Consider the room shown in Figs. 1 and 2.

- Fig. 1 shows an example of an integrated unit (similar to a cassette-type Lossnay unit) and supply air diffuser (with return grille).
  Fig. 2 shows an example of a separated unit (similar to a ceiling-embedded type Lossnay unit) and supply air diffuser (with return grille).
- ⓐ is the direct sound from the supply air diffuser (return grille), and ⓑ is the echo sound. ⓒ (ⓒ1 to ⓒ3) is the direct sound emitted from the unit and duct that can be detected through the finished ceiling. ⓓ is the echo sound of ⓒ.

3) Position of Sound Source and Sound Value

$$SPL \text{ [dB]} = PWL + 10 \log \left\{ \underbrace{\frac{Q}{4\pi r^2}}_{(i)} + \underbrace{\frac{4}{R}}_{(ii)} \right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots (II)$$

SPL : Sound pressure level at reception point [dB]
PWL : Power level of sound source [dB]
Q : Directivity factor (Refer to Fig. 3)
r : Distance from sound source [m]
R : Room constant [$R = \overline{\alpha} S/(1 - \overline{\alpha})$]
$\overline{\alpha}$: Average sound absorption ratio in room (Normally, 0.1 to 0.2)
S : Total surface area in room [m^2]

Fig. 1.

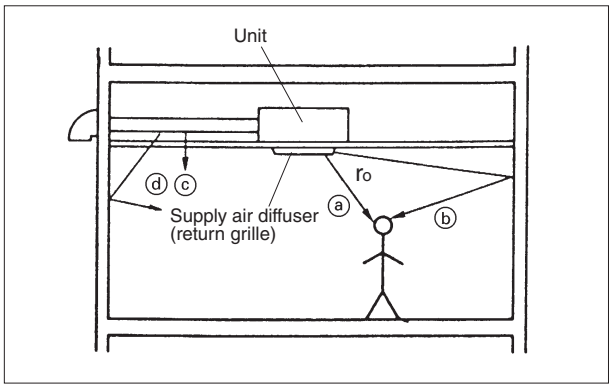


Fig. 2.

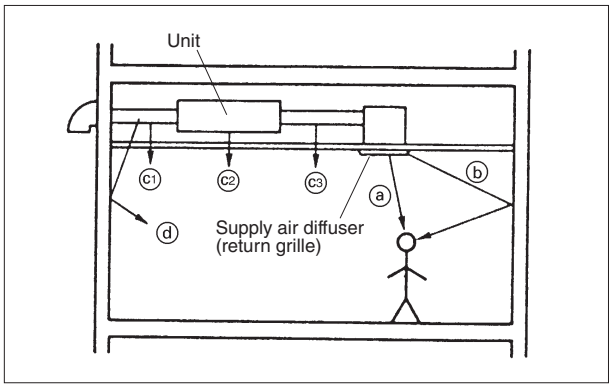
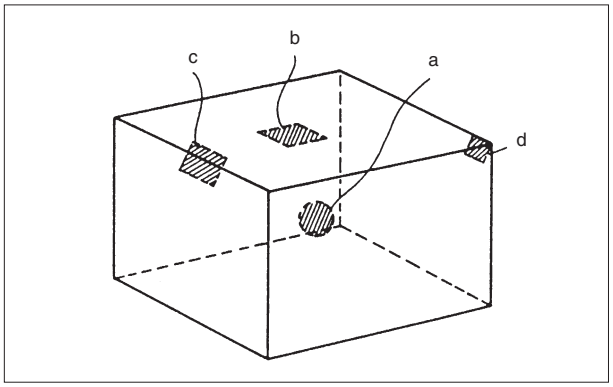


Fig. 3. (Position of Sound Source and Directivity Factor Q)



	Position of Sound Source	Q
a	Center of room	1
b	Center of ceiling	2
c	Edge	4
d	Corner	8

- For the supply air diffuser (and return grille) in Fig. 2, PWL must be corrected for the sound transmission loss from the duct work (TL) such that:

  PWL' = PWL – TL

- Item (i) in formula (II) page 48 is the direct sound (ⓐ , ⓒ), and (ii) is the echo sound (ⓑ , ⓓ).
- The number sources of sound in the room (main unit, supply air diffuser, return grille etc.) is obtained by calculating formula (II), and combining the number with formula (III).

  $SPL = 10 \log (10^{SPL_1/10} + 10^{SPL_2/10})$ ..... (III)

- The average sound absorption rate in the room and the ceiling transmission loss differ according to the frequency, so formula (II) is calculated for each frequency band, and calculated values are combined by formula (III) for an accurate value. (When A-range overall value is required, subtract A-range correction value from calculated values of formula (II), and then combine them by formula (III).)

Transmission Loss in Ceiling Material (dB) Example

		Plaster Board (7mm thick)	Plaster Board (9mm thick)	Lauan Plywood (12mm thick)
Average		20	22	23
Frequency band (Hz)	125	10	12	20
	250	11	15	21
	500	19	21	23
	1,000	26	28	26
	2,000	34	35	24
	4,000	42	39	—

(2) Reducing Lossnay Unit Operating Sound

1) When the airflow of the unit from above the ceiling is the sound source.
   (See page U-40: Fig. 1 ⓒ, ⓓ , Fig. 2 ⓒ1 to ⓒ3, ⓓ)

   (A) Do not install the unit using the following specifications if disturbing sound could be emitted from large units. (Refer to Fig. 4)
   - a) Decrease in diameters in the ductwork: (Ex. ø 250 → ø 150, ø 200 → ø 100)
   - b) Curves in aluminum flexible ducts, etc. (Especially if immediately installed after unit outlet)
   - c) Opening in ceiling panels
   - d) Hanging the unit on materials that cannot support the wight.

   (B) The following countermeasures should be taken. (Refer to Fig. 5)
   - a) Use ceiling material with high soundproofing properties (high transmission loss). (Care is required for low frequency components as the difference in material is high).
   - b) Adding of soundproofing materials to areas below the source of the sound. (The entire surface must be covered with soundproofing sheets. Note that in some cases, covering the area around the unit may not be possible due to generated heat.)

Fig. 4. Large Unit Installation (Example)

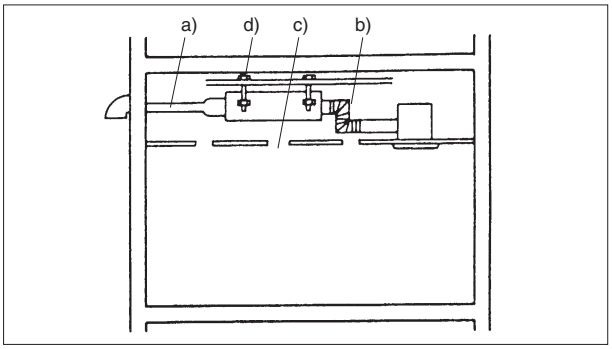
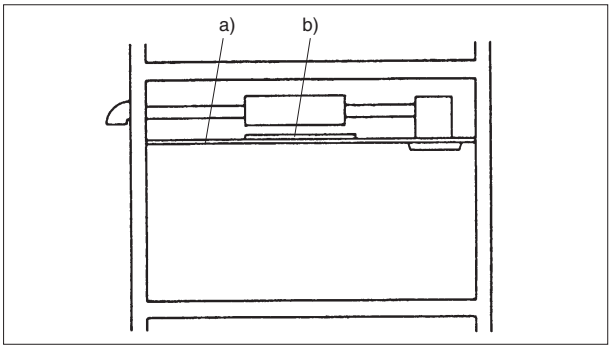


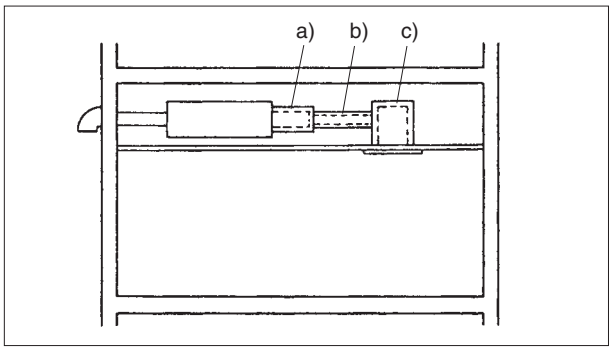
Fig. 5. Countermeasure (Example)



2) When supply air diffuser (and return grille) is the source of the sound
Part 1

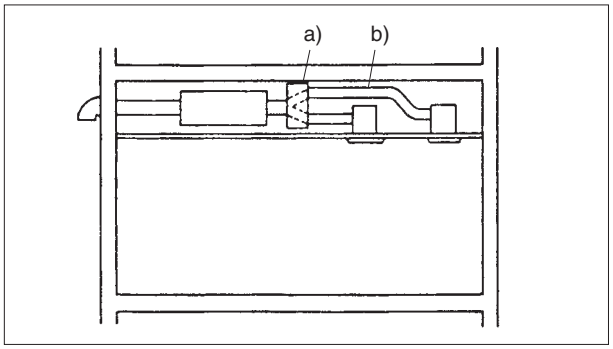
(A) If the main unit is separated from the supply air diffuser (and return grille) as shown in Fig. 6, installing an a) silencer box, b) silence duct or c) silence grille is recommended.

Fig. 6 Sound from Supply Air Diffuser



(B) If sound is being emitted from the supply air diffuser (and return grille), a) branch the flow as shown in Fig. 7, b) add a grille to lower the flow velocity and add a silencer duct to section b).
(If the length is the same, a silencer duct with a small diameter is more effective.)

Fig. 7 Countermeasure (Example)

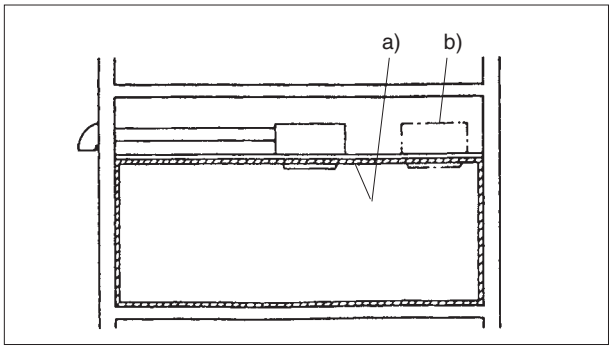


3) When supply air diffuser (and return grille) is the source of the sound
Part 2

(A) If the main unit and supply air diffuser (and return grille) are integrated as shown in Fig. 8, or if the measures taken in 2) (A) and (B) are inadequate, add soundproofing material that has a high sound absorbency as shown in Fig. 8 a).
This is not, however, very effective with direct sounds.

(B) Installing the sound source in the corner of the room as shown in Fig. 8 b) is effective with sound emitted from center of the room, but will be inadequate towards sound emitted from corner of the room.

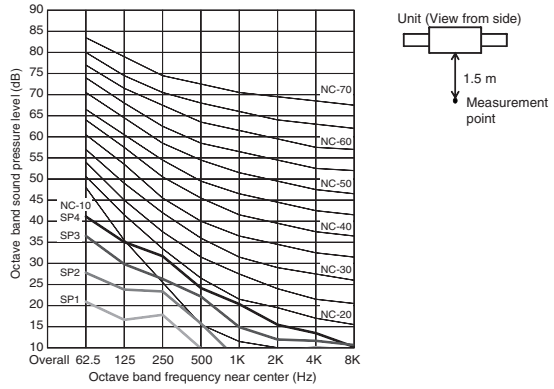
Fig. 8 Additional Countermeasure (Example)



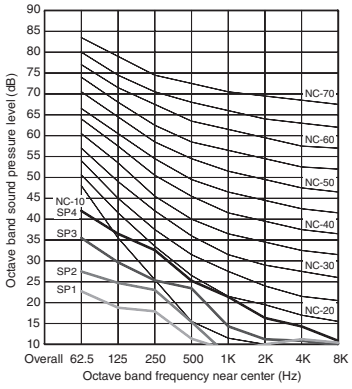
5. NC Curves

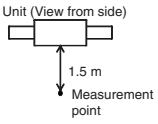
LGH-15RVX-E

Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Energy recovery ventilation
Power supply : Single phase 230V, 50Hz



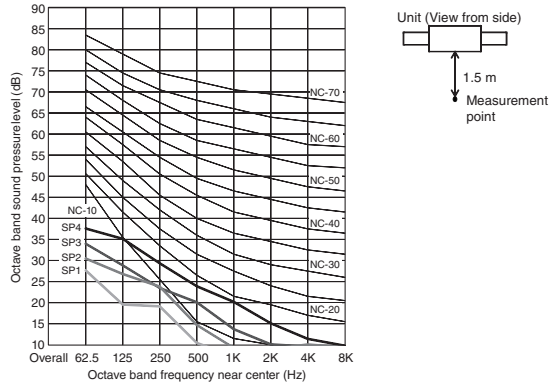
Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Bypass ventilation
Power supply : Single phase 230V, 50Hz



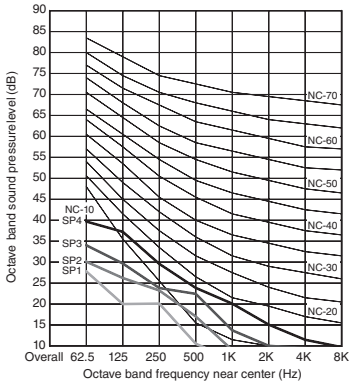


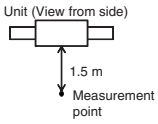
LGH-25RVX-E

Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Energy recovery ventilation
Power supply : Single phase 230V, 50Hz



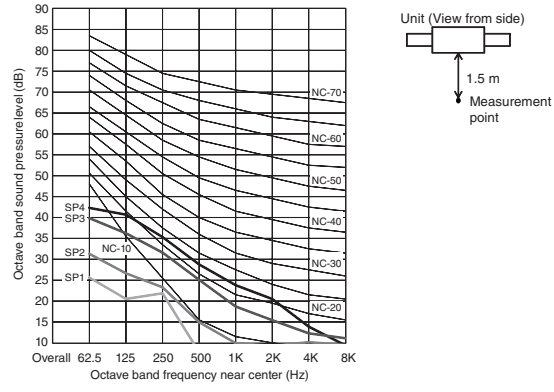
Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Bypass ventilation
Power supply : Single phase 230V, 50Hz



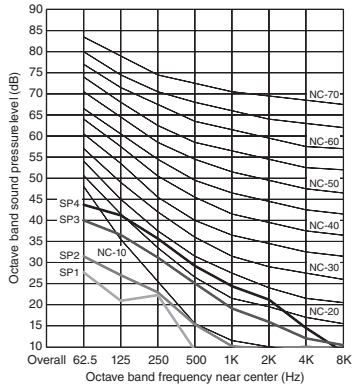


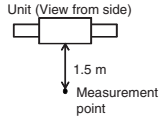
LGH-35RVX-E

Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Energy recovery ventilation
Power supply : Single phase 230V, 50Hz



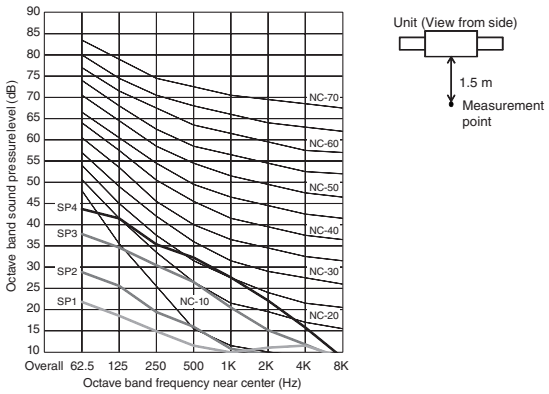
Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Bypass ventilation
Power supply : Single phase 230V, 50Hz



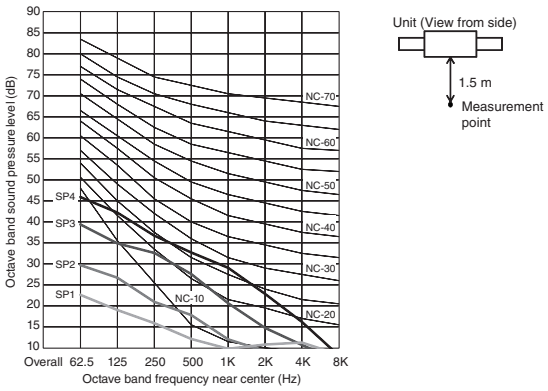


LGH-50RVX-E

Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Energy recovery ventilation
Power supply : Single phase 230V, 50Hz

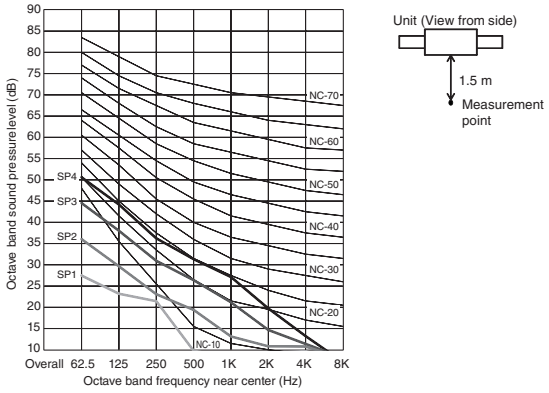


Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Bypass ventilation
Power supply : Single phase 230V, 50Hz

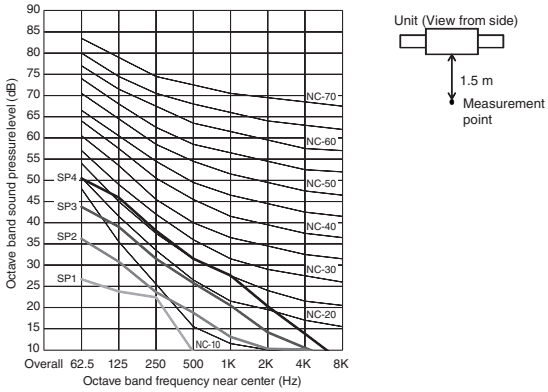


LGH-65RVX-E

Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Energy recovery ventilation
Power supply : Single phase 230V, 50Hz

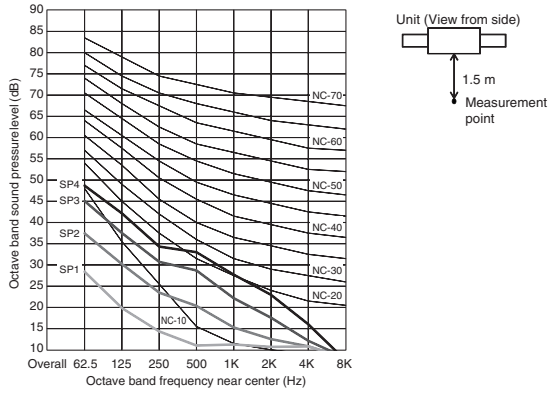


Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Bypass ventilation
Power supply : Single phase 230V, 50Hz

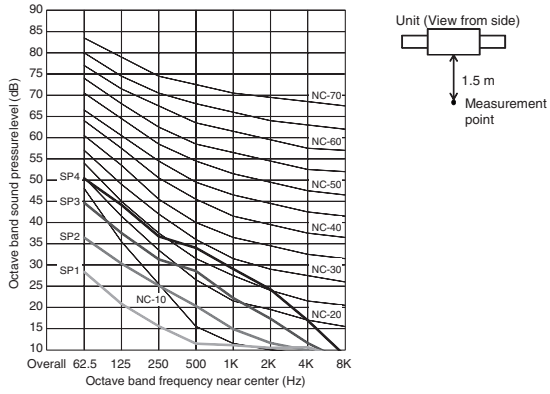


LGH-80RVX-E

Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Energy recovery ventilation
Power supply : Single phase 230V, 50Hz

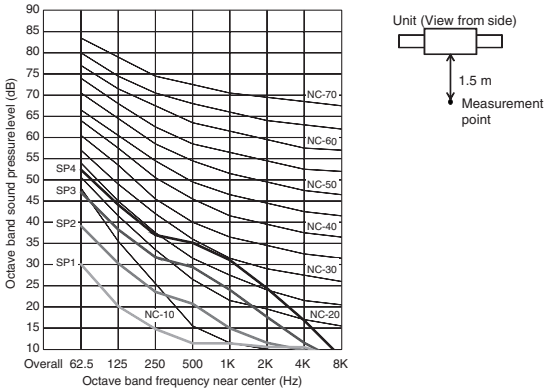


Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Bypass ventilation
Power supply : Single phase 230V, 50Hz

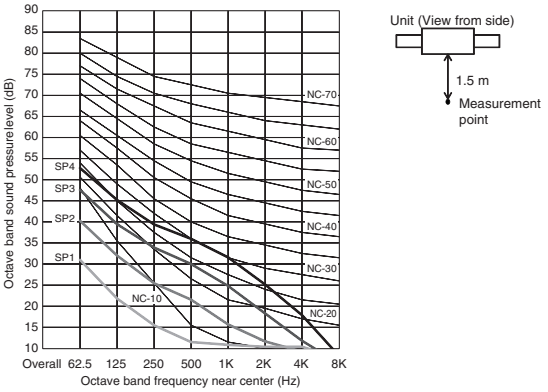


LGH-100RVX-E

Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Energy recovery ventilation
Power supply : Single phase 230V, 50Hz

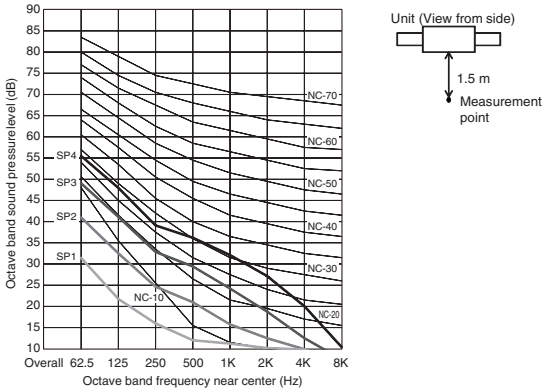


Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Bypass ventilation
Power supply : Single phase 230V, 50Hz

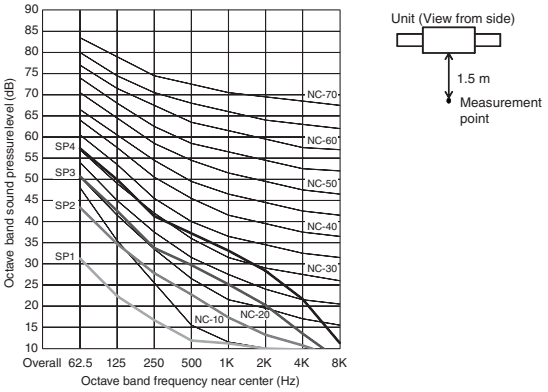


LGH-150RVX-E

Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Energy recovery ventilation
Power supply : Single phase 230V, 50Hz

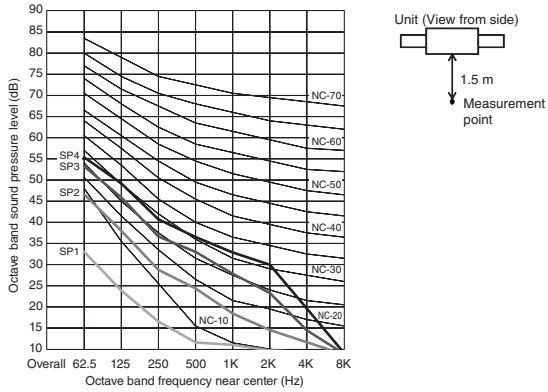


Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Bypass ventilation
Power supply : Single phase 230V, 50Hz

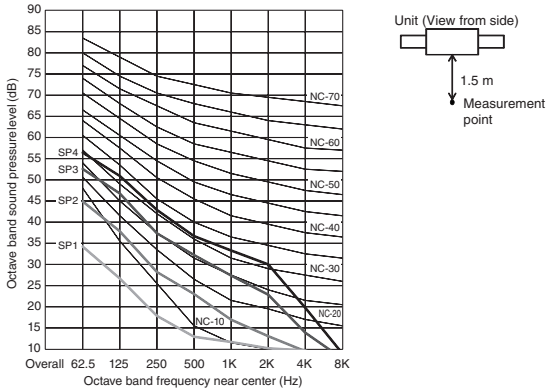


LGH-200RVX-E

Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Energy recovery ventilation
Power supply : Single phase 230V, 50Hz



Background noise : 25 dB or less (A range)
Measurement site : Anechoic chamber
Operation conditions : Bypass ventilation
Power supply : Single phase 230V, 50Hz



CHAPTER 5

System Design Recommendations

1. Lossnay Operating Environment

	Main Unit Installation Conditions	OA (Outdoor Air) conditions	RA (Return Air) conditions
Lossnay LGH series	-10°C to 40°C 80% RH or less	-15°C to 40°C 80% RH or less	-10°C to 40°C 80% RH or less

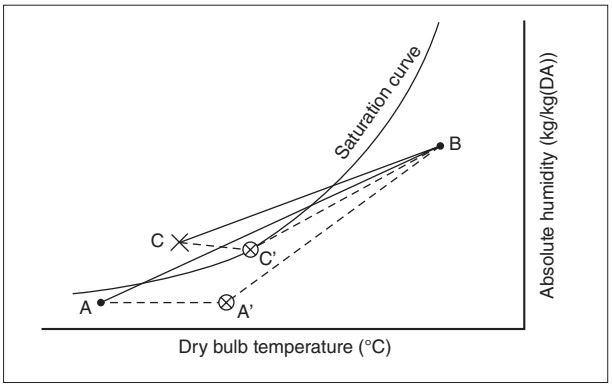
Pay special attention to extreme operating conditions.

1.1 Cold Weather Area Intermittent Operation

When the OA temperature falls below -10°C during operation, the suppy fan will change to intermittent operation.
Refer to page C-48.

1.2 In Cold Climates with Outdoor Temperature

Plot the Lossnay intake air conditions A and B on a psychrometric chart (see right). If the high temperature side air B intersects the saturation curve such as at C, moisture condensation or frost will build on Lossnay. In this case, the low temperature side air A should be warmed up to the temperature indicated by Point A' so that Point C shifts to the Point C'.



1.3 In High Humidity Conditions with Relative Humidity of 80% or More

When using the Lossnay in high humidity conditions such as heated indoor pools, bathrooms, mushroom cultivation houses, high-fog areas etc., moisture will condense inside the core, and drainage will occur. Lossnay units that use treated paper cannot be installed in those types of environments.

1.4 Other Special Conditions

- **Lossnay units cannot be installed in locations where toxic gases and corrosive elements such as acids, alkalis, organic solvents, oil mist or paints exist.**
- **Cannot be installed where heat is recovered from odiferous air and supplied to another area.**
- **Avoid installing in a location where unit could be damaged by salt or hot water.**

2. Sound Levels of Lossnay Units with Built-in Fans

The sound levels specified for Lossnay units are generated from tests conducted in an anechoic chamber. The sound levels may increase by 8 to 11 dB according to the installation construction material and room contents.
When using Lossnay units in a quiet room, it is recommended silencer duct, silencer intake/exhaust grill or silencer box be installed.

3. Air Filters

An air filter must be mounted to both the intake and exhaust air inlets to clean the air and to prevent the core from clogging. Periodically clean the filter for optimum Lossnay unit performance.

4. Constructing the Ductwork

- Always add insulation to the two ducts on the outdoor side (outdoor air intake and exhaust outlet) to prevent frost or condensation from forming.
- The outdoor duct gradient must be 1/30 or more (to wall side) to prevent rain water from going into the system.
- Do not use standard vent caps or round hoods where those may come into direct contact with rain water. (A deep hood is recommended.)

5. Bypass Ventilation

Do not operate “Bypass ventilation” when heating during winter. Frost or condensation may form on the main unit.

6. Night-purge function

Do not use the Night-purge function if fog or heavy rain is expected. Rain water may enter the unit during the night.

7. Transmission Rate of Various Gases and Maximum Workplace Concentration Levels

Measurement Conditions	Gas	Air Volume Ratio Q_{SA}/Q_{RA}	Exhaust Air Concentration C_{RA} (ppm)	Supply Air Concentration C_{SA} (ppm)	Transmission Rate (%)	Max. Workplace Concentrations* (ppm)
Measurement method • Chemical analysis with colorimetric method for H_2SO_4 • Ultrasonic method with gas concentration device for CO, SF_6 • Infrared method with gas concentration device for CO_2 • Gas chromatography for others The fans are positioned at the air supply/exhaust suction positions of the element Measurement conditions: 24°C, 85% RH * OA density for CO_2 is 500 ppm.	Hydrogen fluoride	1.0	36	<0.5	~ 0	2
	Hydrogen chloride	1.0	42	<0.5	~ 0	
	Nitric acid	1.0	20	<0.5	~ 0	
	Sulfuric acid (H_2SO_4)	1.0	2.6 mg/m^3	~ 0 mg/m^3	~ 0	5
	Trichlene	1.0	85	1.36	1.6	25
	Acetone	1.0	5	0.04	0.8	500
	Xylene	1.0	313	<5.0	<1.6	50
	Isopropyl alcohol	1.0	3,000	<25	<0.8	200
	Methanol	1.0	41	0.49	1.2	200
	Ethanol	1.0	35	0.49	1.4	
	Ethyl acetate alcohol	1.0	25	0.28	1.1	200
	Ammonia	1.0	290	7.25	2.5	
	Hydrogen sulfide	1.0	15	0.24	1.6	5
	Carbon monoxide (CO)	1.0	71.2	0.43	0.6	
	Carbon dioxide (CO_2)	1.0	37,800	600	0.3	
	Formaldehyde	1.0	32	0.3	0.9	
	Sulfur nexafluoride	1.0	116	0.8	0.7	
	Toluene	1.0	6.1	0.1	1.7	50

*Refered from the announcement No.369 of Ministry of Health, Labour and Welfare on 1st October 2004.

8. Solubility of Odors and Toxic Gases, etc., in Water and the Effect on the Lossnay Core

Gas	Molecular Formula	Gas Type	Solubility in Water		Useability of Lossnay	*Max. Workplace Concentration
			mℓ /mℓ	g/100g		
Sulfur dioxide	SO_2	Gas	32.8		△	- (0.25 ppm)
Ammonia	NH_3	Gas	635	40	△	25 ppm
Carbon monoxide	CO	Gas	0.0214		○	50 ppm
Nitric monoxide	NO	Gas	0.0043		○	- (25 ppm)
Indole	C_9H_7N	Gas	Minute		○	-
Ethanol	CH_3CH_2OH	Gas	Soluble		△	- (1,000 ppm)
Hydrogen chloride	HCl	Gas	427	58	×	5 ppm
Chlorine	Cl_2	Gas	Minute		△	0.5 ppm
Ozone	O_3	Gas		0.00139	△	0.1 ppm
Ketone		Vapor	Soluble		△	-
Acetic acid	CH_3COOH	Mist		2,115	×	10 ppm
Nitric acid	HNO_3	Mist		180	×	2 ppm
Skatole	C_9H_9N	Gas	Minute		○	-
Hydrogen fluoride	HF	Gas		90	×	3 ppm
Methanol	CH_3OH	Vapor	Soluble		△	200 ppm
Methane	CH_4	Vapor	0.0301		○	- (1,000 ppm)
Hydrogen sulfide	H_2S	Vapor	2.3		△	5 ppm
Sulfuric acid	H_2SO_4	Mist		2,380	×	1 mg/m^3
Phosphoric acid	H_3PO_4	Mist		41	×	1 mg/m^3
Phosphine	PH_3	Gas	0.26		○	0.3 ppm

[Reference]

Air	Mixed gases	Gas	0.0167		○	-
Oxygen	O_2	Gas	0.0283		○	-
Nitrogen	N_2	Gas	0.0143		○	-
Carbon dioxide	CO_2	Gas	0.759		○	5,000 ppm

○ : Recommended △ : Not recommend × : Avoid

Note: 1. Lossnay should not be used in environments with water soluble gases and mists because the amount that is transmitted with the water is too high.
2. Lossnay should not be used in environments with acidic gases and mists because these will accumulate in the Core and cause damage.
3. The table data above apply to only Lossnay treated paper of total energy recovery units.

**Refered from Chemial Risk Information Platform (CHRIP) URL : http://www.safe.nite.go.jp/japan/db.html

9. Automatic Ventilation Switching (Refer to page C-40)

Effect of Automatic Ventilation Mode

The automatic mode automatically provides the correct ventilation for the conditions in the room. It eliminates the need for manual switch operations when setting the Lossnay to Bypass. The following shows the effect Bypass ventilation will have under various conditions.

(1) Reduces Cooling Load

If the air outside is cooler than the air inside the building during the cooling season (such as early morning or at night), Bypass ventilation will draw in the cooler outside air and reduce the cooling load on the system.

(2) Cooling Using Outdoor Air

During cooler seasons (such as between spring and summer or between summer and fall), if the occupants in a room cause the temperature of the room to rise, Bypass ventilation will draw in the cool outside air and use it as is to cool the room.

(3) Night-purge

Bypass ventilation can be used to release hot air from inside the building that has accumulated during the hot summer season.
LGH-RVX-E series has Night-purge function, that is used in the summer to automatically ventilate a room at night, to discharge accumulated heat and thereby reduce the air conditioning load the next morning.

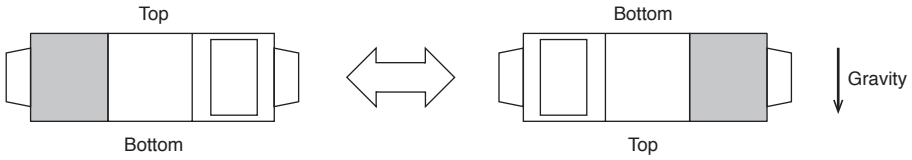
(4) Cooling the Office Equipment Room

During cold season, outdoor air can be drawn in and used as is to cool rooms where the temperature has risen due to office equipment use. (Only when interlocked with City Multi and Mr. Slim indoor units.)

10. Alternate Installation for Lossnay

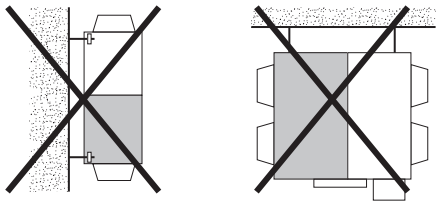
10.1 Up-side-down Installation

All LGH-RVX-E models can be installed in up-side-down.



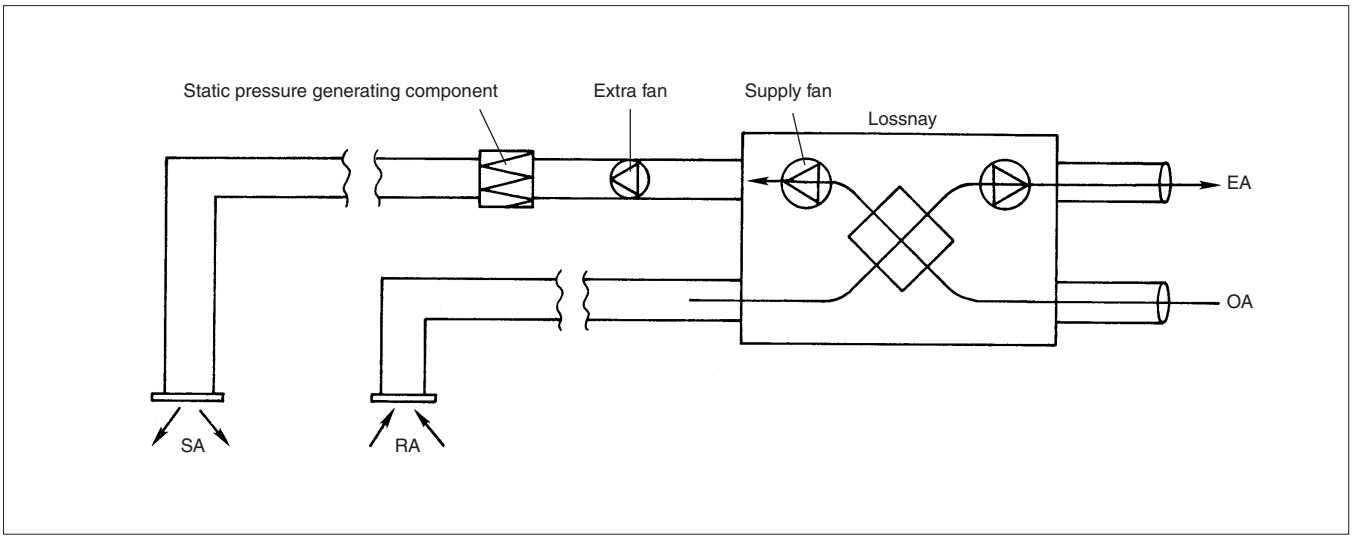
10.2 Prohibition on vertical installation

All LGH-RVX-E models are prohibited to install vertical or incline. It may cause malfunction or decrease performance (motor noise, water incoming, etc)



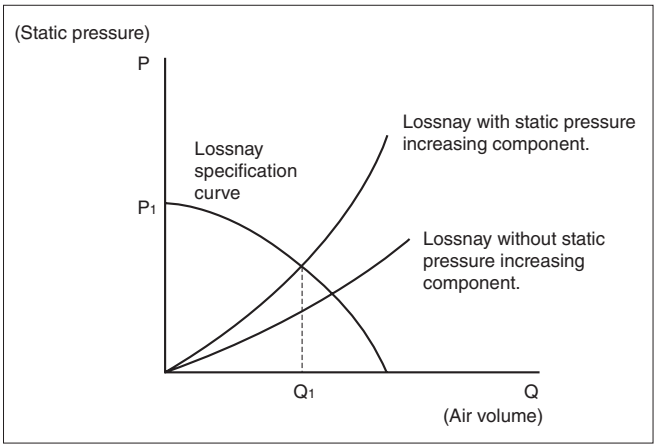
11. Installing Supplementary Fan Devices

On occasions it may be necessary to install extra fans in the ductwork because of the addition of extra components such as control dampers, high-efficiency filters, sound attenuators, etc. which create a significant extra static pressure to the airflow. An example of such an installation is as shown below.

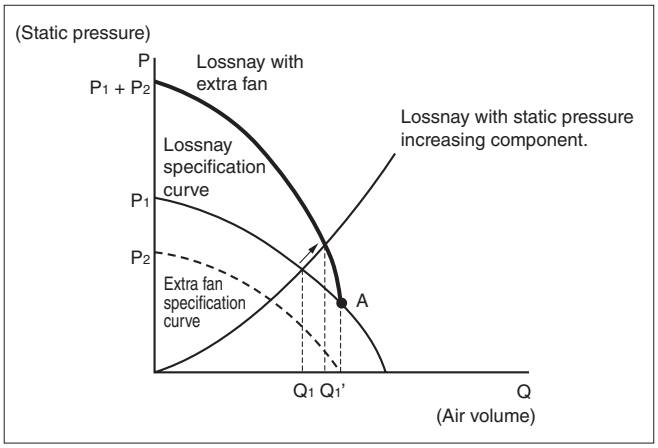


For such an installation, avoid undue stress on the fan motors. Referring to the diagrams below, Lossnay with extra fans should be used at the point of left side from A.

P-Q for Lossnay without extra fan



P-Q for Lossnay with extra fan



CHAPTER 6

Examples of Lossnay Applications

This chapter proposes Lossnay ventilation systems for eight types of applications. These systems were planned for use in Japan, and actual systems will differ according to each country - the ventilation systems listed here should be used only as reference.

1. Large Office Building

1.1 System Design Challenges

Conventional central systems in large buildings, run in floor and ducts, had generally been preferred to individual room units; thus, air conditioning and ventilation after working hours only in certain rooms was not possible.
In this plan, an independent dispersed ventilation method applied to resolve this problem. The main advantage to such a system was that it allows 24-hour operation.
A package-type indoor unit of air conditioner was installed in the ceiling, and ventilation was performed with a ceiling embedded type Lossnay. Ventilation for the toilet, kitchenette and elevator halls, etc., was performed with a straight centrifugal fan.

System Design

- Building specifications: Basement floor SRC (Slab Reinforced Concrete), seven floors above ground floor
  Total floor space 30,350 m^2
- Basement : Employee cafeteria
- Ground floor : Lobby, conference room
- 2nd to 7th floor : Offices, salons, board room
- Air conditioning system: Package air conditioning
- Ventilation : Ceiling embedded type Lossnay, straight centrifugal fan

1.2 System Requirements

(1) Operation system that answers individual needs was required.
- Free independent operation system
- Simple control

(2) Effective use of floor space
(Eliminating the equipment room)

(3) Application to Building Management Laws
- Effective humidification
- Eliminating indoor dust

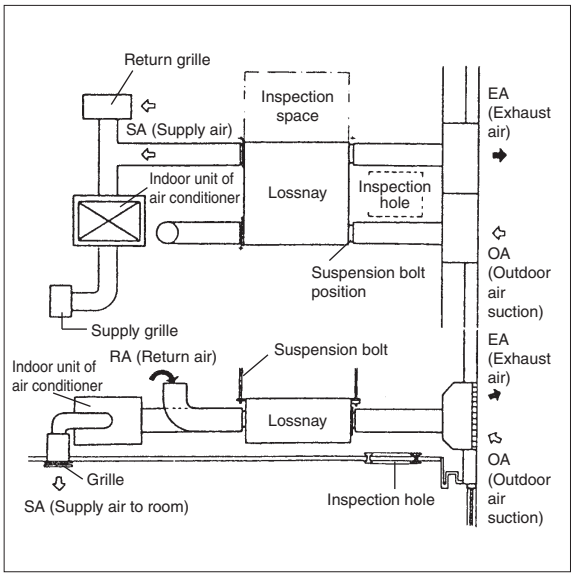
(4) Energy conservation

1.3 Details

(1) Air Conditioning

- In general offices, the duct method would applied with several ceiling embedded multiple cooling heat pump packages in each zone to allow total zone operation.
- Board rooms, conference rooms, and salons would air conditioned with a ceiling embedded type or cassette type multiple cooling heat pump package.

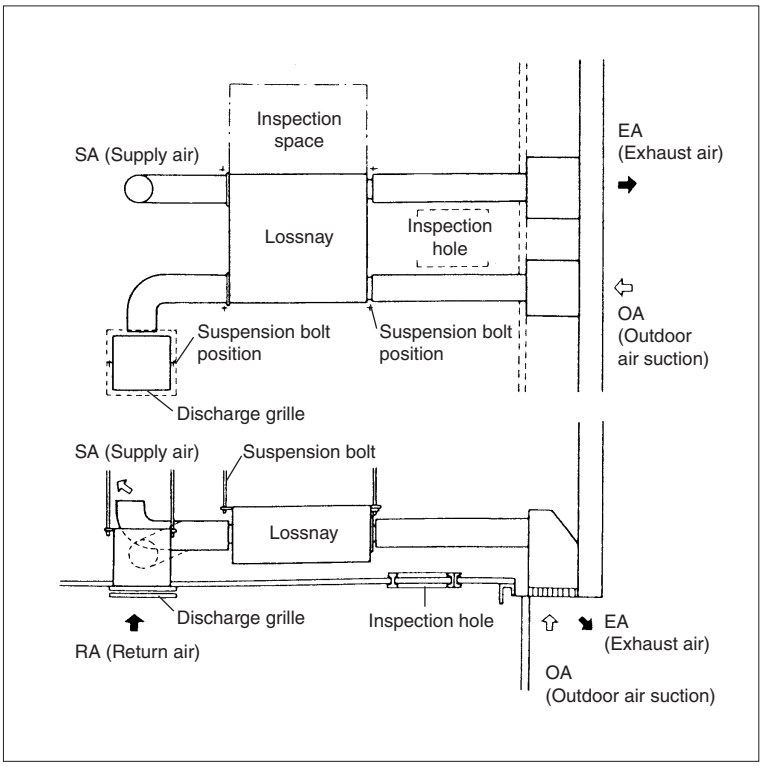
Installation of an office system air conditioning system
– The air supplied from the Lossnay unit was introduced into the intake side of the indoor unit of air conditioner, and the stale air from the room was directly removed from the inside of the ceiling.



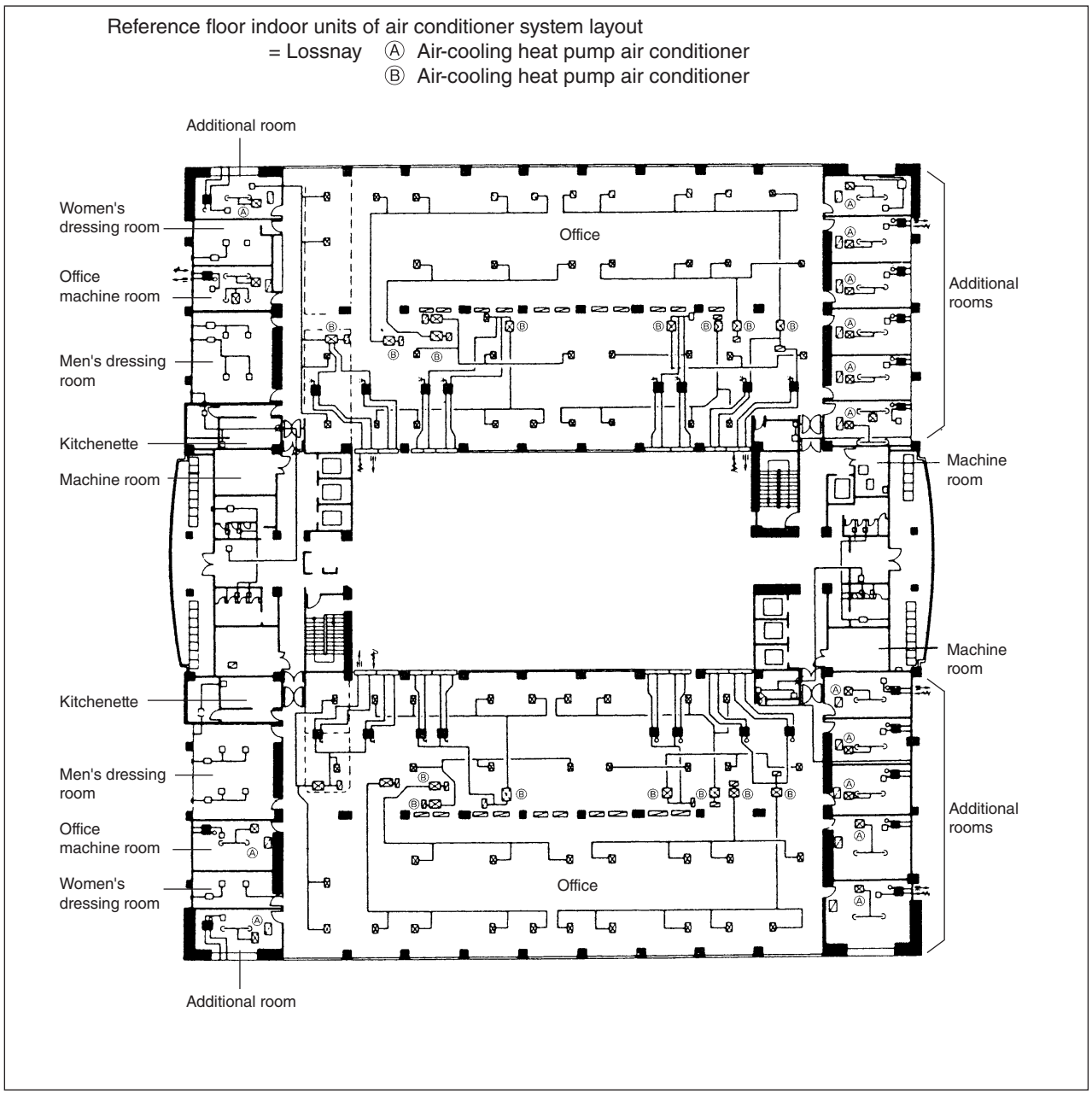
(2) Ventilation

- For general offices, a ceiling embedded type Lossnay unit would be installed. The inside of the ceiling would be used as a return chamber for exhaust, and the air from the Lossnay unit would be supplied to the air-conditioning return duct and mixed with the air in the air conditioning passage. (Exhaust air was taken in from the entire area, and supply air was introduced into the indoor units of air conditioner to increase the effectiveness of the ventilation for large rooms.)
- For board rooms, conference rooms, and salons, a ceiling embedded type Lossnay unit would be installed. The stale air would be exhausted from the discharge grille installed in the center of the ceiling. The supply air would be discharged into the ceiling, where, after mixing with the return air from the air conditioner, it was supplied to the air conditioner.
- The air in the toilet, kitchenette, and elevator hall, etc., would be exhausted with a straight centrifugal fan. The OA supply would use the air supplied from the Lossnay unit. (The OA volume would be obtained by setting the Lossnay supply fan in the general office to the extra-high mode.)

Installation of air conditioning system for board rooms, conference rooms, salons - the air supplied from the Lossnay unit was blown into the ceiling, and the stale air was removed from the discharge grille.



- A gallery for the exhaust air outlets would be constructed on the outside wall to allow for blending in with the exterior.



(3) Humidification

If the load fluctuation of the required humidification amount was proportional to the ventilation volume, it was ideal to add a humidifier with the ventilation system. For this application, the humidifier was installed on with the air supply side of the Lossnay unit.

(4) Conforming to Building Laws

Many laws pertaining the building environments were concerned with humidification and dust removal; in these terms, it was recommended that a humidifier was added to the air conditioning system to allow adequate humidification.
Installing of a filter on each air-circulation system in the room was effective for dust removal, but if the outdoor air inlet was near a source of dust, such as a road, a filter should also be installed on the ventilation system.

1.4 Outcome

(1) Air conditioning and ventilation needs were met on an individual room or were basis.
(2) Operation was possible with a 24-hour system.
(3) Operation was simple because the switches were accessible in the room. (A controller was not required.)
(4) Floor space was saved.
(5) Energy was conserved with the independent energy recovery function.
(6) Air-conditioning with ventilation was possible with the independent system.

2. Small-Scale Urban Building

2.1 System Design Challenges

The system was designed effectively using limited available air conditioner and ventilator installation space.
For this application, air flow must be considered for the entire floor and the ventilator was installed in the ceiling plenum.

System Design

- Application : Office
- Building specification : RC (Reinforced Concrete)
- Total floor space : 552 m^2 (B1 to 5F)
- Application per floor : B1: Parking area
  GF to 5F: Office
- Air conditioning system : Package air conditioner
- Ventilation : Ceiling embedded type and cassette type Lossnay, straight centrifugal fan, duct ventilation fan.

2.2 System Requirements

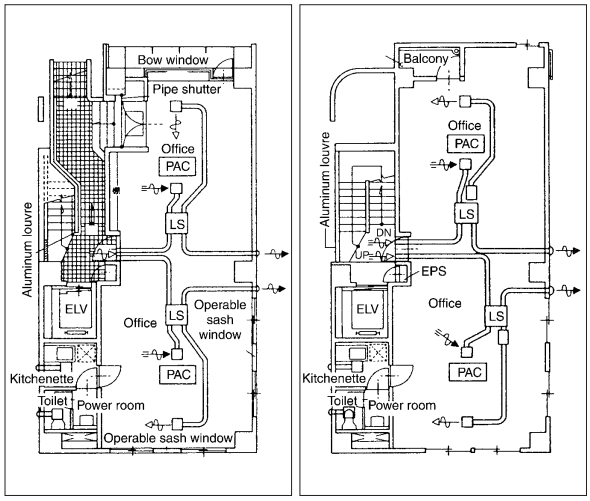
(1) Three sides of the building were surrounded by other buildings, and windows could not be installed; therefore mechanical ventilation needed to be reliable.

(2) Ample fresh outdoor air could not be supplied. (Generally, only “Class 3” ventilation (forced exhaust) was possible.)

(3) If the exhaust in the room was large, odors from other areas could have affected air quality.

(4) Humidification during winter was not possible.

GF Layout **1F to 5F Layout**



PAC : Package air conditioner
LS : Lossnay

2.3 Details

(1) Air conditioning
- Space efficiency and comfort during cooling/heating was improved with ceiling embedded cassette type package air conditioner.

(2) Ventilation
- Room, Salon: Entire area was ventilated by installing several ceiling embedded type Lossnay units. Humidification was possible by adding a humidifier. (Outdoor air was supplied to the toilet and kitchenette by setting the selection switch on the Lossnay unit for supply to the extra-high.)
- Conference room, Board room, Toilet, powder room: Area was independently ventilated by installing a ceiling embedded type or cassette-type Lossnay in each room.
- Kitchenette: Area was exhausted with a straight centrifugal fan or duct ventilation fan. (An adequate exhaust volume was obtained by introducing outdoor air into the space with the toilet being ventilated constantly.)
- Location of air intake/exhaust air outlets on outside wall
  The freshness of the outdoor air taken in by the Lossnay was important, and because the building was surrounded by other buildings, the intake and exhaust ports must be placed as far apart as possible.

2.4 Outcome

(1) Appropriate ventilation was possible with “Class 1” ventilation (forced simultaneous air intake/exhaust) using Lossnay units.

(2) Outdoor air to the toilet and kitchenette was possible with Lossnay units, and appropriate ventilation was possible even in highly sealed buildings.

(3) Odors infiltrating into other rooms was prevented with constant ventilation using an adequate ventilation air volume.

(4) Humidification was possible by adding a simple humidifying unit to the Lossnay unit.

3. Hospitals

3.1 System Design Challenges

Ventilating a hospitals required adequate exhaust air from the generation site and ensuring a supply of ample fresh outdoor air. An appropriate system was an independent ventilation system with “Class 1” ventilation (forced simultaneous air intake/exhaust).
The fan coil and package air conditioning were according to material and place, and the air conditioned room was ventilated with ceiling embedded type Lossnay units. The toilet and kitchenette, etc., were ventilated with a straight centrifugal fan.

System Design

- Building specification : RC (Reinforced Concrete)
- Total floor space : 931 m^2 (GF to 2F)
- Application per floor : GF : Waiting room, diagnosis rooms, surgery theater, director room, kitchen
  1F : Patient rooms, nurse station, rehabilitation room, cafeteria
  2F : Patient rooms, nurse station, head nurse room, office
- Air conditioning system : Fan coil unit, package air conditioner
- Ventilation : Ceiling embedded type Lossnay, straight centrifugal fan

3.2 System Requirements

(1) Prevented in-hospital disease transmission.
(Meeting needs for operating rooms, diagnosis rooms, waiting rooms and patient rooms were required.)

(2) Adequate ventilation for places where odors were generated
(Preventing odors generated from toilets from infiltrating into other rooms was required.)

(3) Blocking external sound
(Blocking sound from outside of the building and from adjacent rooms and hallway was required.)

(4) Assuring adequate humidity

(5) Energy conservation

3.3 Details

(1) Air Conditioning

- Centralized heat-source control using a fan coil for the general system allowed efficient operation timer control and energy conservation.
- A 24-hour system using a package air conditioner for special rooms (surgery theater, nurse station, special patient rooms, waiting room) was the most practical.

(2) Ventilation

- **Hallway**

  Independent system using centralized control with LP Lossnay units, or independent system with ceiling suspended type Lossnay units.

- **Surgery theater**

  Combination of LP Lossnay and package air-conditioner with HEPA filter on room supply air outlet.

- **Diagnosis rooms and examination room**

  Patient rooms
  Nurse stations
  Independent ventilation for each room using ceiling suspended/embedded type Lossnay.
  - Integral system with optional humidifier for required rooms.
  - Positive/negative pressure adjustment, etc., was possible by setting main unit selection switch to extra-high mode (25R, 50R models) according to the room.

- **Toilet/kitchenette**

  Straight centrifugal fan or duct ventilation fan

- **Storage/linen closet**

  Positive pressure ventilation fan or duct ventilation fan.
  The outdoor air was supplied from the hallway ceiling with the straight centrifugal fan, and was distributed near the indoor unit of air conditioner after the air flow was reduced.

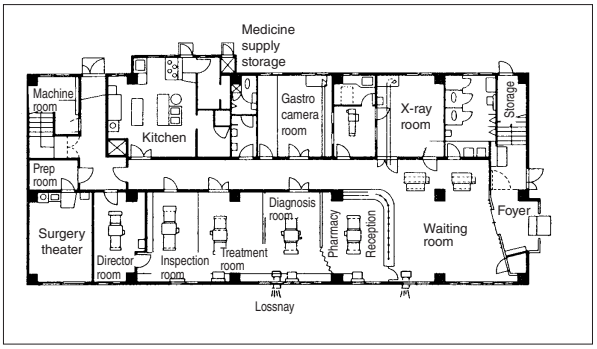
- **Kitchen**

  Exhaust with negative pressure ventilation fan or straight centrifugal fan. Outdoor air was supplied with the straight centrifugal fan.

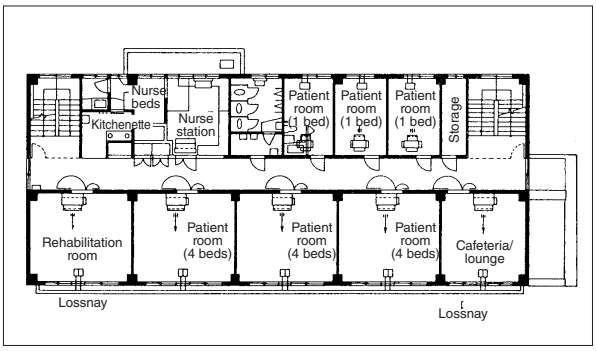
- **Machine room**

  Exhaust with positive pressure ventilation fan.

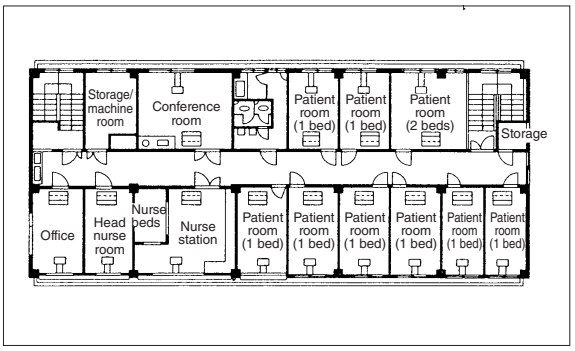
GF Layout



1F Layout



2F Layout



3.4 Outcome

(1) The following outcomes were possible by independently ventilating the air-conditioned rooms with Lossnay units:
- Disease transmission could be prevented by shielding the air between rooms.
- Lossnay Core's sound reducing properties reduced outside sound.
- Because outdoor air did not need to be taken in from the hallway, doors could be sealed, shutting out sounds from the hallway.
- Humidification was possible by adding a humidifier.

(2) By exhausting the toilet, etc., and supplying outdoor air to the hallway:
- Odors infiltrating into other rooms were prevented.

4. Schools

4.1 System Design Challenges

A comfortable classroom environment was necessary to improve the students' desires to study.
Schools near airports, railroads and highways had sealed structures to soundproof the building, and thus air conditioning and ventilation facilities were required. Schools in polluted areas such as industrial districts also required air conditioning and ventilation facilities. At university facilities which had a centralized design to efficiently use land and to improve the building functions, the room environment had to also be maintained with air conditioning.

System Design

- Total floor space : 23,000 m^2
- Building specifications : Prep school (high school wing)
  Memorial hall wing
  Library wing
  Main management wing

4.2 System Requirements and Challenges

(1) Mainly single duct methods, fan coil unit methods, or package methods were used for cooling/heating, but the diffusion rate was still low, and water-based heaters were still the main heating source.

(2) The single duct method was difficult to control according to the usage, and there were problems in operation costs.

(3) Rooms were often ventilated by opening windows or using a ventilation gallery; although the methods provide ample ventilation volume, those may introduce sound coming from the outside.

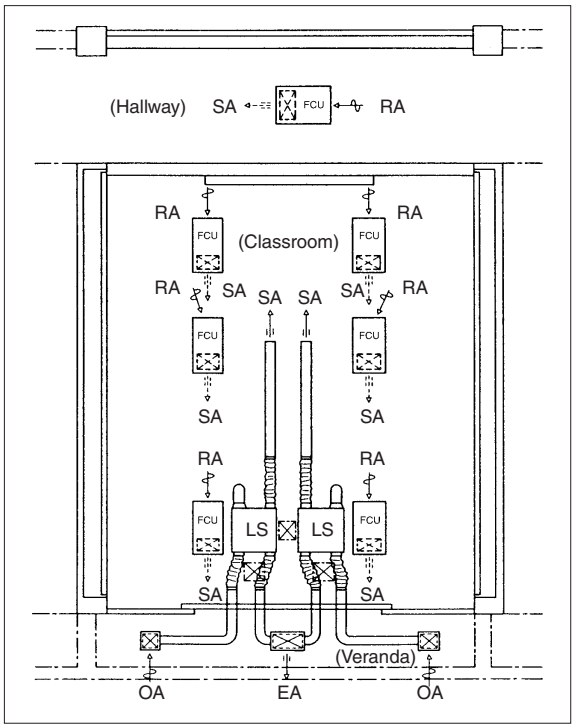
4.3 Details

(1) To achieve the goals of overall comfort, saving space and energy, an air conditioning and ventilation system with a ceiling embedded type fan coil unit and ceiling embedded type Lossnay was installed.

(2) Automatic operation using a weekly program timer was used, operating when the general classrooms and special classrooms were used.

(3) By using a ventilation system with a total energy recovery unit, energy was saved and soundproofing was realised.

Classroom Layout



4.4 Criteria for installing air conditioning system in schools (Example)

(1) Zoning according to application must be possible.

(2) Response to load fluctuations must be swift.

(3) Ventilation properties must be ideal.

(4) The system must be safe and firmly installed.

(5) Future facility expansion must be easy.

(6) Installation in existing buildings must be possible.

(7) Installation and maintenance costs must be low.

4.5 System Trends

(1) It was believed that environmental needs at schools would continue to progress, and factors such as comfort level, ventilation, temperature/humidity, sound proofing, natural lighting, and color must be considered during the design stage.

(2) Independent heating using a centralized control method was mainly applied when the air conditioner unit was installed for heating only application. For cooling/heating, a combination of a fan coil method and package-type was the main method used.

(3) "Class 1" ventilation was applied, and the total energy recovery unit was mainly used in consideration of the energy saved during air conditioning and the high soundproofing properties.

5. Convention Halls, Wedding Halls in Hotels

5.1 System Design Challenges

Hotels often included conference, wedding, and banquet halls.
Air conditioning systems in these spaces had to have a ventilation treatment system that could handle extremely large fluctuations in loads, any generated tobacco smoke, and odor removal.

5.2 Systems Requirements

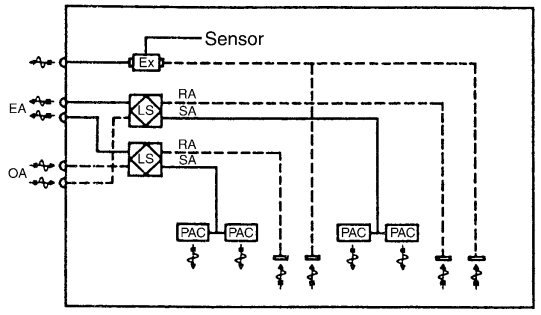
The presence of CO and CO_2 at permissible values, odor removal, and generated tobacco smoke were often considered in ventilation standards; often the limit was set at 30 m^3/h·person to 35 m^3/h·person. Several package air conditioners with ventilation or air-handling unit facilities were often used, but these were greatly affected by differences in capacity, ratio of smokers, and length of occupancy in the area.

5.3 Details

The proposed plan had two examples using a Lossnay unit as a ventilator for total energy recovery in the air-conditioned conference room, and using several package air-conditioners with ventilation for convention and banquet halls.

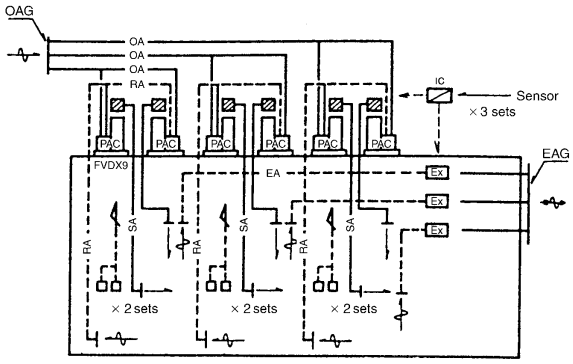
A) Conference room
Energy recovery ventilation was executed with continuous operation of the Lossnay unit, but when the number of persons increased and the CO_2 concentration reached a set level (for example, 1,000 ppm in the Building Management Law), a separate centrifugal fan turned on automatically. The system could also be operated manually to rapidly remove smoke and odors.

B) Convention and banquet halls
The system included several outdoor air introduction-type package air conditioners and straight centrifugal fans for ventilation. However, an inverter controller was connected to the centrifugal fan so that it constantly operated at 50 percent, to handle fluctuations in ventilation loads. By interlocking with several package air-conditioners, detailed handling of following up the air condition loads in addition to the ventilation volume was possible.
Systems using Lossnay were also possible.



LS : Lossnay
EX : Centrifugal fan
PAC: Package air conditioner

Conference Room Ventilation System Diagram



EX : Centrifugal fan
PAC: Package air conditioner
IC : Inverter controller

Convention and Banquet Hall Ventilation System Diagram

5.4 System Trends

The load characteristics at hotels was complex compared to general buildings, and were greatly affected by the occupancy, and operation. Because of the high ceilings in meeting rooms and banquet halls preheating and precooling also needs to be considered. Further research on management and control systems and product development would be required to achieve even more comfortable control within these spaces.

6. Public Halls (Facilities Such as Day-care Centers)

6.1 System Design Challenges

For buildings located near airports and military bases, etc., that required soundproofing, air conditioning and ventilation facilities had conventionally been of the centralized type. However, independent dispersed air conditioning and ventilation systems had been necessary due to the need for zone control, as well as for energy conservation purposes. The system detailed below was a plan for these types of buildings.

System Design

- Building specifications : Two floors above ground floor, Total floor space: 385 m^2
- Application : GF · · Study rooms (two rooms), office, day-care room, lounge
  1F · · · Meeting room
- Air conditioning : GF · · Air-cooling heat pump chiller and fan coil unit
  1F · · · Air-cooling heat pump package air conditioner
- Ventilation : Ceiling embedded Lossnay unit

6.2 System Requirements

(1) Conventional systems used centralized units with air-handling units, and air conditioning and ventilation were performed together.

(2) Topics
  1) Special knowledge was required for operation, and there were problems in response to the users' needs.
  2) When the centralized method was used, the air even in rooms that were not being used was conditioned, increasing operation costs.
  3) Machine room space was necessary.
  4) Duct space was necessary.

6.3 Details

(1) Air-conditioning Facilities

1) Small rooms : Air-cooling heat pump chiller and fan coil unit combination
2) Meeting rooms : Single duct method with air-cooling heat pump package air conditioner

(2) Ventilation Facilities

1) A ceiling embedded type Lossnay unit was used in each room, and a silence chamber, silence-type supply/return grille, silence duct, etc. was incorporated on the outer wall to increase the total soundproofing effect.

6.4 Outcome

(1) Operation was possible without special training, so system management was easy.

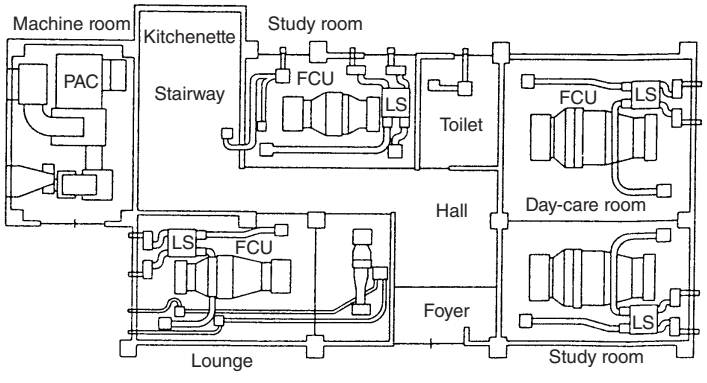
(2) Zone operation was possible, and was thus energy-saving.

(3) Soundproof ventilation was possible with the separately installed ventilators.

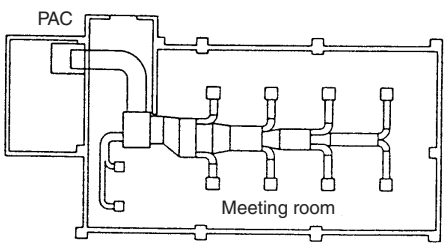
(4) Energy saving ventilation was possible with the energy recovery ventilation.

(5) Ceiling embedded type Lossnay unit saved space.

Ground Floor Layout



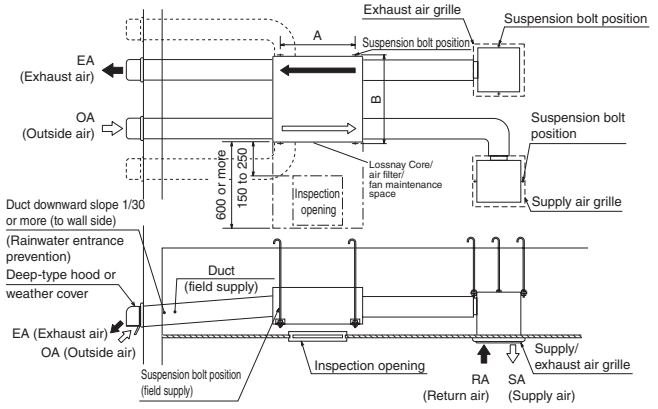
1F Layout



1. LGH-Series Lossnay Ceiling Embedded Type (LGH-RVX-E Series)

LGH-15 · 25 · 35 · 50 · 65 · 80 · 100RVX-E

■ **Installation diagram**



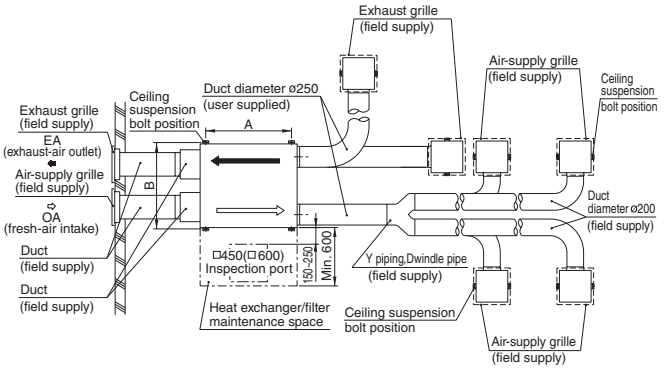
Unit (mm)

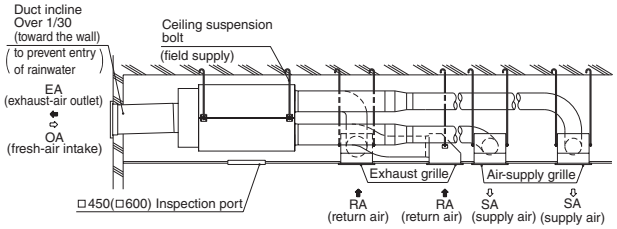
- Always leave inspection holes (□ 450 or □ 600) on the air filter and Lossnay Core removal side.
- Always insulate the two ducts outside the room (intake air and exhaust air ducts) to prevent condensation.
- It is possible to change the direction of the outside air ducts (OA and EA side).
- Do not install the vent cap or round hood where it will come into direct contact with rain water.

Air volume (m^3/h)	Model	Dimension	
		A	B
150	LGH-15RVX-E	768	658
250	LGH-25RVX-E	768	782
350	LGH-35RVX-E	875	921
500	LGH-50RVX-E	875	1,063
650	LGH-65RVX-E	895	1,001
800	LGH-80RVX-E	1,131	1,051
1000	LGH-100RVX-E	1,131	1,278

LGH-150 · 200RVX-E

■ **Installation diagram**





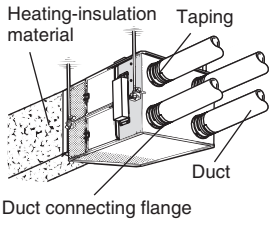
Unit (mm)

- Always leave inspection holes (□ 450 or □ 600) on the air filter and Lossnay Core removal side.
- Always insulate the two ducts outside the room (intake air and exhaust air ducts) to prevent condensation.
- If necessary, order a weather cover to prevent rain water from direct contact or entering the unit.

Air volume (m^3/h)	Model	Dimension	
		A	B
1500	LGH-150RVX-E	1,010	1,045
2000	LGH-200RVX-E	1,010	1,272

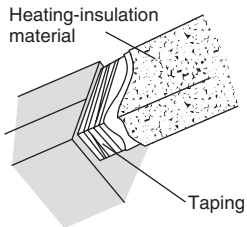
- Ducting

Indoor

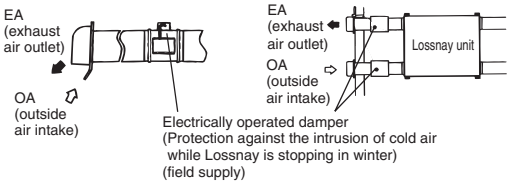


Should secure with airtight tape to prevent air leakage.

Outdoor



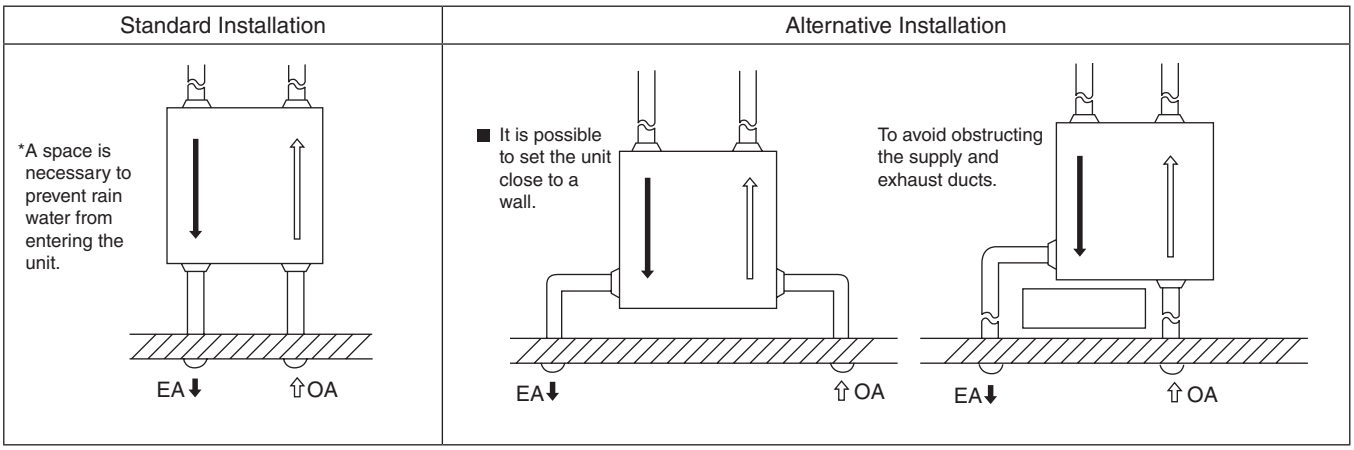
Should secure with airtight tape to prevent air leakage. Cover duct with insulation foam prevent condensation.



- In a region where there is risk of freezing in winter, it is recommended to install an Electrically operated damper, or the like, in order to prevent the intrusion of (cold) outdoor air while Lossnay is stopped.

1.1 Choosing the Duct Attachment

Choose between two directions for the outside duct (OA, EA) piping direction for alternative installation.



1.2 Installation and Maintenance

(1) Always leave an inspection hole (a square, 450 mm each side) to access the filter and Lossnay core.

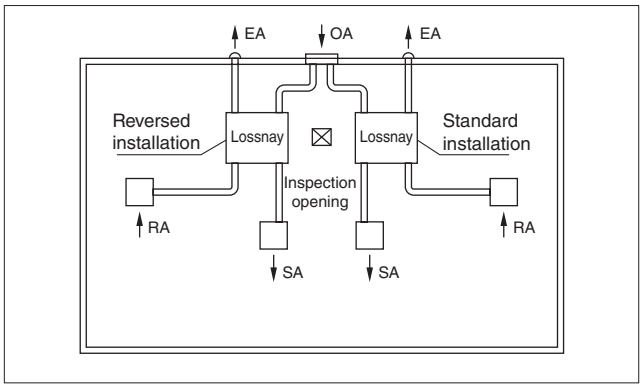
(2) Always insulate the two ducts outside the room (intake air and exhaust air ducts) to prevent frost from forming.

(3) Prevent rainwater from entering.
- Apply a slope of 1/30 or more towards the wall to the intake air and exhaust air ducts outside the room.
- Do not install the vent cap or round hood where it will come into direct contact with rainwater.

1.3 Installation Applications

(1) Installing Two Units to One Outside Air Duct

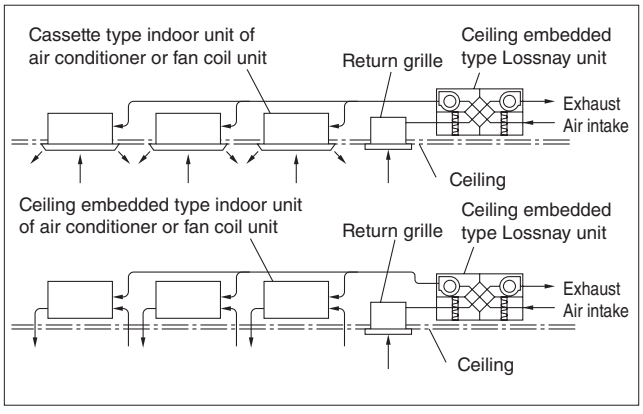
The main unit's supply outlet and suction inlet and the room side and outdoor side positions cannot be changed. However, the unit can be installed up-side-down, and installed as shown below. (This is applicable when installing two units in one classroom, etc.)



(2) System Operation with Indoor Unit of Air Conditioner

There is an increased use of air conditioning systems with independent multiple air-conditioner unit due to their features such as improved controllability, energy conservation and saving space.

For these types of air conditioning systems, combining the operation of the dispersed air conditioners to Lossnay is possible.



CHAPTER 8

Filters

1. Importance of Filters

Clean air is necessary for comfort and health. Besides atmospheric pollution that has been generated with the development of modern industries, the increased use of automobiles, air pollution in air-tight room has progressed to the point where it has an adverse effect on occupants.
Also, demands for preventing pollen from entering inside spaces are increasing.

2. Dust

The particle diameter of dust and applicable range of filters are shown in Table 1, and representative data regarding outdoor air dust concentrations and indoor dust concentrations is shown in Table 2.

Table 1. Aerosol particle diameters and applicable ranges of various filters

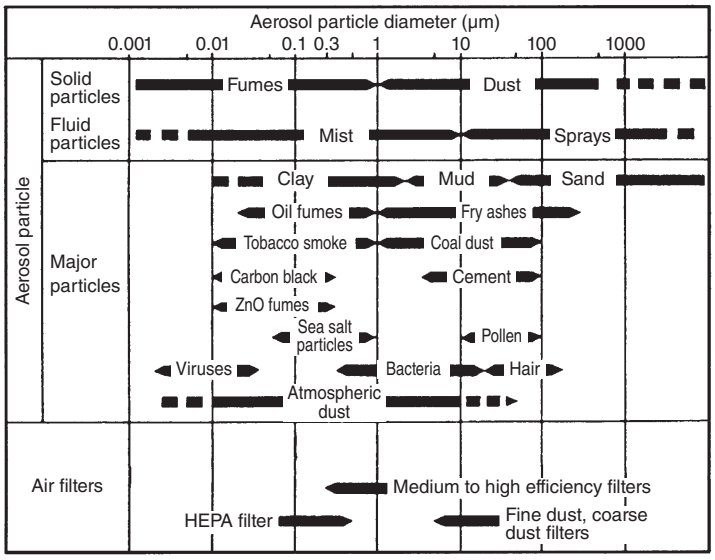


Table 2. Dust Concentrations

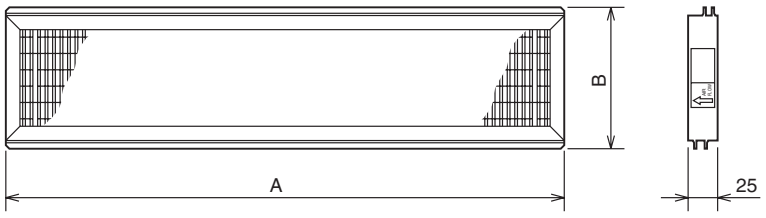
Type	Reference Data	
Outdoor air dust concentration	Large city	0.1 - 0.15 mg/m^3
	Small city	0.1 mg/m^3 or less
	Industrial districts	0.2 mg/m^3 or more
Indoor dust concentration	General office	10 mg/h per person
	Stores	5 mg/h per person
	Applications with no tobacco smoke	5 mg/h per person

Remarks:
1. Outdoor dust is said to have a diameter of 2.1 μm; the 11 types of dust (average diameter 2.0 μm) as listed by JIS Z8901 for performance test particles are employed.
2. Dust in office rooms is largely generated by tobacco smoke, and its diameter is 0.72 μm. The 14 types of dust (average 0.8 μm) as listed by JIS Z 8901 for performance test particles are employed.
3. Dust generated in rooms where there is no smoking has approximately the same diameter as outdoor air.
4. Smoking in general offices (Japan):
   Percentage of smokers : Approx. 70% (adult men)
   Average number of tobacco : Approx. 1/person·h (including non-smokers)
   Length of cigarette (tobacco section) : Approx. 4 cm
   Amount of dust generated by one tobacco : Approx. 10 mg/tobacco

3. Calculation Table for Dust Collection Efficiency of Each Lossnay Filter

Measurement method / Tested dust / Filter type		Applicable model	AFI Gravitational method	ASHRAE Colorimetric method	Certificate in EU	Countingh method (DOP method)		Application
			Compound dust	Atomspheric dust		JIS 14 types DOP 0.8 μm	DOP 0.3 μm	
Pre-filter	NP/400	Commercial Lossnay (LGH)	82%	8% - 12%	G3 (EU3) (EN 779:2002)	5% - 9%	2% - 5%	Protection of heat recovery element
High efficiency filter	Model PZ-15 to 100RFM-E	Optional Part for model LGH-15 to 200RVX-E	99%	65%	F7 (EU7) (EN 779:2002)	60%	25%	Assurance of sanitary environment (According to Building Management Law)

3.1 High-Efficiency Filter (Optional Parts)



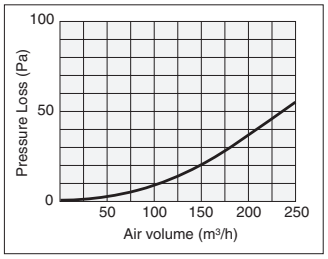
Model		PZ-15RFM-E	PZ-25RFM-E	PZ-35RFM-E	PZ-50RFM-E	PZ-65RFM-E	PZ-80RFM-E	PZ-100RFM-E
Applicable Model		LGH-15RVX-E	LGH-25RVX-E	LGH-35RVX-E	LGH-50RVX-E	LGH-65RVX-E	LGH-80RVX-E LGH-150RVX-E (2sets)	LGH-100RVX-E LGH-200RVX-E (2sets)
Dimension(mm)	A	553	327	393	464	427	446	559
	B	123	148	175	175	209	236	236
Number of filters perset		1	2	2	2	2	2	2

Note: This is one set per main body.

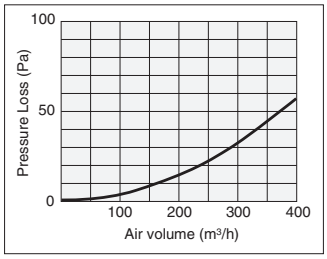
3.2 Pressure Loss

■ **Pressure Loss Characteristics**

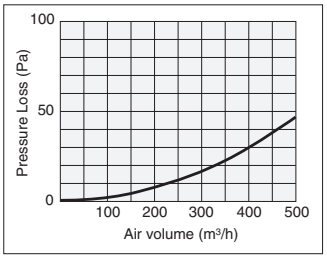
PZ-15RFM-E



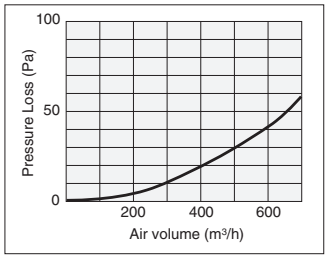
PZ-25RFM-E



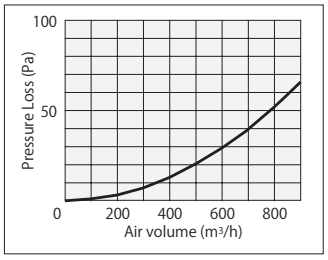
PZ-35RFM-E



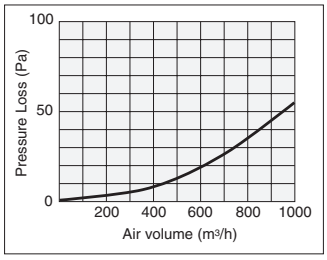
PZ-50RFM-E



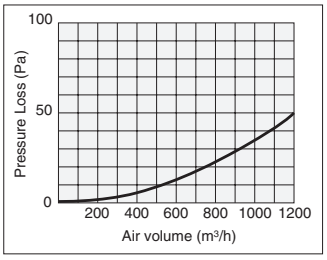
PZ-65RFM-E



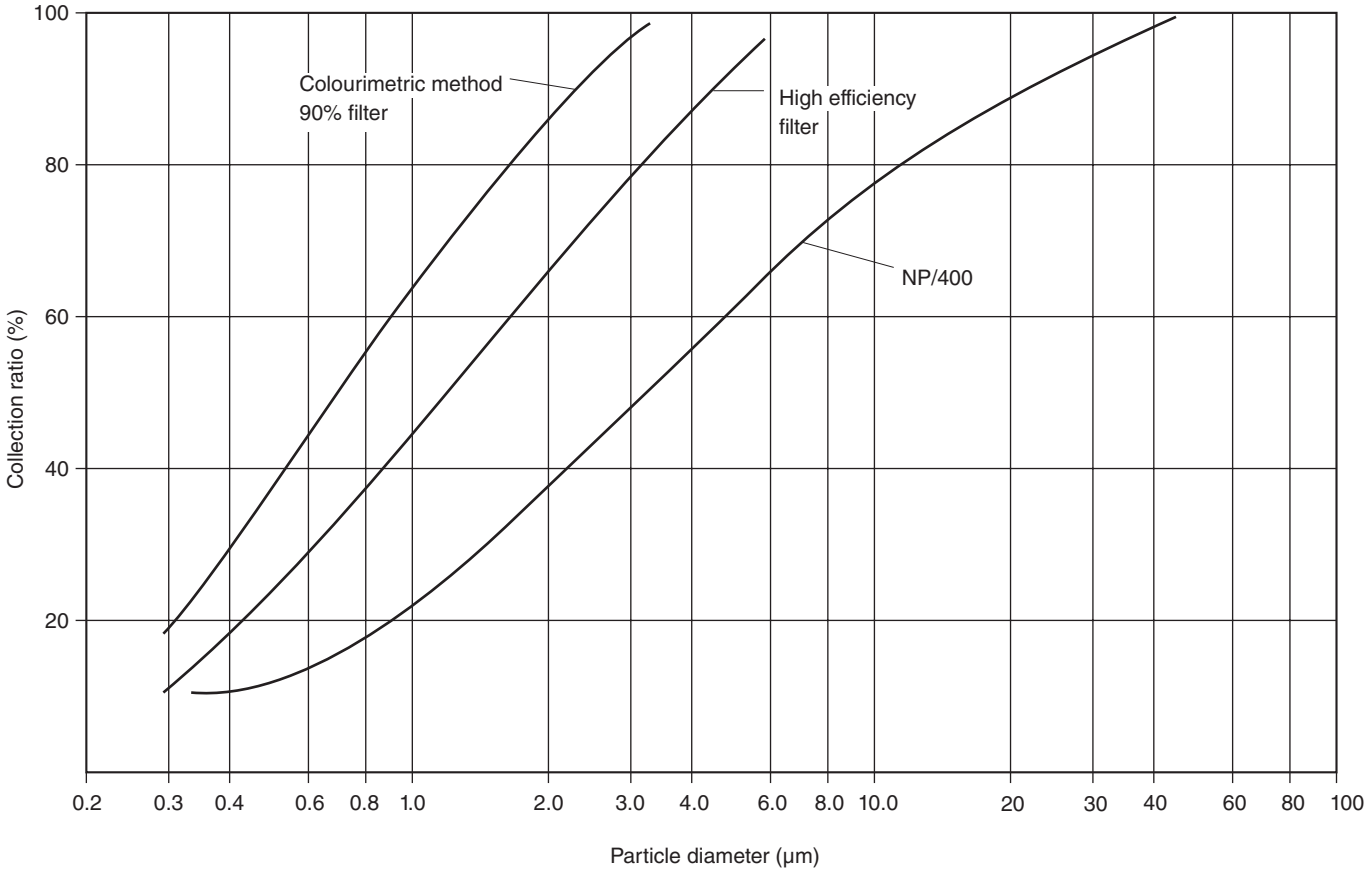
PZ-80RFM-E



PZ-100RFM-E



Effectiveness of the filters used in the Lossnay units are shown below, expressed in terms of collection ratio (%).



4. Comparing Dust Collection Efficiency Measurement Methods

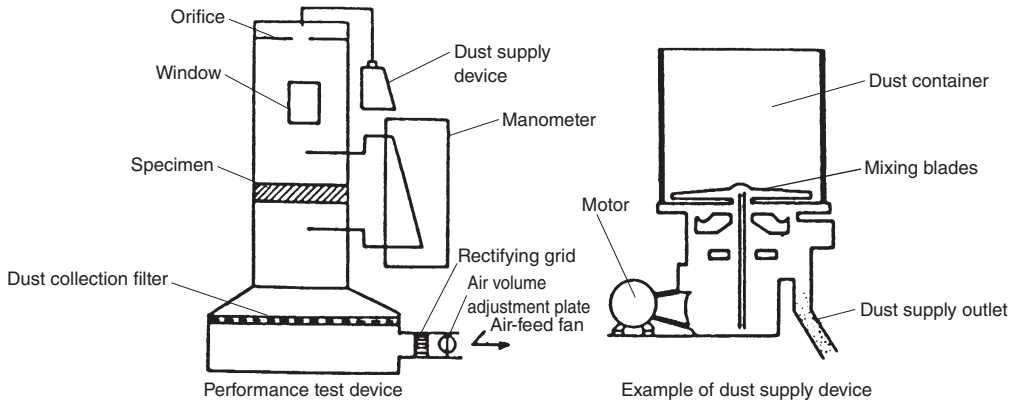
The gravitational, colorimetric, and counting methods used for measuring dust collection efficiency each have different features and must be used according to filter application.

Test Method	Test Dust	Inward Flow Dust Measurement Method	Outward Flow Dust Measurement Method	Efficiency Indication Method	Type of Applicable Filters
AFI Gravitational method	Synthetic: •Dust on standard road in Arizona: 72% •K-1 carbon black: 25% •No. 7 cotton lint: 3%	Dust weight measured beforehand	•Filter passage air volume measured •Weigh the dust remaining on the filter and compare	Gravitational ratio	Synthetic dust filters
NBS Colorimetric method	Atmospheric dust	Degree of contamination of white filter paper	Degree of contamination of white filter paper	Comparison of contamination of reduction in degree of contamination	Electrostatic dust percentage of (for air conditioning)
DOP Counting method	Diameter of dioctyl-phthalate small drop particles: 0.3 μm	Electrical counting measurement using light aimed at DOP	Same as left	Counting ratio	Absolute filter and same type of high efficiency filter
ASHRAE Gravitational method	Synthetic: •Regulated air cleaner fine particles: 72% •Morocco Black: 23% •Cotton linter: 5%	Dust weight measured beforehand	•Filter passage air volume measured •Weigh the dust remaining on the filter and compare	Gravitational ratio	Pre-filter Filter for air conditioning (for coarse dust)
ASHRAE Colorimetric method	Atmospheric dust	Degree of contamination of white filter paper	Degree of contamination of white filter paper	Comparison of percentage of reduction in degree of contamination	Filter for air conditioning (for fine dust) Electrostatic dust collector
Air filter test for air conditioning set by Japan Air Cleaning Assoc. (Colorimetric test)	JIS 11-type dust	Degree of contamination of white filter paper	Degree of contamination of white filter paper	Comparison of percentage of reduction in degree of contamination	Filter for air conditioning
Pre-filter test set by Japan Air Cleaning Assoc. (Gravitational test)	JIS 8-type dust	Dust weight measured beforehand.	•Filter passage air volume measured •Weigh the dust remaining on the filter and compare.	Gravitational ratio	Pre-filter
Electrostatic air cleaning device test set by Japan Air Cleaning Assoc. (Colorimetric test)	JIS 11-type dust	Degree of contamination of white filter paper	Degree of contamination of white filter paper	Comparison of percentage of reduction in degree of contamination	Electrostatic dust collector

Gravitational Method

This method is used for air filters that remove coarse dust (10 μm or more). The measurement method is determined by the gravitational ratio of the dust amount on the in-flow and out-flow sides.

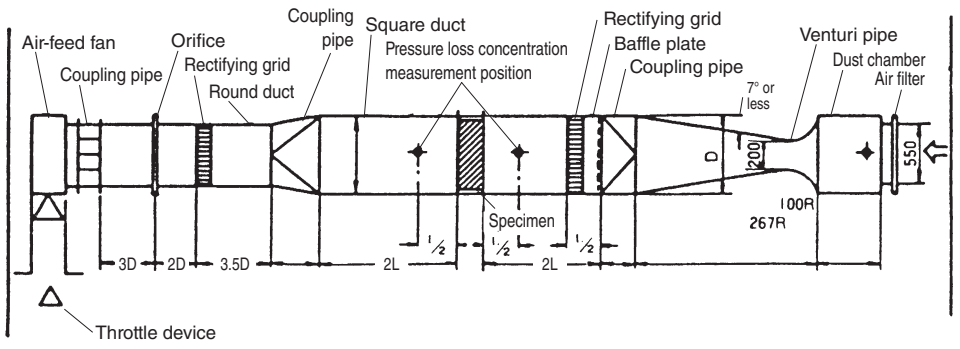
$$\text{Dust collection ratio} = \frac{\text{In-flow side dust amount} - \text{Out-flow side dust amount}}{\text{In-flow side dust amount}} \times 100\ (\%)$$



Colorimetric Method

The in-flow side air and out-flow side air are sampled using a suction pump and passed though filtering paper. The sampled air is adjusted so that the degree of contamination on both filter papers is the same, and the results are determined by the sampled air volume ratios on both sides.

$$\text{Dust collection ratio} = \frac{\text{Out-flow side sampling amount} - \text{In-flow side sampling amount}}{\text{Out-flow side sampling amount}} \times 100\ (\%)$$

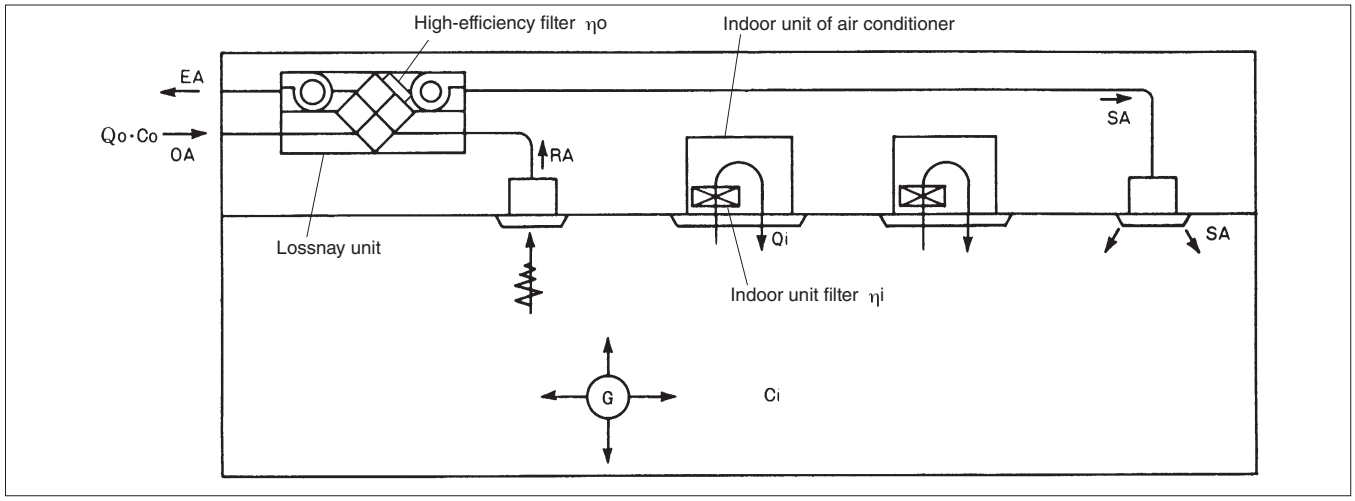


Unit (mm)

5. Calculating Dust Concentration Levels

An air conditioning system using Lossnay units is shown below. Dust concentration levels can be easily determined using this diagram.

Dust Concentration Study Diagram



Q_o : Outdoor air intake amount (m^3/h)
Q_i : Indoor unit of air conditioner air volume (Total air volume of indoor unit) (m^3/h)
η_o : Filtering efficiency of humidifier with high efficiency filter % (colorimetric method)
η_i : Efficiency of the filter for the indoor unit of air conditioner % (colorimetric method)
C_o : Outdoor air dust concentration (mg/m^3)
C_i : Indoor dust concentration (mg/m^3)
G : Amount of dust generated indoors (mg/h)

When the performance of each machine is known, the indoor dust concentration C_i may be obtained with the filter performance, η_o and η_i having been set to specific values as per manufacturer's data. The following formula is used:

$$C_i = \frac{G + C_o Q_o (1 - \eta_o)}{Q_o + Q_i \ \eta_i}$$

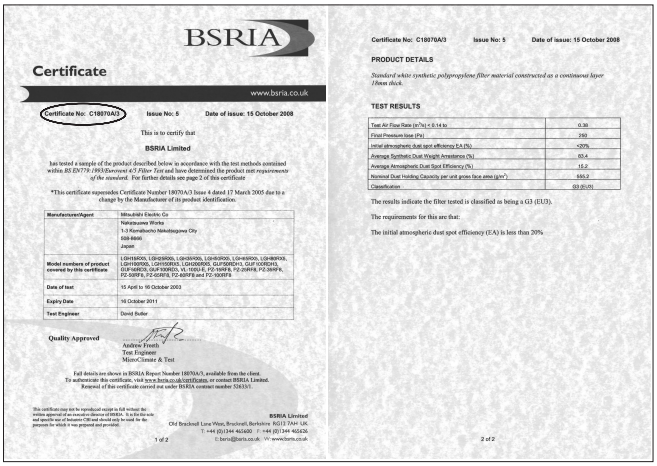
Also, with the value of Ci and η_o known, indoor unit of air conditioner efficiency can be found using:

$$\eta_i = \frac{G + C_o Q_o (1 - \eta_o) - C_i Q_o}{C_i Q_i} \times 100$$

6. Certificate in EU

Pre-filter of LGH-RVX-E series are certificated as G3(EU3), and High-efficiency filter of model PZ-15-100RFM-E are certificated as F7(EU7) under BS EN779 : 2002 / Eurovent 4/5 Filter Test.

Certificate No. C18070A/3


BSRIA
Certificate
www.bsria.co.uk
Certificate No: C18070A/3 Issue No: 5 Date of issue: 15 October 2008
This is to certify that
BSRIA Limited
has tested a sample of the product described below in accordance with the test methods contained within *BS EN779 : 2002/Eurovent 4/5 Filter Test* and have determined the product met *requirements of the standard*. For further details see page 2 of this certificate
*This certificate supersedes Certificate Number 18070A/3 Issue 4 dated 17 March 2005 due to a change by the Manufacturer of its product identification.
Manufacturer/Agent: Mitsubishi Electric Co, Nakatsusima Works, 1-3 Komakoncho Nakatsugawa City, 508-8666, Japan
Model numbers of product covered by this certificate: LGH15RDS, LGH15RDS, LGH15RDS, LGH15RDS, LGH15RDS, LGH15RDS, LGH15RDS, LGH15RDS, LGH20RDS, GLP50RDH1, GLP100RDH3, GUP18RDS, YL-15S3-E, PZ-15RFB, PZ-20RFB, PZ-30RFB, PZ-50RFB, PZ-60RFB and PZ-100RFB
Date of test: 15 April to 16 October 2003
Expiry Date: 16 October 2011
Test Engineer: David Butler
Quality Approved
Andrew Freeth
Test Engineer
MicroClimate & Test
Full details are shown in BSRIA Report Number 18070A/3, available from the client.
To authenticate this certificate, visit www.bsria.co.uk/certificates, or contact BSRIA Limited.
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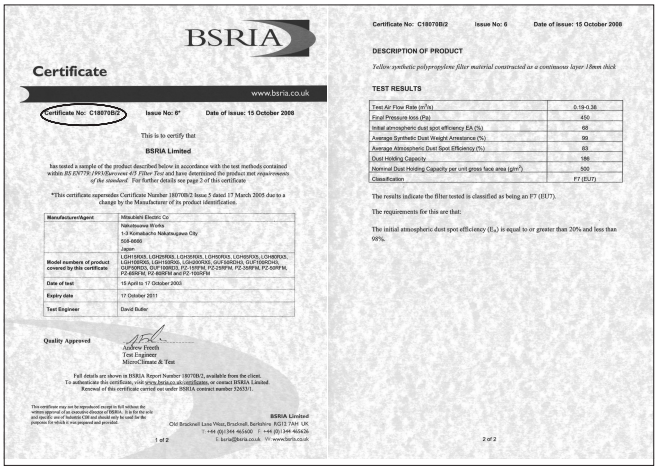
T: +44 (0)1344 465600 F: +44 (0)1344 465626
E: bsria@bsria.co.uk W: www.bsria.co.uk
1 of 2
Certificate No: C18070A/3 Issue No: 5 Date of issue: 15 October 2008
PRODUCT DETAILS
Standard white synthetic polypropylene filter material constructed as a continuous layer 18mm thick.
TEST RESULTS
Test Air Flow Rate (m^3/s) ± 0.14 to: 0.38
Final Pressure loss (Pa): 260
Initial atmospheric dust spot efficiency EA (%): <20%
Average Synthetic Dust Weight Arrestance (%): 80.4
Average Atmospheric Dust Spot Efficiency (%): 15.2
Nominal Dust Holding Capacity per unit gross face area (g/m^2): 565.2
Classification: G3 (EU3)
The results indicate the filter tested is classified as being a G3 (EU3).
The requirements for this are that:
The initial atmospheric dust spot efficiency (EA) is less than 20%
2 of 2

Certificate No. C18070B/2


BSRIA
Certificate
www.bsria.co.uk
Certificate No: C18070B/2 Issue No: 6* Date of issue: 15 October 2008
This is to certify that
BSRIA Limited
has tested a sample of the product described below in accordance with the test methods contained within *BS EN779 : 2002/Eurovent 4/5 Filter Test* and have determined the product met *requirements of the standard*. For further details see page 2 of this certificate
*This certificate supersedes Certificate Number 18070B/2 Issue 5 dated 17 March 2005 due to a change by the Manufacturer of its product identification.
Manufacturer/Agent: Mitsubishi Electric Co, Nakatsusima Works, 1-3 Komakoncho Nakatsugawa City, 508-8666, Japan
Model numbers of product covered by this certificate: LGH15RXS, LGH15RXS, LGH15RXS, LGH15RXS, LGH15RXS, LGH15RXS, LGH15RXS, LGH15RXS, LGH20RXS, GUP50RDH3, GUP100RDH3, GUP18RDS, YL-15S3-E, PZ-15RFM, PZ-20RFM, PZ-30RFM, PZ-50RFM, PZ-60RFM and PZ-100RFM
Date of test: 15 April to 17 October 2003
Expiry date: 17 October 2011
Test Engineer: David Butler
Quality Approved
Andrew Freeth
Test Engineer
MicroClimate & Test
Full details are shown in BSRIA Report Number 18070B/2, available from the client.
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Old Bracknell Lane West, Bracknell, Berkshire, RG12 7AH UK
T: +44 (0)1344 465600 F: +44 (0)1344 465626
E: bsria@bsria.co.uk W: www.bsria.co.uk
1 of 2
Certificate No: C18070B/2 Issue No: 6 Date of issue: 15 October 2008
DESCRIPTION OF PRODUCT
Yellow synthetic polypropylene filter material constructed as a continuous layer 18mm thick
TEST RESULTS
Test Air Flow Rate (m^3/s): 0.19-0.38
Final Pressure loss (Pa): 450
Initial atmospheric dust spot efficiency EA (%): 60
Average Synthetic Dust Weight Arrestance (%): 99
Average Atmospheric Dust Spot Efficiency (%): 83
Dust Holding Capacity: 186
Nominal Dust Holding Capacity per unit gross face area (g/m^2): 500
Classification: F7 (EU7)
The results indicate the filter tested is classified as being an F7 (EU7).
The requirements for this are that:
The initial atmospheric dust spot efficiency (E_A) is equal to or greater than 20% and less than 98%.
2 of 2

CHAPTER 9

Maintenance

1. Service Life

The Lossnay core has no moving parts, which eliminates vibration problems and permits greater installation flexibility. In addition, chemicals are not used in the energy recovery system. Performance characteristics remain constant throughout the period of service.
A lifetime test, currently in progress and approaching thus for 17,300 hours, has revealed no evidence of either reduction in energy recovery efficiency or material deterioration. If 2,500 hours is assumed to be the number of hours an air conditioner is used during a year, 17,300 hours equals to about seven (7) years.
(This is not a guarantee of the service life.)

2. Cleaning the Lossnay Core and Pre-filter

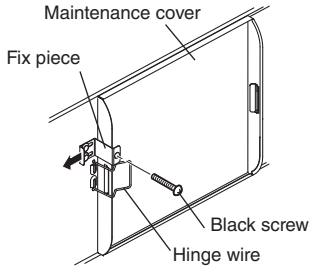
Remove all dust and dirt on air filters and Lossnay cores at regular intervals in order to prevent a deterioration in the Lossnay functions.
Guideline: Clean the air filters once a year.
(or when ▦ are indicated on the remote controller)
Clean the Lossnay cores once two year.
(Clean the Lossnay cores once a year if possible.)
(Frequency should be increased depending on the extent of dirt.)

Removing the parts

1) Maintenance cover

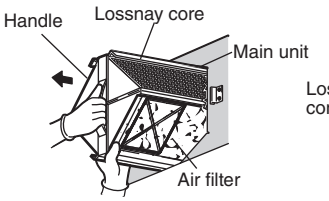
1. Remove the black screw.
2. Slide the fix piece to out side.
3. Open hinge wire.

*Models LGH-150 and 200RVX-E have 2 fix pieces.

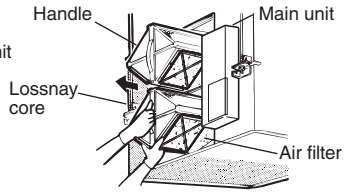


2) Lossnay cores

Take hold of the handle and draw the Lossnay cores out from the main unit.



Models
LGH-15 to 100RVX-E

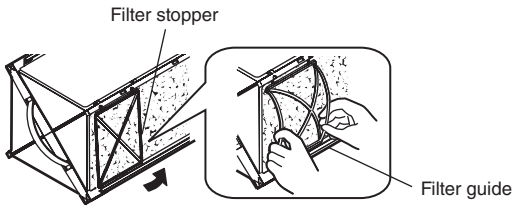


Models
LGH-150 and 200RVX-E

3) Air filters

After pulling out the Lossnay cores, undo filter guides, then remove the air filters, located at the bottom left and right of the Lossnay cores, as right.

Model LGH-15RVX-E: 1 core, 2 filters
Models LGH-25 to 100RVX-E: 2 cores, 4 filters
Models LGH-150 and 200RVX-E: 4 cores, 8 filters



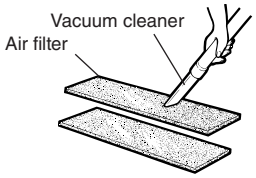
⚠CAUTION

- Bow filter stoppers a little to remove them from filter guide.
- Take filter stoppers careful not to break them.

Cleaning the parts

1) Air filters

Use a vacuum cleaner to remove light dust. To remove stubborn dirt wash in a mild solution of detergent and lukewarm water. (under 40˚C)

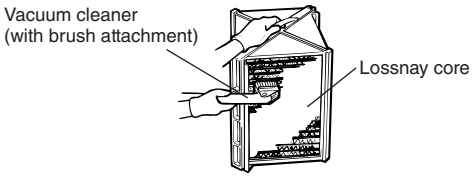


⚠CAUTION

- Never wash the filters in very hot water and never wash them by rubbing them.
- Do not dry the filters by exposing them to a flame.

2) Lossnay cores

Use a vacuum cleaner to suck up the dust and dirt on the exposed surfaces of the Lossnay cores.
Use a soft brush only to clean exposed surface areas.



Do NOT wash in water.

⚠CAUTION

- Do not use the hard nozzle of the vacuum cleaner. It may damage the exposed surfaces of the Lossnay cores.
- Under no circumstances should the Lossnay cores be washed in water.

Assembly after maintenance

Bearing in mind the following points, assemble the parts following the sequence for their removal in reverse.

- Arrange the Lossnay core with the air filter side downward.
- The filter for LGH-15 and 35RVX-E has front and back side. Set the “FRONT” (printed) side of the filter on the outer side.

Note

- If ▦ are indicated on the remote controller, turn off the indication, after maintenance.

1. Ventilation Standards in Each Country

1.1 Japan

Summary of Laws Related to Ventilation

<table>
<tr><th>Item / Related Laws</th><th>Acceptable Range</th><th>Room Environment Standard Values</th><th>Remarks</th></tr>
<tr><td>Law for Maintenance of Sanitation in Buildings</td><td>Buildings of at least 3,000 m^2 (for schools, at least 8,000 m^2).</td><td>If a central air quality management system or mechanical ventilation equipment is installed, comply with the standard target values shown in the table below.<table><tr><td>Impurity Volume of Particles</td><td>Less than 0.15 mg per 1 m^3 of air</td></tr><tr><td>CO Rate</td><td>Less than 10 ppm. (Less than 20 ppm when outside supply air has a CO rate of more than 10 ppm.)</td></tr><tr><td>CO$_2$ Rate</td><td>Less than 1,000 ppm.</td></tr><tr><td>Temperature</td><td>1)Between 17°C and 28°C
2)When making the room temperature cooler than the outside temperature, do not make the difference too great.</td></tr><tr><td>Relative Humidity</td><td>40% - 70%</td></tr><tr><td>Ventilation</td><td>Less than 0.5 m/sec.</td></tr></table></td><td>Applicable buildings are those designed to serve a specific purpose.</td></tr>
<tr><td>The Building Standard Law of Japan</td><td>Buildings with requirements for ventilation equipment.
1) Windowless rooms.
2) Rooms in theaters, movie theaters, assembly halls, etc.
3) Kitchens, bathrooms, etc.
Rooms with equipment or devices using fire.</td><td>Central air quality management system ventilation capacity and characteristics
Effective ventilation capacity $V \geqq 20Af/N(m^3)$
Af: Floor space (m^2); N: Floor space occupied by one person<table><tr><td>Impurity Volume of Particles</td><td>Less than 0.15 mg per 1 m^3 of air</td></tr><tr><td>CO Rate</td><td>Less than 10 ppm.</td></tr><tr><td>CO$_2$ Rate</td><td>Less than 1,000 ppm.</td></tr><tr><td>Temperature</td><td>1)Between 17°C and 28°C
2)When making the room temperature cooler than the outside temperature, do not make the difference too great.</td></tr><tr><td>Relative Humidity</td><td>40% - 70%</td></tr><tr><td>Ventilation</td><td>Less than 0.5 m/sec.</td></tr></table></td><td>Applicable buildings are those with ventilation equipment requirements.</td></tr>
<tr><td>Industrial Safety and Health Act</td><td>Offices.
(Office sanitation regulated standards)</td><td>For general ventilation, the effective ventilation area opening is at least 1/20 of the floor space, and the ventilation equipment installed gives a CO density of 50 ppm and CO$_2$ density of 5,000 ppm or less. If a central air quality management system or mechanical ventilation equipment is installed, comply with the standard target values shown in the table below.<table><tr><td>Impurity Volume of Particles</td><td>Air (1 atmospheric pressure, 25°C) less than 0.15 mg per 1 m^3 of air</td></tr><tr><td>CO Rate</td><td>Less than 10 ppm. (Less than 20 ppm when outside supply air has a CO rate of more than 10 ppm.)</td></tr><tr><td>CO$_2$ Rate</td><td>Less than 1,000 ppm.</td></tr><tr><td>Air Flow</td><td>Air flow in room is less than 0.5 m/s, and air taken into the room does not blow directly on or reach occupants.</td></tr><tr><td>Heat and Humidity Conditions</td><td>Heat between 17°C - 28°C
Relative humidity 40% - 70%</td></tr></table></td><td></td></tr>
</table>

2. United States of America

ASHRAE Standard 62 - 2001

Application	Outdoor Air Requirements	Estimated Maximum* Occupancy P/1000 ft^2 or 100 m^2
Commercial dry cleaner	30 cfm / person	30
Dining rooms	20 cfm / person	70
Bars, cocktail lounges	30 cfm / person	100
Kitchens (cooking)	15 cfm / person	20
Hotel bedrooms	30 cfm / room	—
Hotel living rooms	30 cfm / room	—
Hotel lobbies	15 cfm / person	30
Gambling casinos	30 cfm / person	120
Office space	20 cfm / person	7
Conference room	20 cfm / person	50
Smoking lounge	60 cfm / person	70

* Net occupiable space.

3. United Kingdom

CIBSE

Application	Outdoor air			Smoking
	Recommended	Minimum		
	Per person	Per person	Per m^2	
Factories	8 l/s / person	5 l/s / person	0.8 l/s / m^2	None
Offices (open plan)	8 l/s / person	5 l/s / person	1.3 l/s / m^2	Some
Shops, department stores, and supermarkets	8 l/s / person	5 l/s / person	3.0 l/s / m^2	Some
Theaters	8 l/s / person	5 l/s / person	—	Some
Dance halls	12 l/s / person	8 l/s / person	—	Some
Hotel bedrooms	12 l/s / person	8 l/s / person	1.7 l/s / m^2	Heavy
Laboratories	12 l/s / person	8 l/s / person	—	Some
Offices (private)	12 l/s / person	8 l/s / person	1.3 l/s / m^2	Heavy
Residences (average)	12 l/s / person	8 l/s / person	—	Heavy
Restaurant (cafeteria)	12 l/s / person	8 l/s / person	—	Heavy
Cocktail bars	18 l/s / person	12 l/s / person	—	Heavy
Conference rooms (average)	18 l/s / person	12 l/s / person	—	Some
Residence	18 l/s / person	12 l/s / person	—	Heavy
Restaurant	18 l/s / person	12 l/s / person	—	Heavy
Board rooms, executive offices, and conference rooms	25 l/s / person	18 l/s / person	6.0 l/s / m^2	Very Heavy
Corridors	N/A	N/A	1.3 l/s / m^2	N/A
Kitchens (domestic)	N/A	N/A	10.0 l/s / m^2	N/A
Kitchens (restaurant)	N/A	N/A	20.0 l/s / m^2	N/A
Toilets	N/A	N/A	10.0 l/s / m^2	N/A

CHAPTER 11

Lossnay Q and A

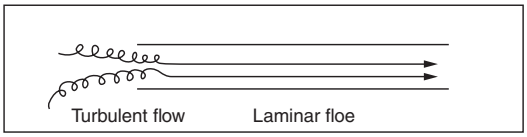
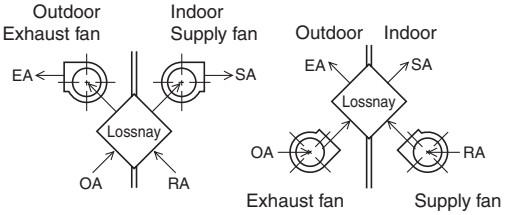
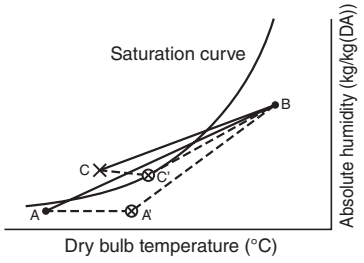
	Question	Answer	Remarks
1	Paper is used for the material, but does it have an adequate life span?	The cellulose membrane will last an adequate amount of time unless it is intentionally damaged, placed in water or in direct sunlight (ultra-violet rays). The life is longer than metal as it does not rust.	Depending on conditions, the cellulose membrane can be stored for up to 2,000 years without deteriorating.
2	Is the paper an insulation material? (Poor conductor of heat)	The cellulose membrane is very thin, and thus the conductivity of the material is low, with heat being transferred approximately the same as metal. This can be tested placing a piece of paper between hands and feel the warmth of the palms. The recovery of humidity can also be felt by blowing on the paper and feeling the moisture in the breath being transferred to the palm.	
3	If the paper can recover humidity, will it not become wet?	It is similar to the phenomenon during heating in winter where the window pane is wet but the paper blinds are dry - humidity is transferred through the paper membrane.	
4	When is the forced simultaneous air intake/ exhaust-type more efficient?	When a building is sealed and normal ventilation is used, accurate exhaust is not possible unless a suction inlet is created. Lossnay units have both an air-supply fan and air-exhaust fan so “Class 1” ventilation is possible.	
5	What are the energy conservation properties of Lossnay units?	For an example, in an approx. 13 m^2 room with five people, a ventilation volume of 100 m^3/h is required. The amount of power consumed in this case is approximately 45 W, and the amount of energy recovered during cooling is approximately 700 W or more. The coefficient of performance (C.O.P.) obtained when converted with the unit power generation amount is 16. When compared to a popular heat pump has a C.O.P. of 2 to 3, the Lossnay can serve a high amount of energy. If a general-purpose ventilator is installed, the cooled air will be lost, thus increasing electrical costs throughout the year.	

<table>
<tr><th></th><th>Question</th><th>Answer</th><th>Remarks</th></tr>
<tr><td>6</td><td>What are the economical factors? (Using Japan specifications)</td><td>
Between 55 to 60% of the heat energy that escapes with ventilation is recovered by Lossnay unit, so the cooling/heating cost can be reduced by approximately 43,000 yen per year. The initial costs can be reduced down to a 59,000 yen increase when comparing an air conditioner, Lossnay, and ventilator (fixed price base).

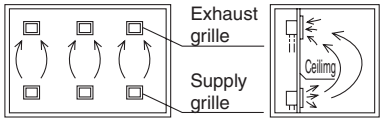
Calculation conditions
Cooling:
Room temperature/humidity: 26°C, 50%
Outdoor air temperature/humidity: 32°C, 70%
Heating:
Room temperature/humidity: 20°C, 50%
Outdoor air temperature/humidity: 0°C, 50%
Building:
General office facing south on middle floor: 100 m^2
Cooling load (room): 104 W/m^2
Heating load (room): 77.7 W/m^2
Ventilation volume: 500 m^3/h
Without Lossnay: Straight lock fan BFS-50SU. . . . . Two units
With Lossnay: Lossnay LGH-50R type . . . . . One unit
Cooling/heating load (W):
<table>
<tr><th></th><th colspan="3">Without Lossnay</th><th colspan="3">With Lossnay</th></tr>
<tr><th></th><th>Room</th><th>Outdoors</th><th>Total</th><th>Room</th><th>Outdoors</th><th>Total</th></tr>
<tr><td>Cooling</td><td>10,400</td><td>5,560</td><td>15,960</td><td>10,400</td><td>2,340</td><td>12,740</td></tr>
<tr><td>Heating</td><td>7,770</td><td>5,630</td><td>13,400</td><td>7,770</td><td>2,140</td><td>9,910</td></tr>
</table>
Air conditioner:
Without Lossnay : Ceiling-suspended cassette-type air conditioner PLZ-J140KA9G9 . . . . . One unit
With Lossnay : PLZ-J112KA9G9 . . . . . One unit
Operation time:
Cooling 10 hours/day, 26 days/month, 4 months/year, operation ratio: 0.7
Heating 10 hours/day, 26 days/month, 5 months/year, operation ratio: 0.7
Power costs (Tokyo Power special industrial power 6 kV supply)
Summer: 16.15 yen /kWh, Other 14.65/kWh
</td><td>There are also “savings in maintenance costs”, “ventilation functions”, “soundproofing” as well as “comfort” and “safety”.</td></tr>
<tr><td>7</td><td>If the air ventilated from the toilet is included in heat-recovery, will the odors be transferred to other rooms?</td><td>
For an example; if the total ventilation volume is 100, and the amount of odors generated from the toilet, etc., is 30, the total volume of conditioned air is still three times the ventilation amount. Thus, if the leakage rate of odors is 7% (hydrogen sulphide), it will be: 100 × 30% × 1/3 × 7% = 0.7%, and there are no problems in terms of total air conditioned air volume. However, exhaust is usually performed with a separate system. In the case of ammonia, the rate is 2.8% using the same formula.

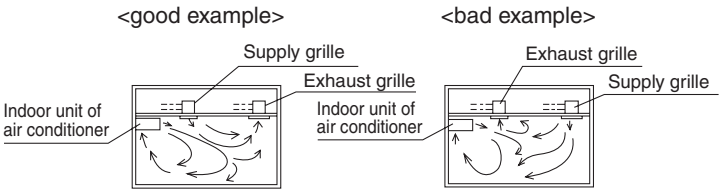
Note: (The rotary-type has approximately the same transmission rate, but for ammonia, the transmission rate is 50% or more than the Lossnay energy recovery method.)
</td><td>
<Gas/smoke transmission rate>
CO : 1%
CO_2 : 2%
H_2S : 3%
NH_3 : 3%
Smoke : 1% - 2%

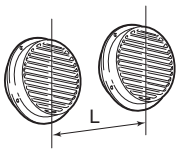
Conditions
(Supply and exhaust fans installed for suction feed. Standard treatment air volume.)
</td></tr>
</table>

	Question	Answer	Remarks
8	Can Lossnay units be used for hospital airconditioning?	According to the results from a test performed by the Tokyo University Hospital (Inspection Center, Prof. Kihachiro Shimizu), as the supply air and exhaust air pass through different passages, bacteria transmission from exhaust side to supply side is low. They found: 1) Bacteria do not propagate in the Lossnay Core. 2) Even if bacteria accumulated in the Lossnay unit, it died off in approximately two weeks.	
9	Because entry into the Lossnay Core is small, won't it clog easily?	Normally the original state of the filter can be regained by cleaning it with a vacuum more than once every year, and the two intake side surfaces of the Lossnay Core more than once every two years. Dust will not accumulate in the passage due to the laminar flow if the air is normal.  	"Normal air" refers to air that does not contain oil mist, etc. When exhausting air contains oil mist, etc., install a filter at return grille.
10	What is the air leakage rate?	This will be different depending on the position of the fans, but for "both suction" or "both forced", the rate is 2% to 3%. LGH type fan position is "both forced".  For using LU type, if the difference in static pressure between SA and RA, and EA and OA is 500 Pa, the air leakage rate will be 2.5% and 3.4% respectively. This value is not a problem for actual use. However, the single suction or single forced methods will have a leakage rate of 10% or higher and should be avoided.	
11	Can Lossnay units be used in extreme cold climates (-10°C or lower)?	If the winter room air temperature is above 20°C, humidity is above 50%, and the outdoor temperature is -10°C or lower, moisture condensation or frost will develop on the Lossnay Core. In this case, the intake air must be preheated. Plot the Lossnay intake side air conditions A and B on a psychrometric chart as shown below. If the high temperature side air B intersects the saturation curve such as at C, moisture condensation or frost will accumulate on the Lossnay unit. In this case, the air should be warmed up to the temperature indicated by Point A' so that Point C reaches the C' point.  	

<table>
<tr><th></th><th>Question</th><th>Answer</th><th>Remarks</th></tr>
<tr><td>12</td><td>Will tobacco and tar affect the Lossnay Core?</td><td>Tobacco smoke tends to adhere to dust, and when it passes through the Lossnay Core, most of the nicotine and tar will be filtered by the air filter. However, in very smoky places (ex. gambling parlors, casinos), or when used for a long period, the tobacco will accumulate and move to the intake side. In this case, the Core and filter should be replaced.</td><td>Ample filtering will not be possible with a net air filter.</td></tr>
<tr><td>13</td><td>What are the guidelines for ventilation. (These are Japan guidelines.)</td><td>According to the “The Building Standard Law of Japan”, a ventilation volume of 20 m^3/h·person is required if the windows cannot be opened for ventilation.
In buildings to which the Law for Maintenance of Sanitation in Buildings is applied, the carbon gas concentration must be 0.1% or less, so a ventilation of 34 m^3/h·person is required. In Tokyo, the guideline is set at 25 to 30 m^3/h·person.
The required ventilation volume per person is noted below.
<table>
<tr><th rowspan="2">Degree of Smoking</th><th rowspan="2">Application Example</th><th colspan="2">Required Ventilation Volume (m^3/h)</th></tr>
<tr><th>Recommended</th><th>Minimum</th></tr>
<tr><td>Extremely heavy</td><td>Broker’s office
Newspaper editing room
Conference room</td><td>85</td><td>51</td></tr>
<tr><td>Quite Heavy</td><td>Bar
Cabaret</td><td>51</td><td>42.5</td></tr>
<tr><td>Heavy</td><td>Office
Restaurant</td><td>25.5
25.5</td><td>17
20</td></tr>
<tr><td>Light</td><td>Shop
Department store</td><td>25.5</td><td>17</td></tr>
<tr><td>None</td><td>Theater
Hospital room</td><td>25.5
34</td><td>17
25.5</td></tr>
</table></td><td></td></tr>
<tr><td>14</td><td>Are there any locations where Lossnay units cannot be used?</td><td>Lossnay units cannot be used where toxic gases and corrosives such as acids, alkalis, organic solvents, oil mist or paints exist.
The Lossnay cannot be used in energy recovery in air containing odors.</td><td></td></tr>
</table>

<table>
<tr><th></th><th>Question</th><th>Answer</th><th>Remarks</th></tr>
<tr><td>15</td><td>What is the short circulation of the air intake/ exhaust air outlet?</td><td>
The Lossnay unit uses the forced simultaneous supply/exhaust method, so insufficient ventilation found in standard ventilators without air intake is found.
⚠ Caution
(1) The fresh outdoor air supplied to the room should not short circulate and be drawn back into the return grille - should flow through the entire room.


(2) The relation of the supply and suction air flows must be also considered.


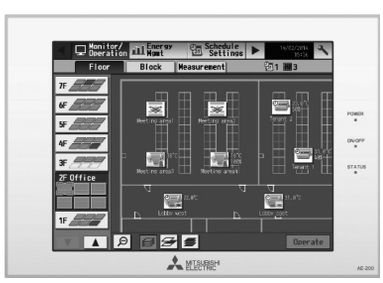
■ The air intake/exhaust grille on the outside wall is out in the open, so there is a natural wind, and short circulation will not occur easily. However, if the wind blows from the exhaust grille towards the intake grille, short circulation may occur, so the grilles should be placed as far apart as possible.
Distance should be three times the duct diameter.
<table>
<tr><th>Duct Diameter</th><th>L (mm)</th></tr>
<tr><td>ø100</td><td>300</td></tr>
<tr><td>ø150</td><td>450</td></tr>
<tr><td>ø200</td><td>600</td></tr>
<tr><td>ø250</td><td>750</td></tr>
</table>


</td><td></td></tr>
<tr><td>16</td><td>Is total operation possible via the switches?</td><td>Several units can be operated with the optional control switch.</td><td></td></tr>
<tr><td>17</td><td>What is the difference between the rotary-type and static-type?</td><td>Refer to page U-30,</td><td></td></tr>
<tr><td>18</td><td>Is an inspection hole necessary?</td><td>For the ceiling embedded type, the unit is installed in the false ceiling, so an inspection hole is required to access the core and filter, section and for fan maintenance.
Refer to the installation manual for details.</td><td></td></tr>
<tr><td>19</td><td>What must be performed during maintenance?</td><td>Periodic inspection and cleaning of the Lossnay core and air filter is necessary. Refer to page U-70, for details.</td><td></td></tr>
<tr><td>20</td><td>Can the Lossnay be used in factories?</td><td>Do not install in machine or chemical factories, where hazardous substances such as acidic gases, alkaline gases, organic solvent fumes, paint fumes, or gases containing corrosive components are generated.</td><td></td></tr>
</table>

<table>
<tr><th></th><th>Question</th><th>Answer</th><th>Remarks</th></tr>
<tr><td>21</td><td>What are “Class 1” ventilating facilities?</td><td>“Class 1” ventilation refers to mechanical ventilation (forced simultaneous air supply/exhaust) using both intake and exhaust fans for suction feed. All Lossnay models (with built-in air-feed fans) are “Class 1” ventilators. The ventilation method is classified in relation to the degree of natural and/or mechanical ventilation employed.
Classification of Ventilation
<table>
<tr><th></th><th>Intake</th><th>Exhaust</th><th>Ventilation Volume</th><th>Room Pressure</th></tr>
<tr><td>Class 1</td><td>Mechanical</td><td>Mechanical</td><td>Random (constant)</td><td>Random</td></tr>
<tr><td>Class 2</td><td>Mechanical</td><td>Natural</td><td>Random (constant)</td><td>Positive pressure</td></tr>
<tr><td>Class 3</td><td>Natural</td><td>Mechanical</td><td>Random (constant)</td><td>Negative pressure</td></tr>
<tr><td>Class 4</td><td>Natural</td><td>Assisted natural</td><td>Limited (inconstant)</td><td>Negative pressure</td></tr>
</table></td><td></td></tr>
<tr><td>22</td><td>Can the high-efficiency filter* be installed on the supply air side?</td><td>Install the high efficiency filter only on the outside air side.
• If installed on the supply air side, primary dirty air will enter the Lossnay before passing through the pre-filter and accelerate clogging for the core.
• Moisture prevention measures may also be required.</td><td></td></tr>
<tr><td>23</td><td>What are the anti-vibration measures for Lossnay units?</td><td>Measures are not required.</td><td></td></tr>
<tr><td>24</td><td>Can the LGH series Lossnay types be installed vertically?</td><td>Vertical installation is prohibited. Refer to page U-50, for details.</td><td></td></tr>
</table>

* Please consult with the nearest Lossnay supplier about part availability.

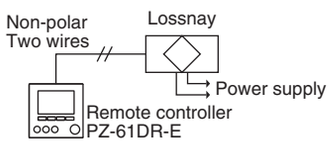
— Lossnay Control —



1. System Examples

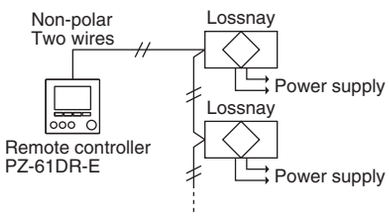
Basic System (Refer to page C-10)

One Lossnay with one remote controller



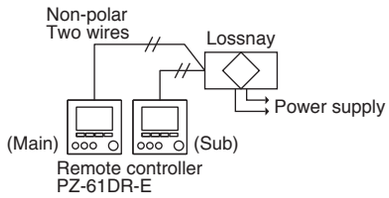
- A simple system in which Lossnay is operated independently with one remote controller.

Multiple Lossnay units with one remote controller



- Up to 15 Lossnay units can be controlled at one time with one remote controller.

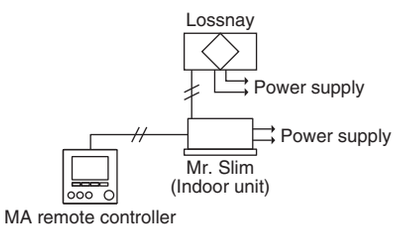
Two remote controller system with one Lossnay



- Lossnay can be controlled from two remote locations.
- The remote controller gives priority to the last operation function request.

Operation with an Air Conditioning Unit (Refer to page C-11)

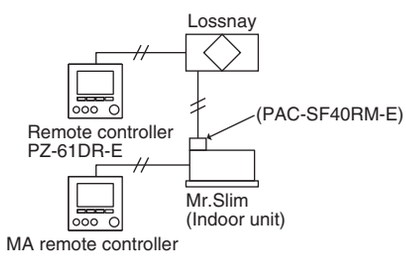
Operating with Mr. Slim (without Losnay remote controller)



- Use MA remote controller of Mr.Slim for switching Lossnay ON/OFF or the fan speed.
- The ventilation mode is "automatic ventilation".

Operating with an External Device (Refer to page C-12)

Operating with Mr. Slim (with Lossnay remote controller)

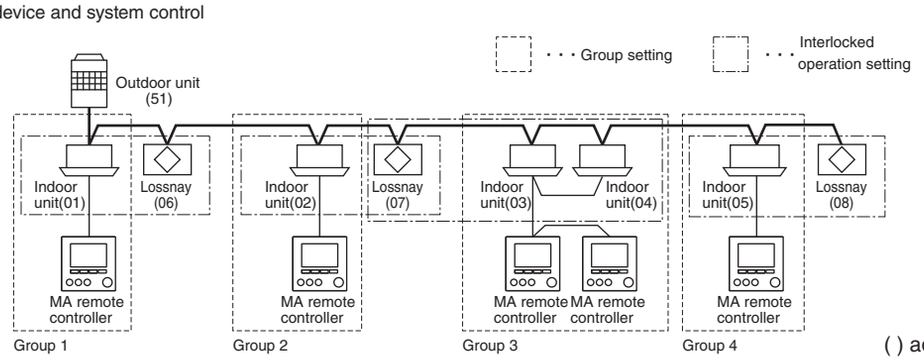


- Lossnay starts or stops according to Mr.Slim.

M-NET System

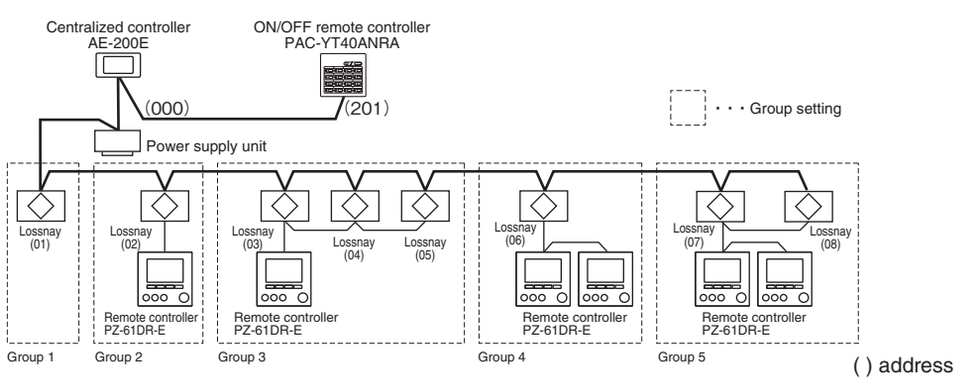
City Multi and Lossnay Interlocked System

Air conditioning device and system control



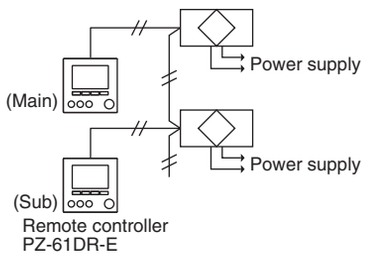
- One Lossnay can be interlocked with 16 indoor units. In addition, PZ-61DR-E can be connected for each Lossnay units.

Centralized Management System

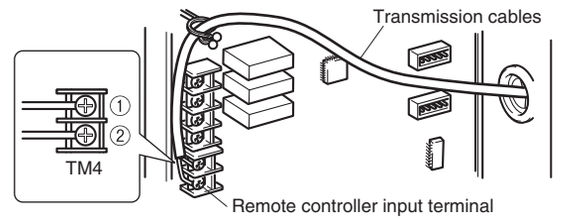


- ON/OFF, fan speed and ventilation mode control is possible from the centralized controller.
- Controller can set up the group including maximum of 15 indoor or Lossnay units.

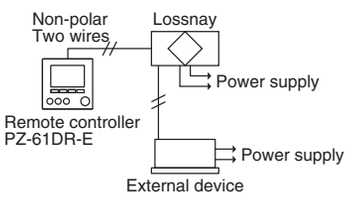
Two remote controller system with multiple Lossnay units



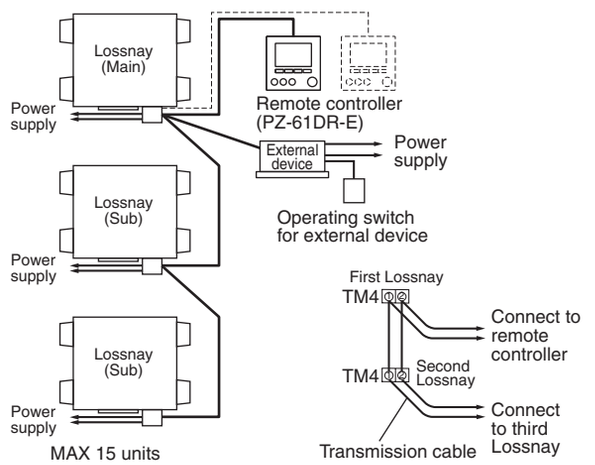
- It is also possible to operate two remote controller units when using multiple Lossnay units.



Operating with an external device



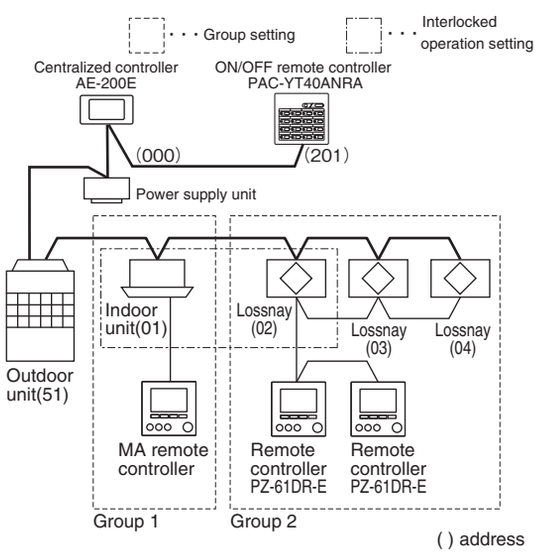
- Selection of interlocked operation mode is possible.
- Delayed start interlocked operation is possible.



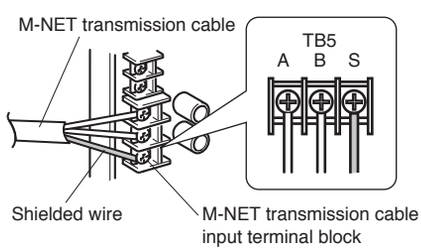
- Lossnay starts or stops addording to the external device.
- Level signal or pulse signal input (12VDC, 24VDC, and volt-free contact) is available.

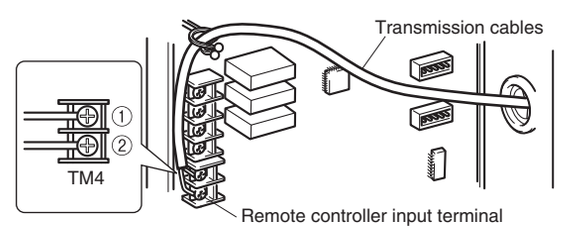
Interlocking/individual combined systems

Interlock settings are possible with the inclusion of a group setting. (Joint use of the air conditioner remote controller and Lossnay remote controller is possible.)

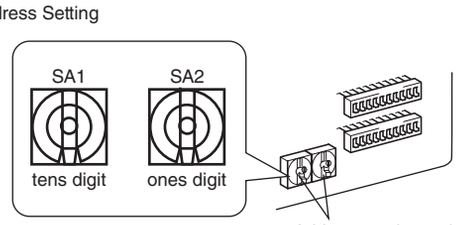


- Applicable indoor units are C type or later (for use with MA remote controller) models
- Set the different groups of indoor unit of air conditioner and Lossnay unit.





Address Setting



- When the address number has been changed, the data in the memory is automatically reset.

2. Function list and outline

2.1 Function list of LGH-RVX-E

No.	Item			LGH-RVX-E		Remarks	Page
				PZ-61DR-E	PZ-43SMF-E		
1	Basic function	ON/OFF		○	○	Refer to RC manual	-
		ON timer, OFF timer		○	○	Refer to RC manual	-
		Weekly timer		○	×	8 pattern in a day	-
		Fan speed switching (4 fan speeds)		○	×	PZ-61DR-E: all fan speed can be used and be skipped	-
		Fan speed switching (2 fan speeds)		-	○	PZ-43SMF-E: 2 of 4 fan speed can be used	-
		Ventilation mode selection (Energy recovery / Bypass / Automatic)		○	○		-
		Night-purge		○	×		C-45
		Night-purge from AG-150A/AE-200E		○	○	Not possible from PZ-43SMF-E	C-46
		Max. fan speed operation during the first 30 minutes		○	×		C-38
		Multi ventilation mode (Indoor negative / positive pressure)		○	○		C-37 C-38
		Temperature display		○	×		C-33
		Operation lock		○	×	Refer to RC manual	-
		Function setting from remote controller		○	×		C-29
2	Connectable remote controller	One LGH to one remote controller operation		○	○		C-10
		Multiple LGHs to one remote controller operation		○ (Max 15 units)	○ (Max 15 units)		C-10
		One or more LGHs to 2 remote controller operation		○ (Max 15 units)	○ (Max 15 units)		C-10
3	Usage in M-NET systems			○	○		C-14
4	Error code display			○	○		-
5	Maintenance sign display	Filter		○	○		C-31
		Lossnay core		○	×		C-31
6	Operation by external device	External device or Type of input signal	City Multi	○	○		C-14
			Mr. Slim (without remote controller)	-	-	Use the cable attached with LGH product	C-11
			Mr. Slim (with remote controller)	△	△	PAC-SF40RM-E is necessary	C-12
			12/24VDC input	○	○		C-19
			Volt-free contact input	○	○		C-19
			Pulse input	○	○		C-20
		Delay operation	LGH starts operation after air conditioner/external device turns ON	○ (15 or 30 min. later)	○ (30 min. later)		C-38
		Interlocked mode	ON/OFF interlock	Function is available either with or without remote controller		RC switching is available when interlocked	C-23
			ON interlock			Available only when becoming ON for not to forget to start operations	C-23
			OFF interlock			Available only when becoming OFF for not to forget to stop operation	C-23
			External priority ON/OFF interlock			OFF from RC is not available during operation	C-23
7	Switching fan speed by input signal					PAC-SA88HA-E is necessary	C-54
	Switching ventilation mode by input signal					PAC-SA88HA-E is necessary	C-56
8	Output signal	Operation monitor					C-52
		Malfunction monitor					C-51
		Bypass monitor or pre-heater					C-48 C-51

○: Possible to use. △: Need accessory parts. ×: NOT available

2.2. Function list for Lossnay from local remote controller and system controller

The table below is a function table of controllers in the case that Lossnay is NOT interlocked with City Multi indoor unit.

When not interlocked with City Multi (Lossnay group)		Local remote controller		System controller			
		Lossnay remote controller		ON/OFF remote controller	Advanced touch controller	Centralized controller	Centralized controller
		PZ-61DR-E	PZ-43SMF-E	PAC-YT40ANRA	AT-50B	AG-150A	AE-200E
Maximum No. of controllable Groups/Units		1 / 15 *2	1 / 15 *2	16 / 50 *3	50 / 50 *3	50 / 50 *3	50 / 50 *3
Operation	ON/OFF	○	○	◎	◎	◎	◎
	Fan speed	4 fan speeds	2 of 4 fan speeds *6	×	2 of 4 fan speeds *6	3 of 4 fan speeds *7	3 of 4 fan speeds *7 4 fan speeds (ver7.30 or later)
	Ventilation mode	○	○	×	○	○	○
	Local permit / prohibit	×	×	△ *4	◎	◎	◎
	Emergency stop *1	×	×	×	○	○	○
Status Monitoring	ON/OFF	○	○	○	○	○	○
	Fan speed	○	○	×	○	○	○
	Ventilation mode	○	○	×	○	○	○
	Temperature display	○	×	×	×	×	×
	Error indicator	○	○	○ *5	○	○	○
	Filter maintenance indicator	○	○	×	○	○	○
	Lossnay core maintenance indicator	○	×	×	×	×	×
	Local permit / prohibit	○	○	×	○	○	○
Scheduling/ Recording	One-day	○	○	×	○	○	○
	Times of ON/OFF per day	1	1	×	16	24	24
	Weekly	○	×	×	○	○	○
	Times of ON/OFF per week	8 x 7	×	×	16 x 7	24 x 7	24 x 7
	Auto-off timer	○	○	×	×	×	×
	Minimum setting (minutes)	5	30	×	5	1	1
	Error record	○	×	×	○	○	○
Others	Operation restrictions (ON/OFF, Ventilation mode, fan speed)	○	×	×	△ *8	△ *8	△ *8
	Operation restrictions (Fan speed skip setting)	○	×	×	×	×	×
	Night-purge (given conditions)	×	×	×	×	△	△(~ver.7.11)
	Night-purge (free setting)	○	×	×	×	×	○(ver.7.20~)
	Bypass temp. free setting	○	×	×	×	×	×
	Heater-On temp. free setting	○	×	×	×	×	×
	Fan power up after installation	○	×	×	×	×	×

◎: Each group / Batched ○:Each group △: Available under some conditions ×: NOT available

*1: Only available for bulk operation.
*2: Maximum number of controllable units may change according to system configuration of the group.
*3: Up to 16 units in a group can be operated with one system controller
*4: By using an external volt-free contact signal it is possible to send ON/OFF or Prohibit/Permit local remote controller operation commands to all units being controlled.
*5: LED flashes during failure.
*6: High fan speed of remote controller is fan speed 3 or 4 of Lossnay unit. Lo is 1 or 2.
*7: High fan speed of remote controller is fan speed 3 or 4 of Lossnay unit. Middle is 2. Lo is 1.
*8: It is possible to lock the touch screen operation.

2.3. Function list for Lossnay interlocked with indoor unit from local remote controller and system controller

The table below is a function table of controllers in the case that Lossnay is interlocked with City Multi indoor unit.

When interlocked with City Multi		Local remote controller			System controller			
		MA remote controller	Smart ME Controller	Simple MA remote controller	ON/OFF remote controller	Advanced touch controller	Centralized controller	Centralized controller
		PAR-31MAA	PAR-U02MEDA	PAC-YT52CRA	PAC-YT40ANRA	AT-50B	AG-150A	AE-200E (Later ver7.20)
Operation	ON/OFF *1	○	○	○	◎	◎	◎	◎
	Fan speed	2 of 4 fan speeds *2	2 of 4 fan speeds *2	N	N	2 of 4 fan speeds *2	2 of 4 fan speeds *2	2 of 4 fan speeds *2
	Ventilation mode	×	×	×	×	×	×	×
	Local permit / prohibit	×	×	×	×	×	×	×
	Emergency stop	×	×	×	×	○	◎	◎
Status Monitoring	ON/OFF	○	○	○	○	○	◎	◎
	Fan speed	○	○	×	×	○	○	○
	Ventilation mode	×	×	×	×	×	×	×
	Temperature display	×	×	×	×	×	×	×
	Error indicator	○	○	○	○*3	◎	◎	◎
	Filter maintenance indicator	○	○	×	×	○	○	○
	Lossnay core maintenance indicator	×	×	×	×	×	×	×
	Local permit / prohibit	×	×	×	×	×	×	×
Scheduling/ Recording	One-day *1	○	○	×	×	○	○	○
	Times of ON/OFF per day	1	1	×	×	16	24	24
	Weekly *1	○	○	×	×	○	○	○
	Times of ON/OFF per week	8 x 7	8 x 7	×	×	16 x 7	24 x 7	24 x 7
	Auto-off timer *1	○	○	×	×	×	×	×
	Minimum setting (minutes)	5	5	×	×	5	1	1
	Error history	○	×	×	×	○	○	○
Others	Operation restrictions (ON/OFF, Ventilation mode, fan speed)	×	×	×	×	×	×	×
	Operation restrictions (Fan speed skip setting)	×	×	×	×	×	×	×
	Night-purge (given conditions)	×	×	×	×	×	×	×
	Night-purge (free setting)	×	×	×	×	×	×	×
	Bypass temp. free setting	×	×	×	×	×	×	×
	Heater-On temp. free setting	×	×	×	×	×	×	×
	Fan power up after installation	×	×	×	×	×	×	×

◎: Each group / Batched ○:Each group △: Available under some conditions ×: NOT available

*1: When City Multi indoor unit is ON, Lossnay is ON.

*2: High fan speed of remote controller is fan speed 3 or 4 of Lossnay unit. Lo is 1 or 2.

*3: LED flashes during failure.

3. System structure

3.1 Notes/Cautions when system configuration

3.1.1 Basic system Operation by local remote controller (Refer to page C-10)

Following local remote controllers can be used.
• Lossnay Remote Controller PZ-61DR-E
• Lossnay Remote Controller PZ-43SMF-E

(1) Different model remote controllers cannot be used together in a group.

(2) Maximum 2 remote controllers can be connected in a group.

(3) When two PZ-61DR-E are used in a group, set one remote controller as main and the other as sub.
(Refer to installation manual of PZ-61DR-E.)

(4) Adequate remote controller cable
• Securely connect the transmission cable from the remote controller to the terminal block (TM4①②). (No polarity)
• Keep the overall length of the transmission cable between Lossnay and the remote controller within 200 m.
• Maximum torque:0.5N·m.

Wire type	2 core sheathed cable
Wire diameter	0.3mm^2
Max overall length between Lossnay and remote controller	200m

3.1.2 Group setting

Lossnay units set in a group can be operated at the same time from local remote controller.

(1) It is not possible to set Lossnay and Indoor unit of air conditioner in a group.

(2) When using local remote controller or interlocking with external device,
• Lossnay units connected via the terminal block (TM4①②) each other become the same group.
• The maximum number of Lossnay units in one group is 15.
• When connected to MELANS*, perform group setting from system controller so that each Lossnay unit connected via the terminal bock (TM4①②) becomes the same group.

(3) When connected to MELANS*, without Lossnay remote controller and not interlocked with City Multi indoor units or any external device.
• Set the groups by the System controller.
• The maximum number of Lossnay units in one group is 16.
• Connection via the terminal block (TM4①②) is not necessary.
However, in order to perform Night-purge function by using the system controller (AE-200E), connect them to each other.

*MELANS : MITSUBISHI ELECTRIC's Air-conditioner Network System

3.1.3 Interlocking with City Multi(Refer to page C-14)

When Lossnay and City Multi are connected to MELANS, it is possible to switch Lossnay “ON/OFF” and “High/Low” operation from the indoor unit remote controller.
Ventilation mode is fixed to Automatic mode.

(1) One Lossnay unit can be interlocked with up to 16 indoor units.

(2) Perform interlock settings at the system controller or local remote controller of City Multi indoor unit.

(3) The Lossnay remote controller (PZ-61DR-E, PZ-43SMF-E) can be used.

(4) It is not possible to be interlocked together with Mr. Slim or external device.

(5) When interlocking City Multi indoor unit and Lossnay,
• Perform interlock wiring from the main indoor unit (smallest address number unit) in the group.
• Connect the terminal block (TM4①②) of each Lossnay unit.

(6) Following interlock mode are NOT available.(Refer to page C-23)
• ON interlock (DIP-SW5-7 ON, DIP-SW5-8 OFF)
• OFF interlock (DIP-SW5-7 OFF, DIP-SW5-8 ON)

3.1.4 Interlocking with Mr. Slim (Refer to page C-11)

When Lossnay is connected to Mr. Slim with Slim-Lossnay connection cable (enclosed accessory parts with Lossnay unit), it is possible to switch Lossnay “ON/OFF ” and “High/Low” operation from the indoor unit remote controller.
Ventilation mode is fixed to Automatic mode.
(1) One Lossnay can be interlocked with an indoor unit of air conditioner, but cannot be interlocked with multiple indoor units .
(2) The Lossnay remote controller (PZ-61DR-E, PZ-43SMF-E) cannot be used on systems interlocked with Mr. Slim.
(3) Use malfunction monitor output (TM3⑧⑩) to notice Lossnay error.
(4) It is not possible to be interlocked together with City Multi or external device.
(5) It is not possible to stop Lossnay unit during Mr. Slim operation.

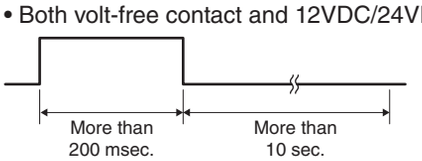
3.1.5 Interlocking with indoor unit of air conditioner or other external device including other manufacturers (Refer to page C-11, C-19)

It is possible to control Lossnay unit ON/OFF by the signal to the terminal block TM2 from the external device interlocked with Lossnay.

(1) When volt-free contact is used. (Refer to page C-19)
- Securely connect signal cable to the input terminal block (TM2 ① ③).
- The units start operation when contact is closed.
- More than 10 sec. is necessary to turn Lossnay ON and OFF.
- The total length of transmission cables should be no longer than 500 m.
- When using relay contact, contact rating must be more than 15 VDC/0.1 A, and minimum application load must be less than 1 mA.
- If an photocoupler or any other type of polar coupler is used at the volt-free contact, connect the live side to TM2 ③ and the neutral side to TM2 ①.

(2) When 12VDC/24VDC level input is used. (Refer to page C-19)
- Securely connect signal cable to the input terminal block (TM2 ① ②). (No polarity)
- The unit starts operation when 12VDC or 24VDC input is received.
- More than 10 sec. is necessary to turn Lossnay ON and OFF.
- Follow the operation manual for the external equipment about overall connection extension length of signal cable.
- Use external device which has input voltage 12VDC or 24VDC and output current more than 0.1A.

(3) When pulse input is used. (Refer to page C-20)
- Turn the [DIP-SW2-2] to ON. When using PZ-61DR-E, it can be set also from the remote controller.
- ON/OFF is inverted each time the pulse signal is input.
- A pulse width of at least 200 msec is needed to turn Lossnay ON or OFF, and 10 sec. absence is necessary to next input.
- External device priority interlock mode and delay operation are not available.
- Both volt-free contact and 12VDC/24VDC input are available.



(4) Controlling a Lossnay group from the external device.
- Be sure to input the signal to main unit in the group. Refer to page C-9
- Connect the terminal block (TM4①②) of each Lossnay unit.

(5) Use signal cable 0.5mm^2 to 1.5mm^2 wire diameter.
(6) Local remote controller can be used.
(7) When not connected to MELANS and not using local remote controller, use monitor output (TM3⑧⑩) to notice Lossnay error.
(8) Cannot be interlocked together with City Multi or Mr. Slim.

3.1.6 Connecting to MITSUBISHI ELECTRIC's Air-conditioner Network System (MELANS)

Lossnay can be used with MELANS. Multiple Lossnay units and groups can be operated by centralized controller.
(1) Perform group setting from system controller. Refer to “System controller manual”.
(2) The Lossnay unit which has smallest address in a group is the main unit. Set the address number of each Lossnay sub unit in the sequential number from the main unit address number.
(3) Local remote controller can be used.
(4) When interlocking with Mr. Slim, install M-NET connection adapter (PAC -SF83MA-E etc.) to outdoor unit in order to connect Mr. Slim to MELANS.
(5) Securely connect the M-NET transmission cables to TB5 [A],[B] (No-Polar).
Adequate transmission cable

Wire type	2 core shielded wire CVVS / CPEVS
Wire diameter	1.25mm^2 to 2.0mm^2
Max total length	500m
Max length between Lossnay and power supply unit or outdoor unit	200m

3.1.7 Main unit setting

When multiple Lossnay units are in one group, main unit setting is needed depending on system configuration or intended end-usage. Main unit exist only one in a group, and it communicates with MELANS, City Multi and external devices.
There are two ways to set main unit, (1) Address setting and (2) DIP-SW setting. If both (1) and (2) are needed, make sure to set the same Lossnay as main unit by both setting.

Check the necessary settings in following chart.

System configuration / Intended end-usage	Main unit settings of multiple Lossnay units
When Lossnay unit make an error, its address number will be displayed on Lossnay remote controller *1	" (1) Address setting" is necessary. Make any unit as main unit.
Connection to M-NET	
Interlocking with indoor unit of non-Mitsubishi air conditioner or other external device *1	" (2) DIP-SW setting" is necessary. Set the Lossnay unit connected signal input as main unit.
Use the remote/local switching and the ON/OFF input (CN32) *1	
Make the same operation to the Lossnay units in the group by the following signal input *1*2*3 • Fan speed switching externally by volt-free contact (CN17) • Fan speed switching externally by 0-10VDC input (CN26) • Bypass switching externally by volt-free contact (CN26)	
None of the above	Main unit setting is not necessary.

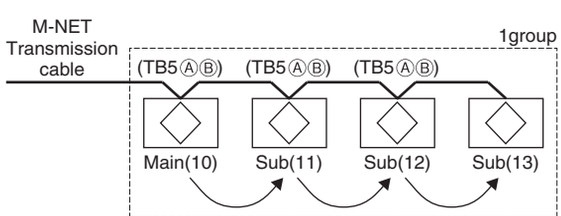
*1 Connect the terminal block (TM4①②) of each Lossnay unit in the group. Refer to page C-3
*2 PZ-61DR-E is necessary.
*3 When performing a signal input to each Lossnay unit in the group, (2)DIP-SW setting is not necessary.

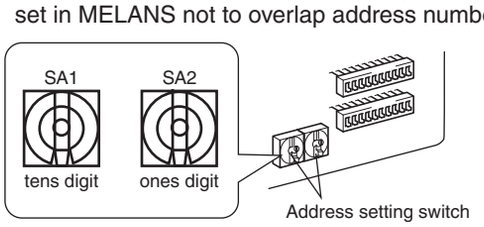
<Caution>
- When there is only one Lossnay unit, main unit setting is not necessary.
- Be sure to set only one unit as main in a group.
- If there is no external input signal, main unit setting is not necessary even if the group includes multiple Lossnay units.
- When using in M-NET (with address setting), Lossnay unit which has the smallest address number is recognized as main unit. In this case, main unit setting is not necessary.

(1) Address setting

Address is identification number set to each unit of Lossnay, indoor unit, outdoor unit, ME remote controller and system controller in MELANS. Set address number not to overlap in a system (connected with M-NET transmission cable).

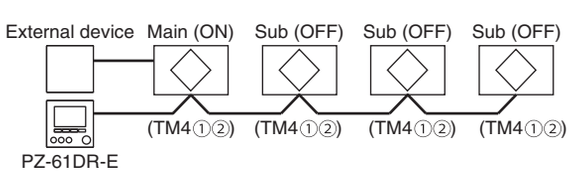
- Main unit
  Set main unit address number within the range of "01" to "50" .
  Be sure to set any address number in MELANS not to overlap.
- Sub unit (Except main unit)
  Address number is set in the sequential number from the main unit address number (see the example on the right). Be sure to set in MELANS not to overlap address number.





(2) DIP-SW setting

DIP-SW		Main / Sub
SW No.	Setting	
SW5-10	OFF (Factory setting)	Sub unit
	ON	Main unit

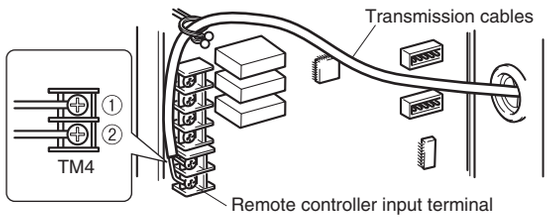


Connect the input terminal block (TM4①②) of each Lossnay units.

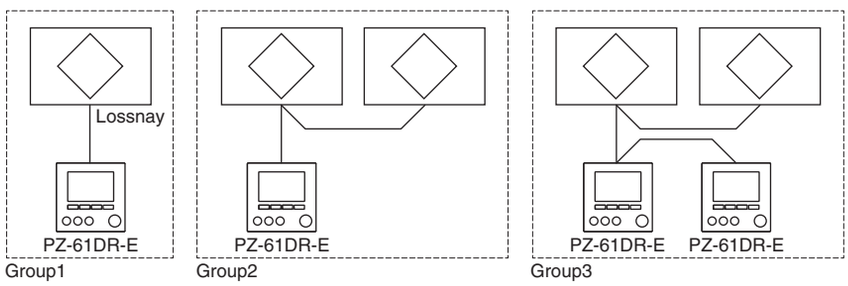
3.2 Basic System

3.2.1 Connecting with remote controller

Securely connect the transmission cable from the remote controller to the terminal block (TM4 ①②).

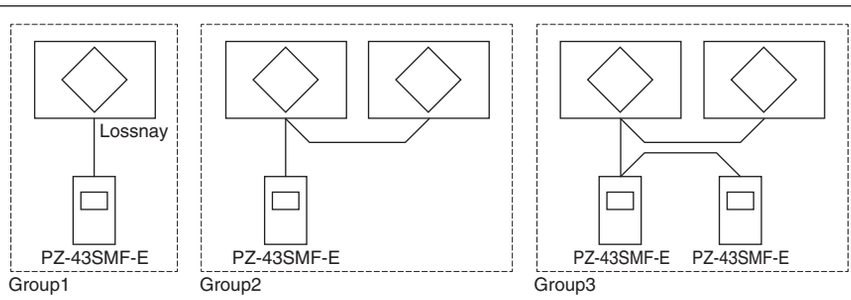


(1) Connecting with PZ-61DR-E



Group	Feature
Group1	One Lossnay unit and one Lossnay remote controller.
Group2	Multiple Lossnay units and one Lossnay remote controller. • Up to 15 Lossnay units can be controlled in a group. • The main unit setting on the Lossnay is not necessary.
Group3	Multiple Lossnay units and two Lossnay remote controllers. • Up to 15 Lossnay units can be connected in a group. • Maximum 2 remote controllers can be used. • 2 of the remote controllers must be the same model. • Set one remote controller as the main and the other as the sub. • The remote controller gives priority to the last touch. • The main unit setting on the Lossnay is not necessary.

(2) Connecting with PZ-43SMF-E



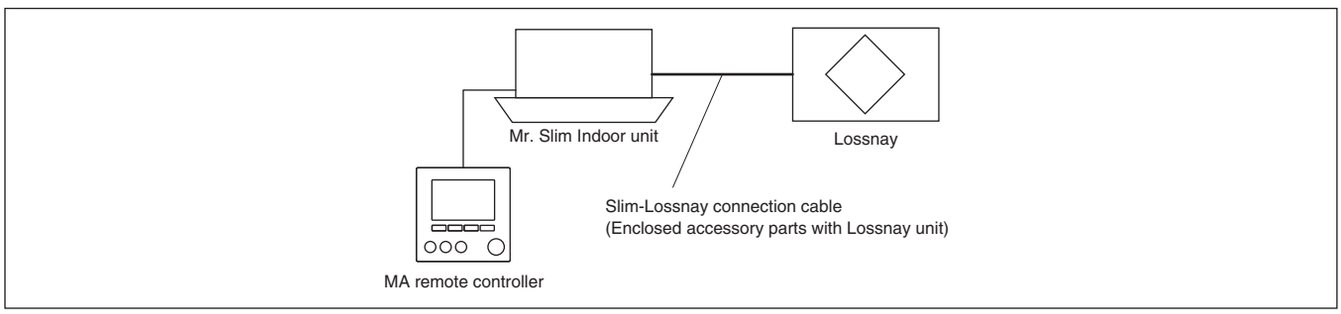
Group	Feature
Group1	One Lossnay unit and one Lossnay remote controller.
Group2	Multiple Lossnay units and one Lossnay remote controller. • Up to 15 Lossnay units can be controlled in a group. • The main unit setting on the Lossnay is not necessary.
Group3	Multiple Lossnay units and two Lossnay remote controllers. • Up to 15 Lossnay units can be connected in a group. • Maximum 2 remote controllers can be used. • 2 of the remote controllers must be the same model. • The remote controller gives priority to the last touch. • The main unit setting on the Lossnay is not necessary.

<CAUTION>

- When it is interlocked with an external device (TM2, CN17, CN26, CN32), turn ON the setting switch (DIP-SW5-10) of the main Lossnay to which the external signal is input.
- See 3.1.1 (page C-7) for the other cautions.

3.3 Interlocking with Mr. Slim

3.3.1 Connecting with Slim-Lossnay connection cable



<Feature>

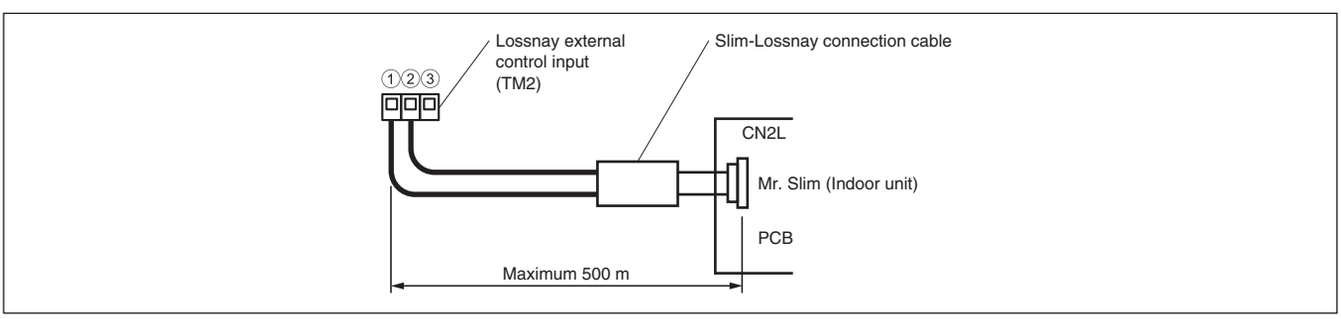
- It is possible to control both of Mr. Slim and Lossnay unit with MA remote controller.
- It is possible to use MA remote controller of the Mr. Slim for switching Lossnay ON/OFF or the fan speed.
- If Lossnay supply duct is connected to Mr. Slim indoor unit, supply fan of Lossnay unit will stop during defrosting of the indoor unit.

<Caution>

- The Lossnay remote controller (PZ-61DR-E) cannot be used with this system.
- The ventilation mode is fixed to "automatic mode".
- When indoor unit is operating, it is not possible to stop the Lossnay unit independently.
- It is not possible to interlock with multiple Mr. Slim indoor units.
- It is necessary to take malfunction monitor output by connection to TM3⑧⑩. (Refer to page C-51)
- See 3.1.4 (page C-8) for the other cautions.

< Wiring >

- Connect CN2L on the PCB of Mr. Slim indoor unit to TM2①② of Lossnay PCB.
- The Slim-Lossnay connection cable is 100 mm long. Extend it to fit the configuration. (Maximum 500m)
  Ensure that all connections are secure and that the appropriate insulation is provided.
  Use extension cable sheathed PVC cable or cable 0.5 mm^2 to 0.75 mm^2.
  Always separate the power supply cable and the Slim-Lossnay connection cable by 5 cm or more to prevent the unit from malfunction.

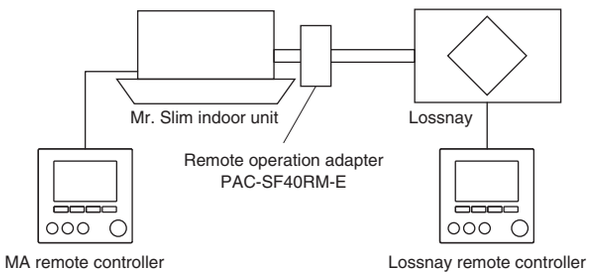


<Operation>

(1) Interlocking operation
- Lossnay unit turns ON at the same time when Mr. Slim starts operation.
- Switching High/Low fan speed is possible.
  "High" is fan speed 4 and "Low" is fan speed 2 at the factory setting. They can be changed. (Refer to page C-40)

(2) Individual operation
[When using MA remote controller PAR-31MAA]
- Select "Vane, Louver, Vent.(Lossnay)" from the main menu, and press the SELECT button.
- Press F3 button to go through ventilation setting options in order of "High", "Low" and "Off".

3.3.2 Connecting with a-control remote operation adapter PAC-SF40RM-E



<Feature>

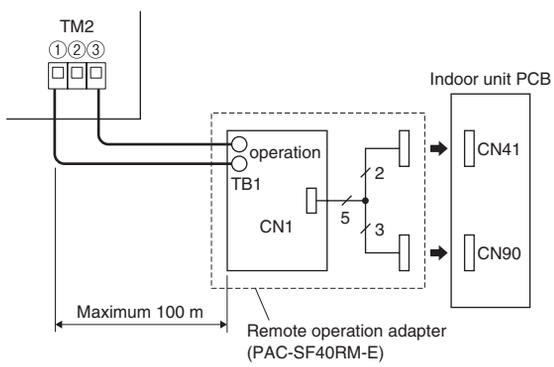
- Lossnay operation can be interlocked with Mr. Slim operation.
- Lossnay can be interlocked with multiple Mr. Slim units.
- This system is similar control to level signal input of volt-free contact. Refer to page C-19

<Caution>

- Ventilation fan speed selection button cannot be used on MA remote controller (Air conditioner remote controller).
- Lossnay cannot operate independently from MA remote controller (Air conditioner remote controller). (Possible from Lossnay remote controller.)
- If Lossnay unit operates during Mr. Slim stop operation, in the case that Lossnay supply air duct is connected to Mr. Slim indoor unit (outside air intake), Lossnay unit cannot supply the air into the room properly because the fan of Mr. Slim does not work.
- Cannot switch ventilation mode automatically in accordance with the operation mode of Mr. Slim.

<Wiring>

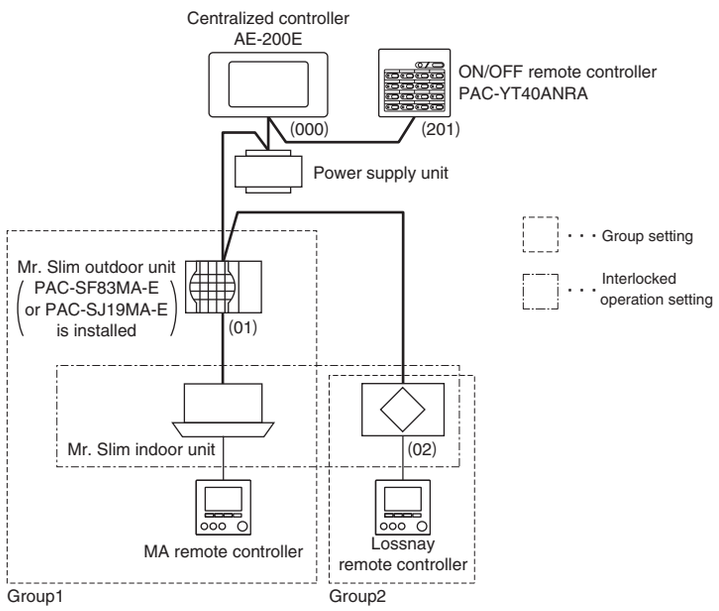
- Connect remote operation adapter connector side to CN41, CN90 on the PCB of the Mr. Slim indoor unit, then connect the lead wire side to the TM2①③ of Lossnay PCB. (No polarity)
- Keep the overall length of the transmission cable between Lossnay and the remote operation adapter within 100 m. Use transmission cable 0.5 mm^2 to 1.25 mm^2 sheathed PVC cable. Always separate the power supply cable and the signal cable by 5 cm or more to prevent the unit from malfunction.



<Operation>

- Lossnay unit turns ON at the same time when Mr. Slim starts operation.
- The fan speed is fixed to “fan speed 4” and ventilation mode is fixed to “automatic mode. However, if there is a remote controller (PZ-61DR-E or PZ-43SMF-E), the unit will follow the settings from the remote controller.

3.3.3 Connecting with M-NET connection adapter PAC-SF83MA-E



<Feature>

- Lossnay can be turned ON/OFF with Mr. Slim operation.
- Lossnay can be interlocked with multiple Mr. Slim units.
- Possible to use with MELANS as same as page C-14

<Caution>

- If Lossnay unit operates when Mr. Slim is OFF, in the case when Lossnay supply air duct is connected to Mr. Slim indoor unit (outside air intake), Lossnay unit cannot supply the air into the room properly because the fan of Mr. Slim does not work.
- When not using ON/OFF remote controller PAC-YT40ANRA, the power supply unit is not necessary.

<Wiring>

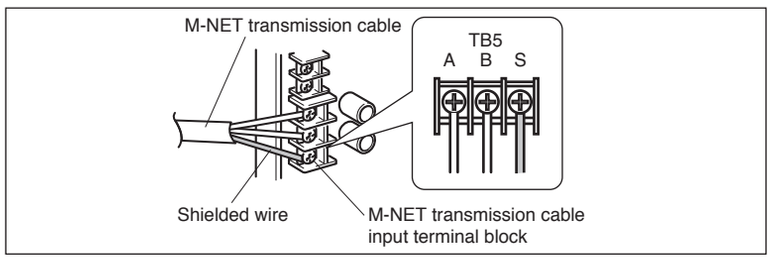
- Connect M-NET transmission cable to TB5 [A], [B] on Lossnay PCB.

<Operation>

(1) Interlock operation
  - Lossnay unit turns ON at the same time when Mr. Slim starts operation.
  - Switching High/Low fan speed is possible.
    "High" is fan speed 4 and "Low" is fan speed 2 at the factory setting. (Refer to page C-40)

(2) Individual operation
  [When using MA remote controller PAR-31MAA]
  - Select "Vane, Louver, Vent.(Lossnay)" from the main menu, and press the SELECT button.
  - Press F3 button to go through ventilation setting options in order of "High", "Low" and "Off".
    It is possible to set the fan speed when receiving "High/Low" signal. (Refer to page C-40)

3.4 M-NET system



3.4.1 Wiring

- Securely connect the M-NET transmission cables to TB5 [A] [B] and shielded wire to TB5 Ⓢ.
  Type: Shielded wire (CVVS/CPEVS)
  Wire diameter: 1.25 mm^2 to 2.0 mm^2
  Maximum torque: 0.5 N·m

3.4.2 Address setting

Address setting is required when connecting to City Multi and MELANS. Refer to page C-9

3.4.3 Lossnay system

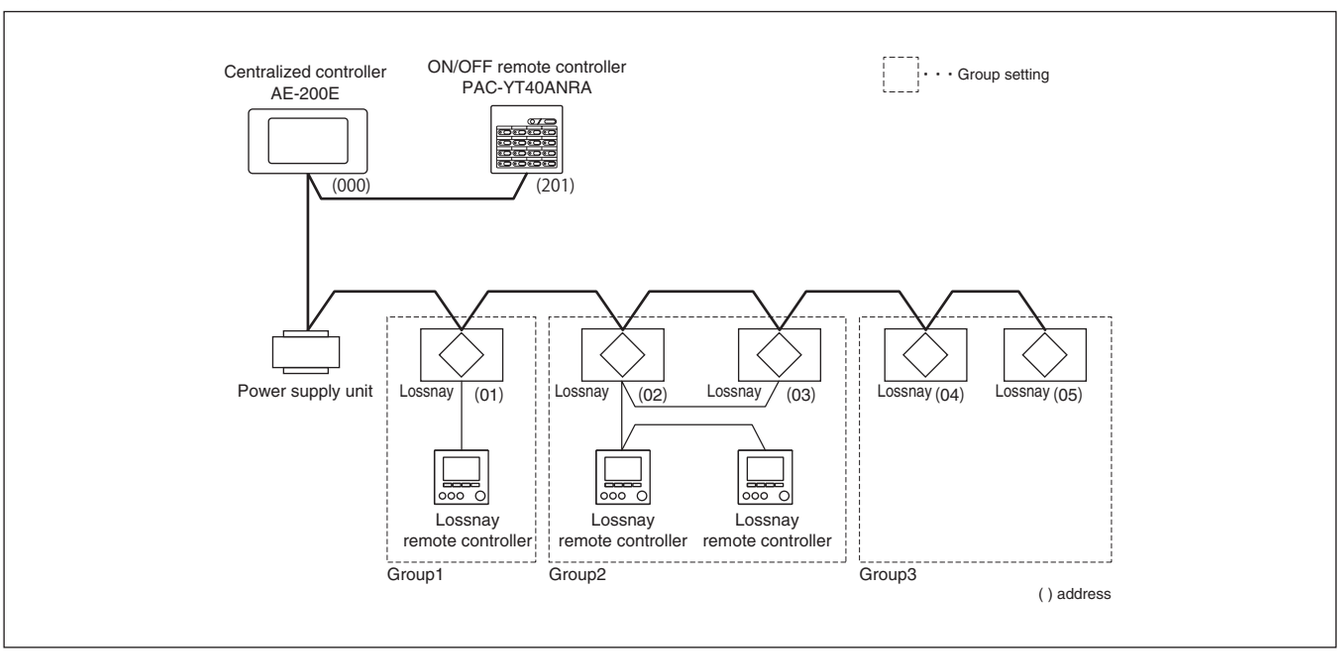
<Feature>

- The MELANS can operate and monitor each group of Lossnay units.
- The Lossnay remote controller can also be used to operate.

<Caution>

- All of Lossnay units require an address.
- When not using ON/OFF remote controller PAC-YT40ANRA, the power supply unit is not necessary.

<System example 1>



Group	Feature
Group1	One Lossnay unit and one Lossnay remote controller. Lossnay unit can be controlled by Lossnay remote controller. All of Lossnay units can be controlled by centralized controller and ON/OFF remote controller, and each group can be controlled individually.
Group2	Multiple Lossnay units and two Lossnay remote controllers. Lossnay can be controlled by Lossnay remote controller. Up to 2 Lossnay remote controllers can be used in a group and they must be the same model. When 2 of PZ-61DR-E are used, one of them must be “sub” setting. For details, refer to the installation manual of PZ-61DR-E. When 2 Lossnay remote controllers are used, the last touch has a priority. All of Lossnay units can be controlled by centralized controller and ON/OFF remote controller, and each group can be controlled individually. Up to 15 Lossnay units can be connected in a group. It is necessary to connect the terminal TM4 ①② of each Lossnay units.
Group3	Multiple Lossnay units without remote controllers. All of Lossnay units can be controlled by centralized controller and ON/OFF remote controller, and each group can be controlled individually. Up to 16 Lossnay units can be connected in a group. It is NOT necessary to connect the terminal TM4 ①② of each Lossnay unit. (It is necessary to connect the terminal TM4 ①② of each Lossnay unit when the Night-purge function is used by a centralized controller.)

3.4.4 City Multi and Lossnay interlocked system

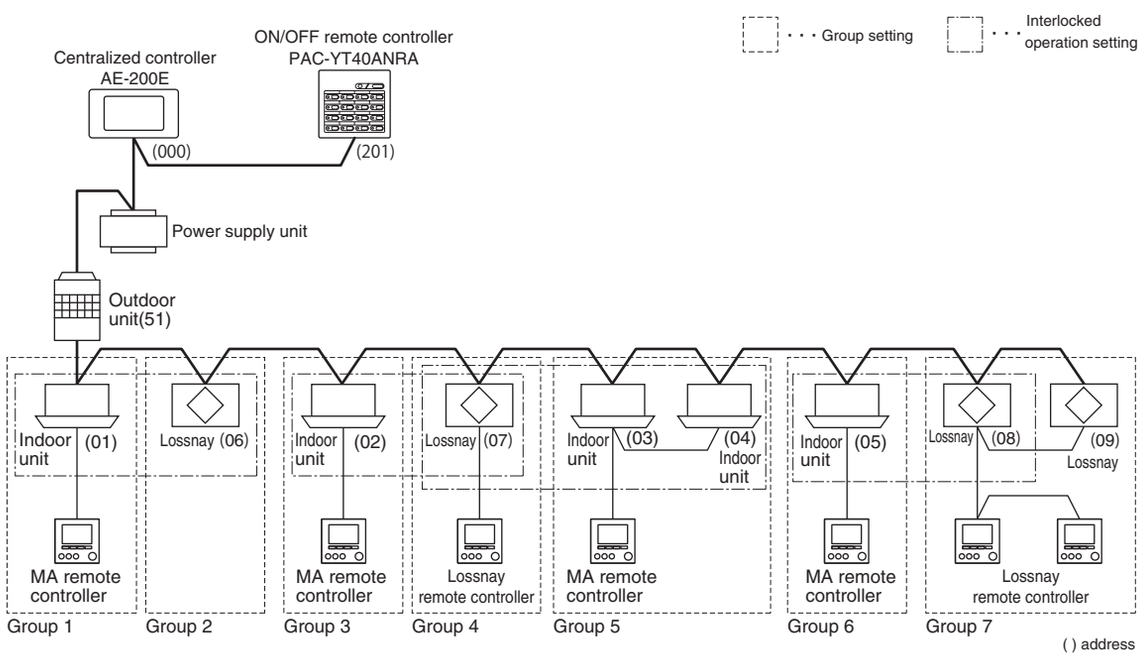
<Feature>

- Lossnay unit operation can be interlocked to City Multi indoor unit.
- ON/OFF and fan speed switching of Lossnay unit can be performed by MA remote controller.
- When Lossnay remote controller is used, the last touch of Lossnay remote controller or MA remote controller has a priority.
- The ventilation mode is automatically selected by the operation mode of City Multi.

<Caution>

- All Lossnay units require an address.
- One Lossnay unit can be interlocked to up to 16 indoor units.
- Indoor unit can NOT be interlocked to 2 or more Lossnay units.
- MA remote controller can switch Lossnay fan speed "High" / "Low".
- When not using ON/OFF remote controller PAC-YT40ANRA, the power supply unit is not necessary.

<System example 2>



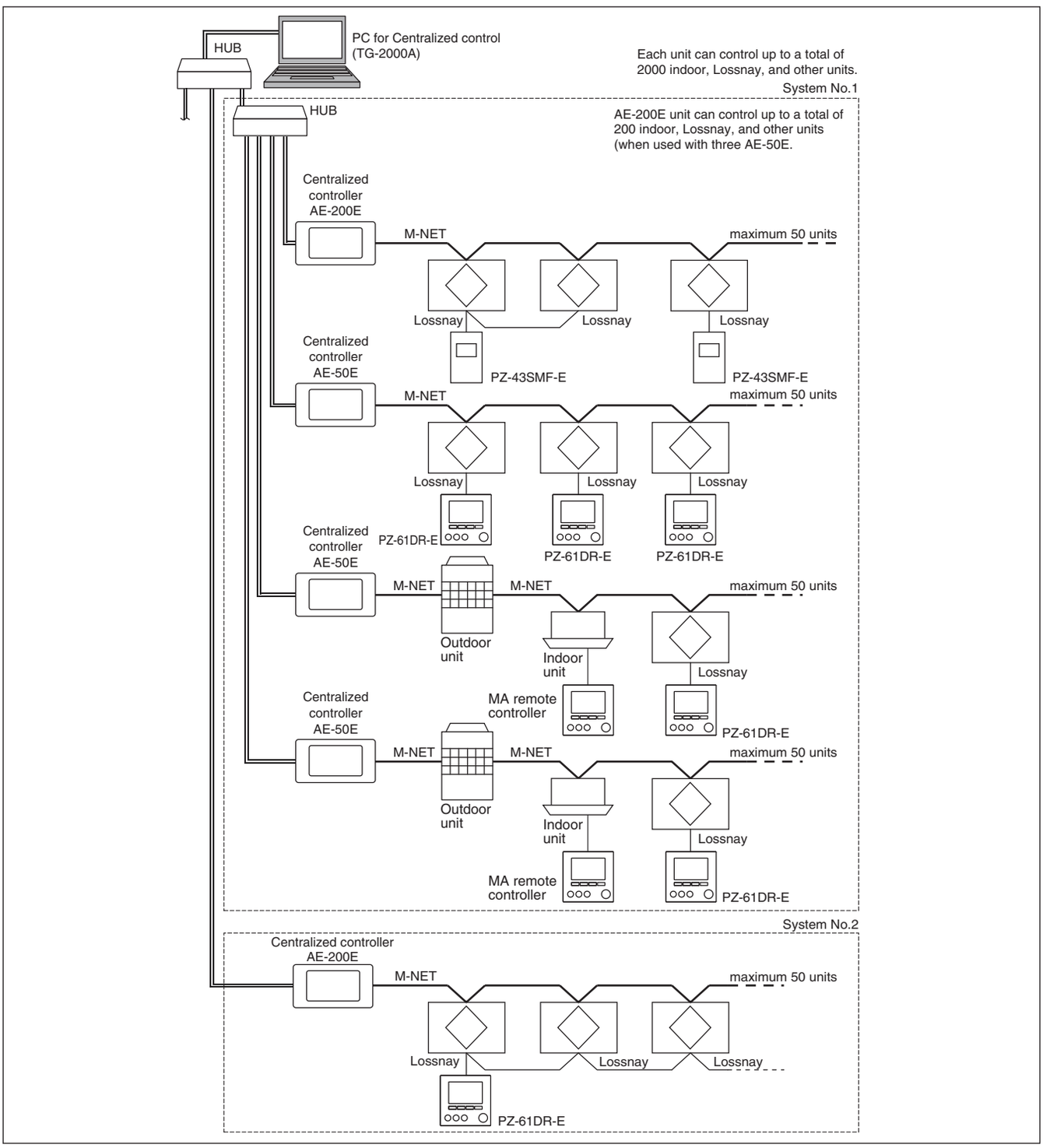
Group	Feature
Group2	One Lossnay unit which are interlocked to indoor unit of group 1. Operation of Lossnay unit can be performed by MA remote controller. All of Lossnay units can be controlled by centralized controller and ON/OFF remote controller, and each group can be controlled individually.
Group4	One Lossnay unit which is interlocked to multiple indoor units. Operation of Lossnay unit can be performed by Lossnay remote controller and 2 MA remote controllers. The last touch of Lossnay remote controller or MA remote controller has a priority. All of Lossnay units can be controlled by centralized controller and ON/OFF remote controller, and each group can be controlled individually. One Lossnay unit can be interlocked to up to 16 indoor units.
Group7	Multiple Lossnay units which are interlocked to indoor unit of group 6. Operation of Lossnay unit can be performed by 2 Lossnay remote controllers and MA remote controller. The last touch of Lossnay remote controller or MA remote controller has a priority. Up to 2 Lossnay remote controllers can be used in a group and they must be the same model. When 2 PZ-61DR-Es are used, one of them must be done “sub” setting. For details, refer to the installation manual of PZ-61DR-E. All of Lossnay units can be controlled by centralized controller and ON/OFF remote controller, and each group can be controlled individually. Up to 15 Lossnay units can be connected in a group. It is necessary to connect the terminal TM4 ①② of each Lossnay units.

3.4.5 System configuration of more than 50 units (Lossnay and indoor units)

<Feature>

- One AE-200E can control maximum 50 units (including Lossnay). Up to 200 units (including Lossnay) can be controlled from one AE-200E connected with three AE-50E.
- The integrated centralized control software TG-2000A can manage maximum 2000 units.
- For details, refer to City Multi technical manual and other manuals.

<System example 3>



Group	Feature
All	All of indoor and Lossnay units can be controlled by the PC for centralized control.
System No. 1	All units of system No.1 can be controlled by centralized controller AE-200E in system No. 1. Each indoor and Lossnay unit can be controlled by each local remote controller.
System No. 2	All units of system No.2 can be controlled by centralized controller AE-200E in system No. 2. Lossnay unit can be controlled by Lossnay remote controller.

3.4.6 Interlocking system with system controller interface MAC-333IF-E

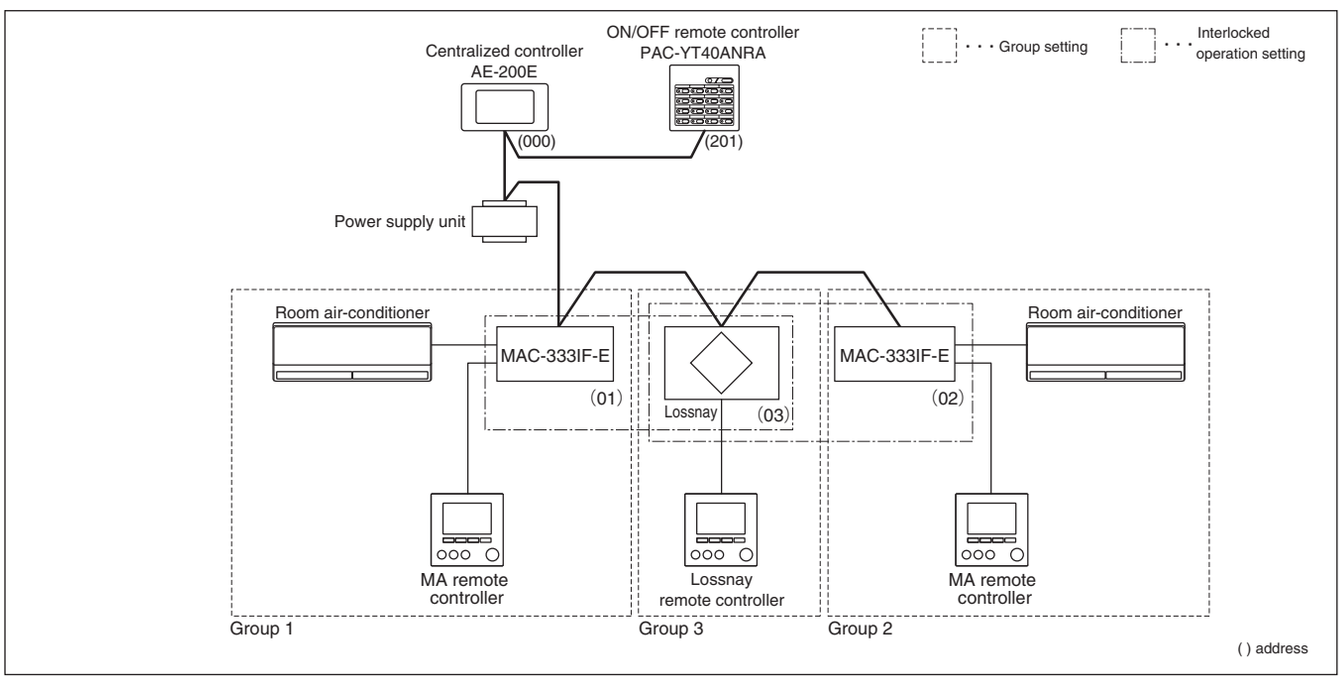
<Feature>

- Lossnay unit operation can be interlocked to RAC (M series) and Mr. Slim (S series) through system controller interface MAC-333IF-E.
- ON/OFF and fan speed switching of Lossnay unit can be performed by MA remote controller.
- When Lossnay remote controller is used, the last touch of Lossnay remote controller or MA remote controller has a priority.

<Caution>

- Select “External priority ON/OFF interlock mode” for interlocking mode otherwise the operation does not work properly. Refer to page C-23.
- One Lossnay unit can be interlocked to up to 16 indoor units.
- Indoor unit can NOT be interlocked to 2 or more Lossnay units.
- MA remote controller can switch Lossnay fan speed “High” / “Low”.
- When not using ON/OFF remote controller PAC-YT40ANRA, the power supply unit is not necessary.

<System example 4>



Group	Feature
Group 3	One Lossnay unit which is interlocked to multiple indoor units. Operation of Lossnay unit can be performed by Lossnay remote controller and 2 MA remote controllers. The last touch of Lossnay remote controller or MA remote controller has a priority. It is possible to control Lossnay unit from PZ-61DR-E when air-conditioner is off. Lossnay unit can be controlled by centralized controller and ON/OFF remote controller. It is impossible to stop Lossnay unit when air-conditioner is operating. One Lossnay unit can be interlocked to up to 16 indoor units.

3.4.7 Automatic-address-start-up function

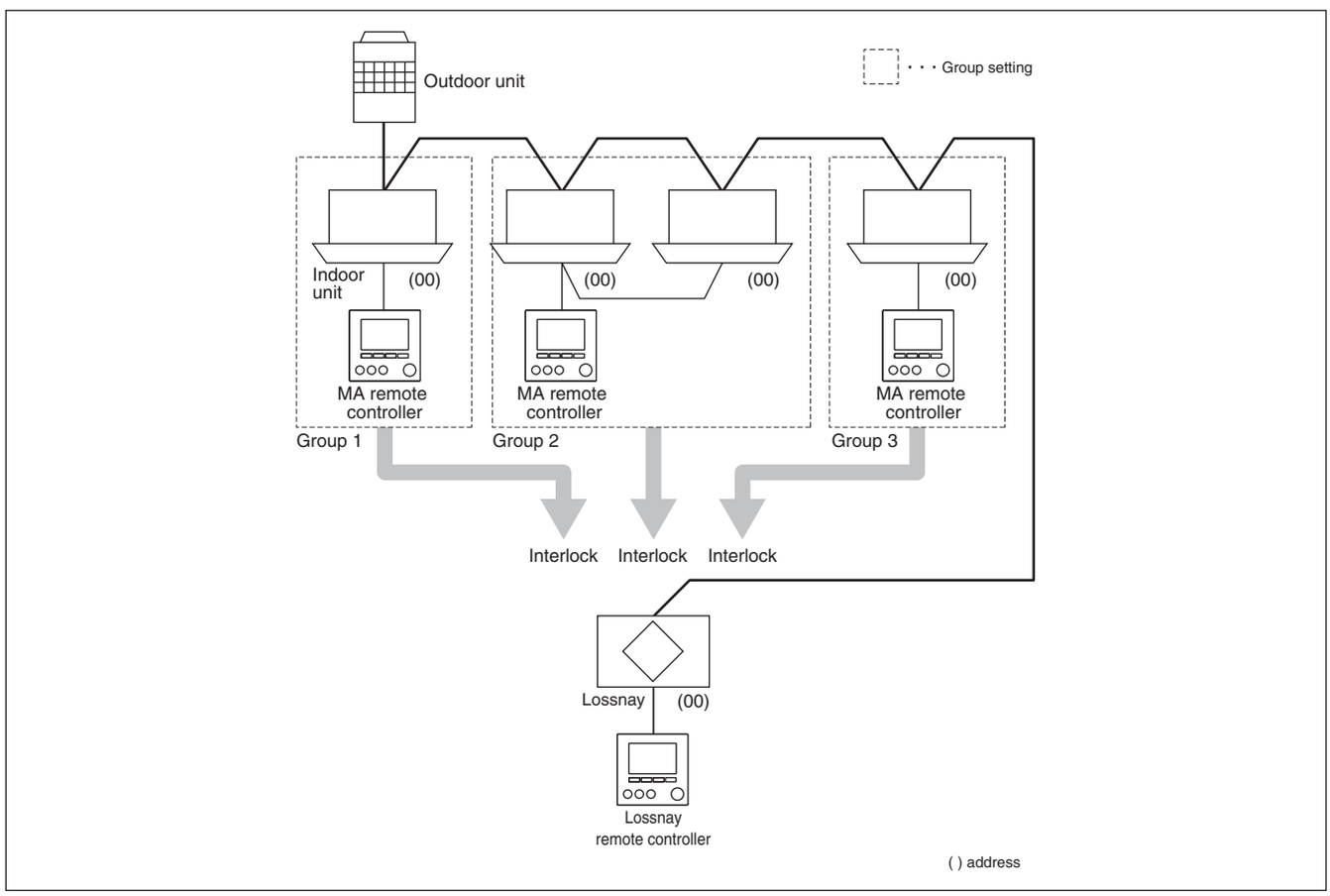
<Feature>

- Under the following conditions, Lossnay can be automatically interlocked to indoor unit without setting the address of Lossnay unit.
  There is indoor unit(s) in a system.
  There is only one Lossnay unit in a system.
  There are NO outdoor-air processing units (GUF series) in a system.

<How to use Automatic-address-start-up function>

- Set the address of Lossnay and indoor units as “00” (factory setting).
- There are some limitations other than above. For details, contact your dealer.

<System example 4>



<Function explanation>

- Lossnay unit is interlocked to all of indoor units.
- One Lossnay unit can be interlocked to up to 16 indoor units.

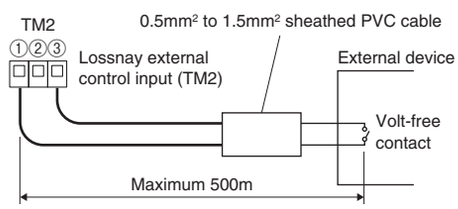
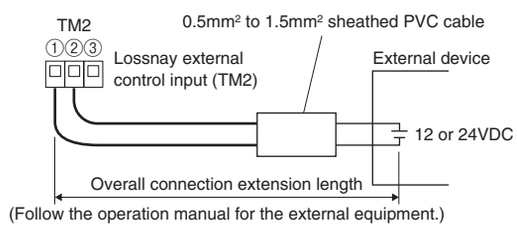
3.5 Interlocked system with an external device

ON/OFF operation of Lossnay unit is possible by the input signal from an air-conditioner, a BMS (Building Management Systems) etc. to the terminal (TM2 ① ~ ③) of Lossnay PCB.
The type of input signal shall be volt-free contact or 12VDC/24VDC. Both level signal and pulse signal are available.

<Caution>
City Multi and Mr. Slim can NOT be interlocked to Lossnay unit together with an external device.

3.5.1 How to use

An external signal should be connected to the terminal (TM2 ① ~ ③) of Lossnay PCB. Maximum wiring length and the exact terminal number depend on the type of signal.

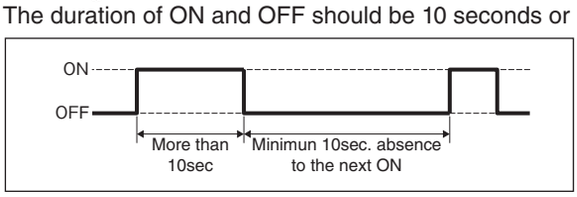
Type of signal	Max wiring length	Terminal
Volt-free contact	500m	 **<Caution>** When use a relay contact, follow the usage conditions below; Rating: 15VDC/0.1A or more Min: 1mA or less When use a signal with polarity, the minus side should be connected to TM2 ①, the plus side should be connected to TM2 ③.
24VDC or 12VDC	See manual of the external device	 **<Caution>** TM2 ①② is a non-polar terminal. The input signal should follow the usage conditions below; Voltage: 24VDC or 12VDC Current: 0.1A or more

(1) Wiring

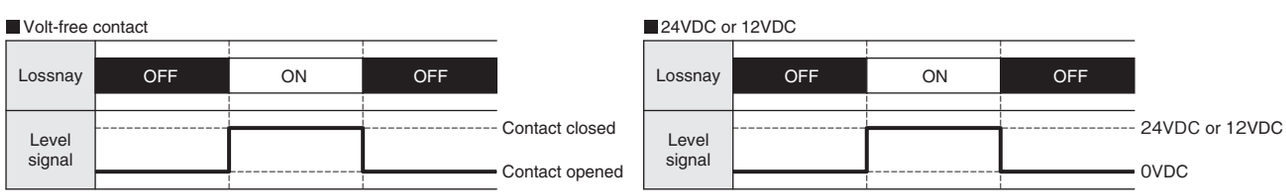
Use 0.5 mm² to 1.5 mm² sheathed PVC cable for wiring.
The signal wire should be away from the power cable and the wires of remote controller more than 5cm.

(2) Level signal

The duration of ON and OFF should be 10 seconds or more.



Type of signal	Lossnay operation
Volt-free contact	When the contact is closed, Lossnay is ON. When it is opened, Lossnay is OFF.
24VDC or 12VDC	When the signal has voltage, Lossnay is ON. When it is 0VDC, Lossnay is OFF.

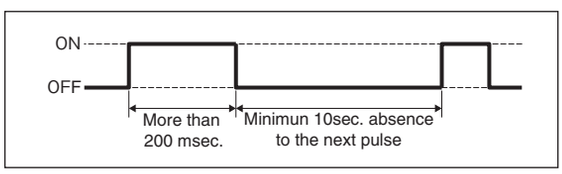


(3) Pulse signal

When using a pulse signal input, set the DIP-SW 2-2 ON or set the function No.28 by PZ-61DR-E. See the table below.

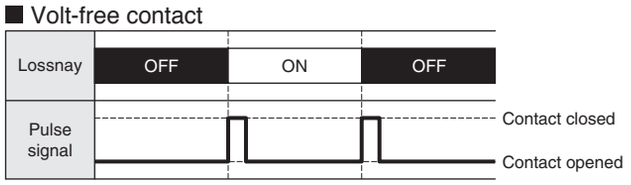
DIP-SW		Setting check	PZ-61DR-E		Setting check	Pulse input setting
SW No.	Setting		Function No.	Setting Data		
SW2-2	-	-	28	0 (Factory setting)		DIP-SW priority
	OFF (Factory setting)			1		NOT pulse input
	ON			2		Pulse input

The duration of ON should be 200 msec. or more and 10 sec. or more absence is necessary to the next pulse .

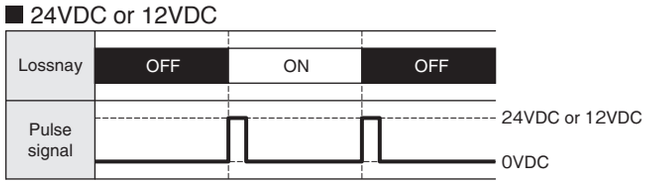


ON/OFF of Lossnay unit is inverted each time a pulse signal is inputted.

■ Volt-free contact



■ 24VDC or 12VDC



<Caution>

In conditions of pulse input is set to ON, following functions are not available.

- Delay start setting (Refer to page C-38)
- "External priority ON/OFF interlock mode" of interlock mode setting (Refer to page C-25)

(4) Group control

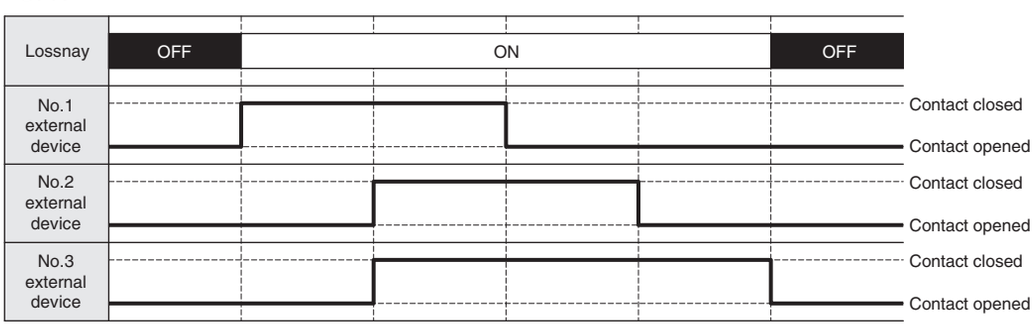
In the case that multiple Lossnay units are controlled by an input signal, follow the connection and setting below.

- Connect the terminal TM4 ①② of each Lossnay units.
- An input signal from the external device must be input to only one “main“ Lossnay unit in a group.
- When Lossnay is in MELANS system, the “main” Lossnay unit should have the smallest address number in a group.

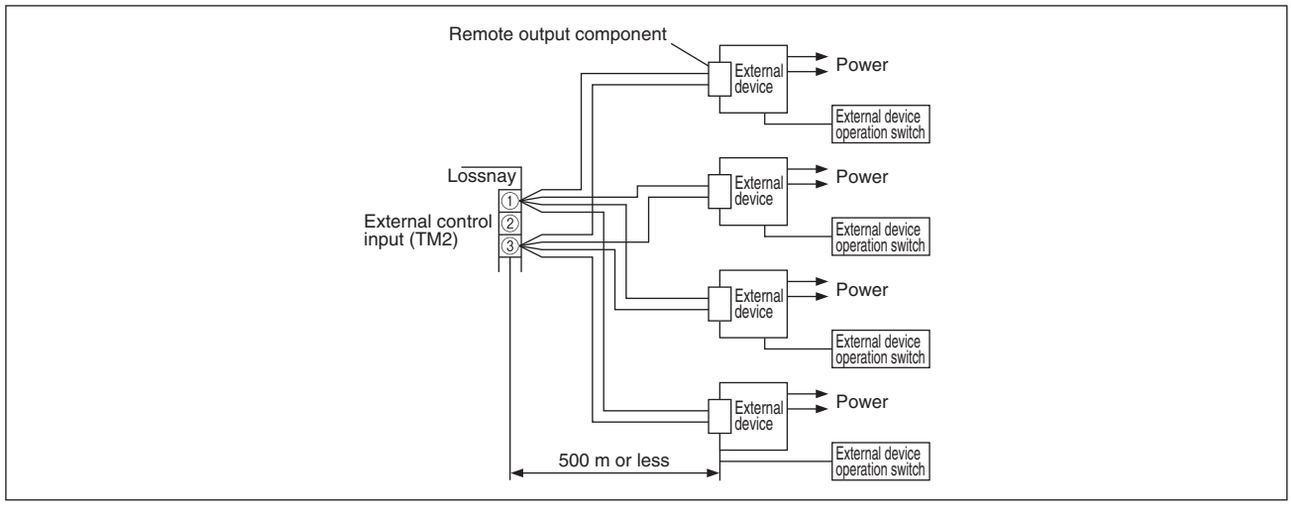
(5) Interlocked to multiple external devices

When the input signal is level signal, one Lossnay unit can be interlocked to multiple external devices.

- Lossnay unit turns ON when at least one external device is ON. Lossnay unit turns OFF when all external devices are OFF.



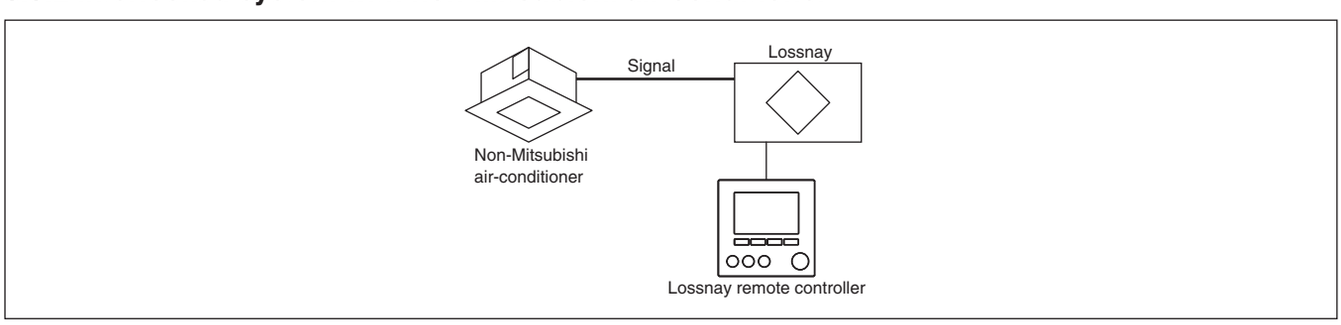
• When volt-free contact is used, make wiring as the picture below.



(6) Operation monitor output (Refer to page C-52)
The ON/OFF status of Lossnay can be checked by the operation monitor output.
When Lossnay unit is ON, the relay X15 of PCB (TM3 ⑨⑩) is closed.
The operation monitor output follows the external input signal with maximum 200 msec delay.

(7) Malfunction monitor output (Refer to page C-51)
When Lossnay unit is not connected to MELANS or Lossnay remote controller, the error monitor output function should be used to know the malfunction of Lossnay unit.
When Lossnay unit has an error, the relay X14 of PCB (TM3 ⑧⑩) is closed.

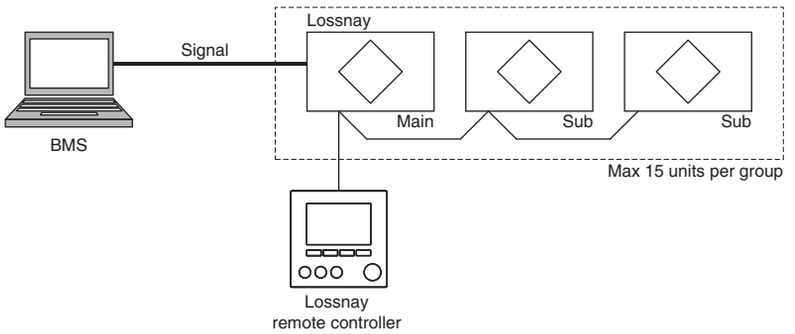
3.5.2 Interlocked system with non-Mitsubishi air-conditioner



<Feature>
• Lossnay unit turns ON/OFF by a signal from an air-conditioner.
• Lossnay unit can be controlled, ON/OFF and fan speed switching, by Lossnay remote controller individually.
• When an error occurs, the error number will appear on Lossnay remote controller.

<Caution>
• When Lossnay remote controller is NOT connected, the fan speed is fixed at 4, the ventilation mode is fixed at automatic mode. Use malfunction monitor output function to notice Lossnay error.

3.5.3 Interlocked system with BMS (Building Management Systems)



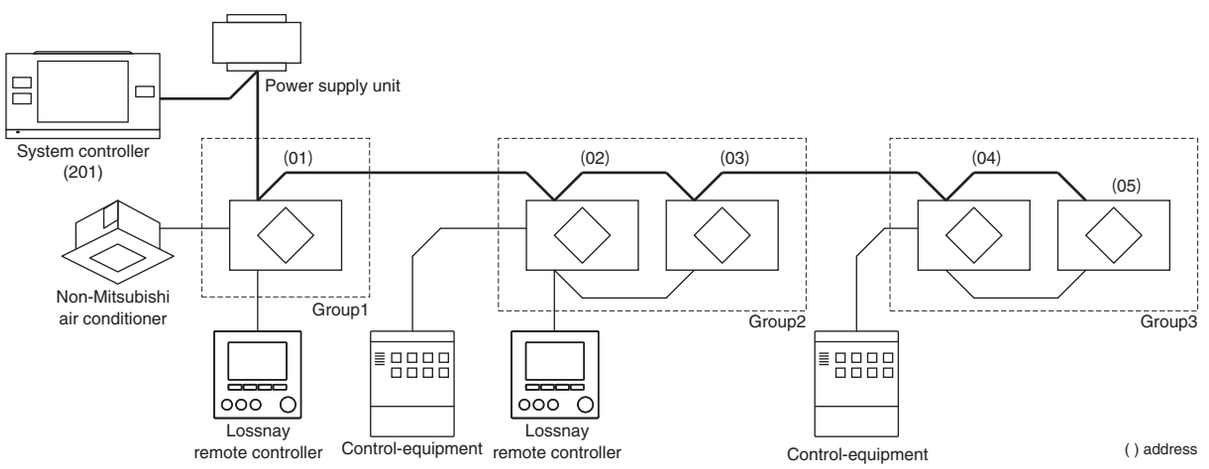
<Feature>

- Lossnay unit turns ON/OFF by a signal from BMS, also fan speed switching is available by analogue 0-10VDC input. For details, refer to page C-54.
- Lossnay unit can be controlled, ON/OFF and fan speed switching, by Lossnay remote controller individually.
- When an error occurs, the error number will appear on Lossnay remote controller.

<Caution>

- When Lossnay remote controller is NOT connected, the fan speed is fixed at 4, the ventilation mode is fixed at automatic mode. Use malfunction monitor output function to notice Lossnay error.

3.5.4 Combination system of MELANS and external devices



Group	Feature
Group1	MELANS control Lossnay unit. Lossnay unit is interlocked with non-Mitsubishi air-conditioner. Lossnay unit turns ON/OFF by a signal from the air-conditioner. Lossnay unit can be controlled, ON/OFF or fan speed switching, by Lossnay remote controller or system controller individually. When an error occurs, the error number will appear on Lossnay remote controller and system controller.
Group2	MELANS control Lossnay unit. Lossnay unit is interlocked to a control-equipment. Lossnay unit turns ON/OFF by a signal from a control-equipment. Lossnay unit can be controlled, ON/OFF or fan speed switching, by Lossnay remote controller or system controller individually. When an error occurs, the error number will appear on Lossnay remote controller and system controller.
Group3	MELANS control Lossnay unit. Lossnay unit is interlocked to a control-equipment. Group 3 is an example as same as group 2 other than Lossnay remote controller. Lossnay unit turns ON/OFF by a signal from a control-equipment. Lossnay unit can be controlled, ON/OFF or fan speed switching, by system controller individually. When an error occurs, the error number will appear on system controller.

3.5.5 Interlock mode setting (External control operating mode)

There are four operation modes of interlocked system from external devices.
a: ON/OFF interlock mode (Factory setting)
b: ON interlock mode
c: OFF interlock mode
d: External priority ON/OFF interlock mode

<How to select the mode>

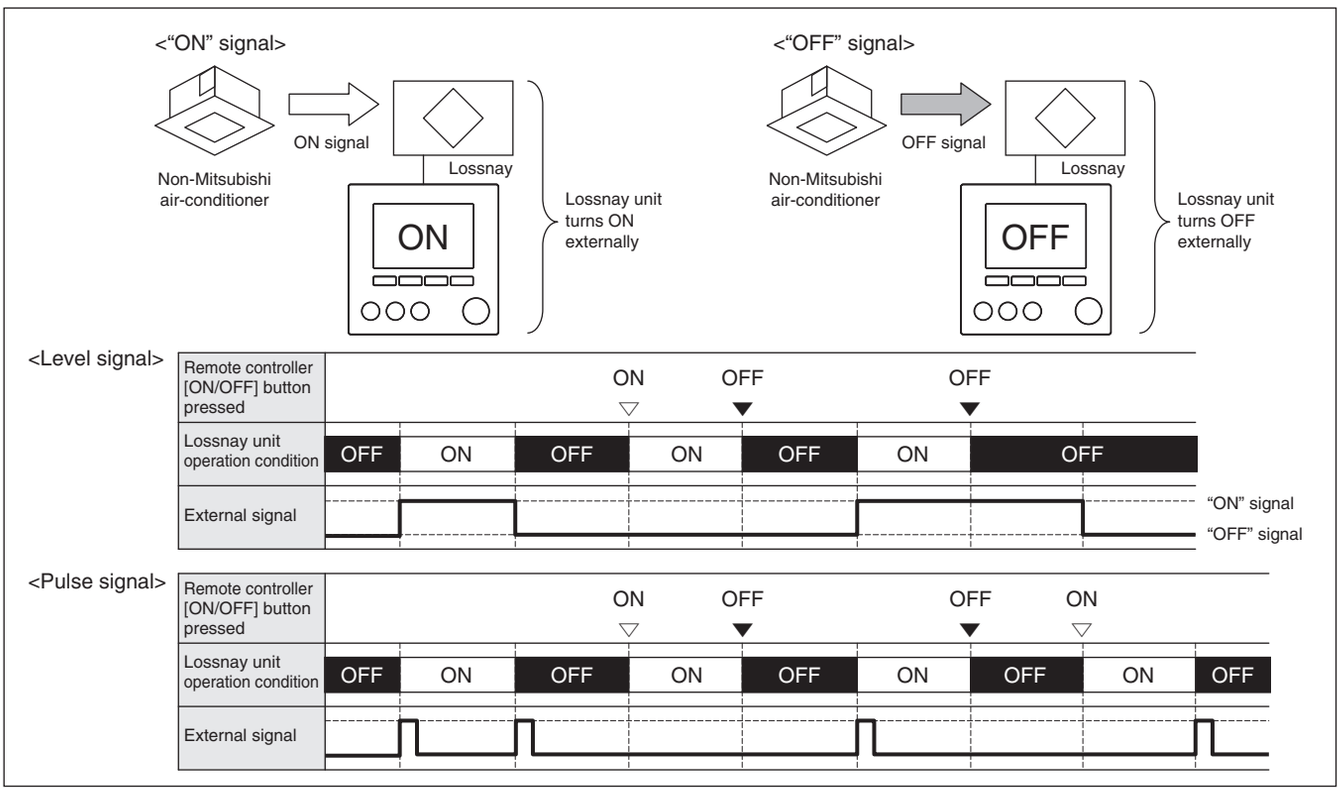
Set the DIP-SW 5-7 and 5-8 or function setting of PZ-61DR-E as the table below.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Interlock setting
SW No.	Setting		Function No.	Setting Data		
SW5-7 SW5-8	-	-	15	0 (Factory setting)		DIP-SW priority
	5-7 OFF 5-8 OFF (Factory setting)			1		a) ON/OFF interlock mode
	5-7 ON 5-8 OFF			2		b) ON interlock mode
	5-7 OFF 5-8 ON			3		c) OFF interlock mode
	5-7 ON 5-8 ON			4		d) External priority ON/OFF interlock mode

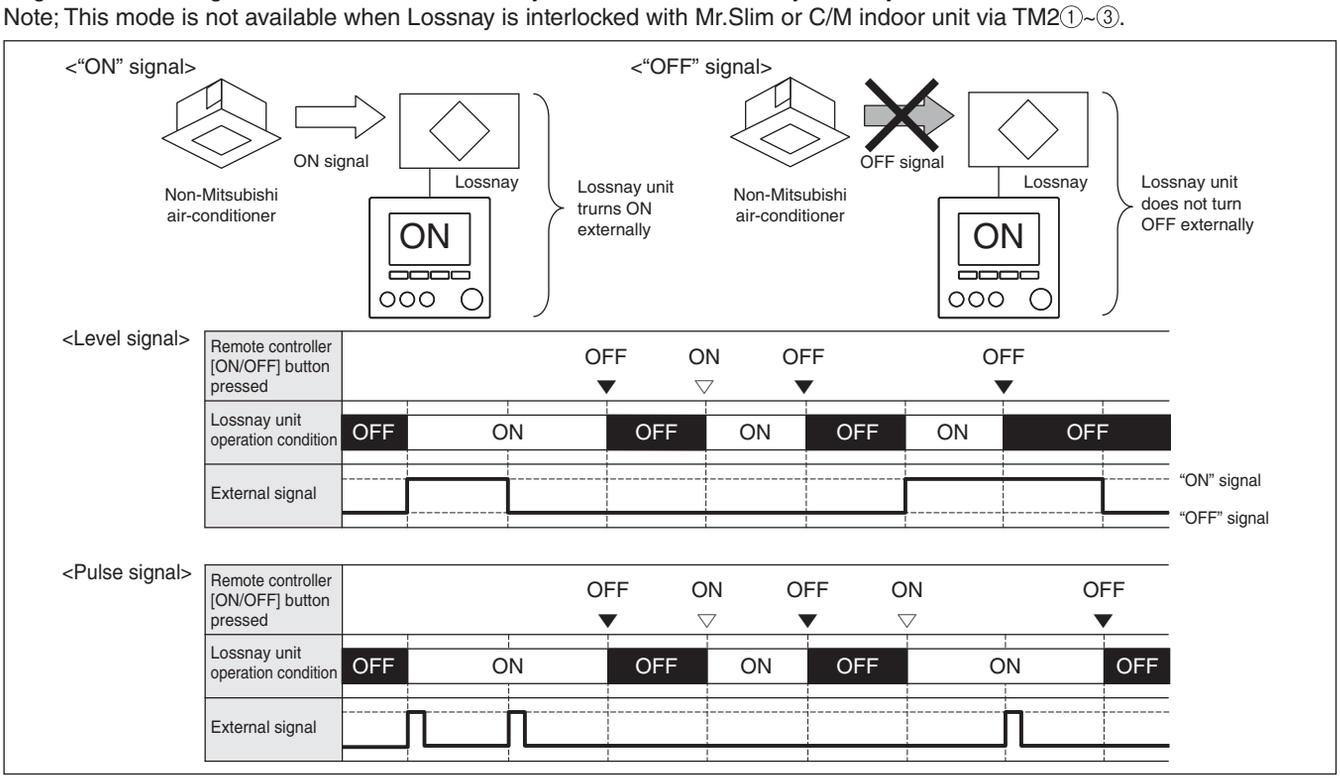
<Caution>

- DO NOT set "d) External priority ON/OFF interlock mode", when "pulse signal input setting" is ON by the DIP-SW 2-2 or the function setting No.28 by PZ-61DR-E.
- When interlocked with MITSUBISHI A/C, "a) ON/OFF interlock mode" and "d) External priority ON/OFF interlock mode" are available. Do NOT set to other mode.
- In the case that PZ-61DR-E is used,
  - "LINK" icon appears on the display when both the Lossnay and external device are operating.
  - When "d) External priority ON/OFF interlock mode" is selected, "INTERLOCKED" is displayed for 3 seconds and ON/OFF button is invalid when both the Lossnay and external device is operating.
- In the case that PZ-43SMF-E is used,
  - "INTERLOCKED" is displayed when both the Lossnay and external device are operating.
  - When "d) External priority ON/OFF interlock mode" is selected, "CENTRAL" is also displayed and ON/OFF button is invalid when both the Lossnay and external device is operating.
- In the case that system controller is used
  - No special indicator on the display.
  - When "d) External priority ON/OFF interlock mode" is selected, ON/OFF button is invalid when both the Lossnay and external device is operating. (The display changes to OFF when pressing ON/OFF button, but it returns soon.)

a) ON/OFF interlock mode (Factory setting)
Lossnay unit turns ON externally.
Lossnay unit turns OFF externally.
Regardless of the signal of external device, Lossnay unit can be controlled by Lossnay remote controller and MELANS controller.

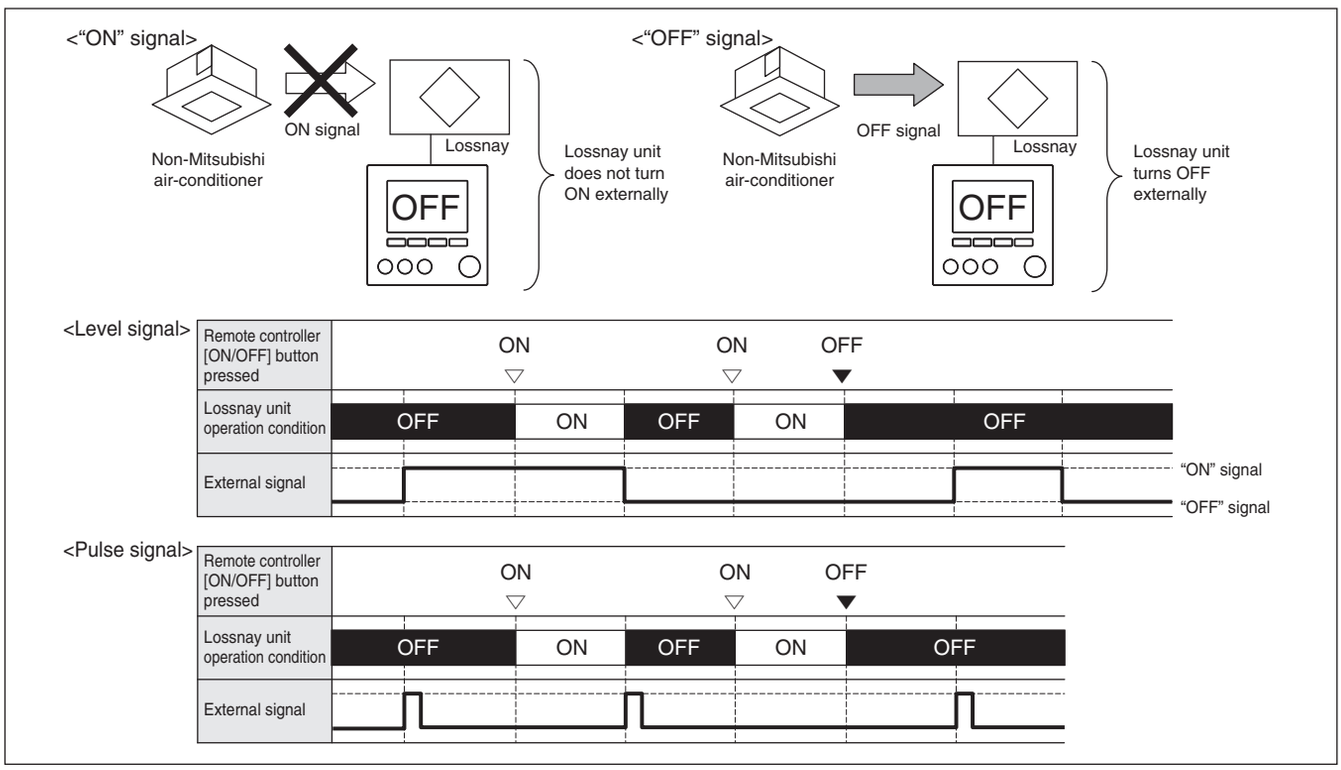


b) ON interlock mode
Lossnay unit turns ON externally.
Lossnay unit does not turn OFF externally.
Regardless of the signal of external device, Lossnay unit can be controlled by Lossnay remote controller and MELANS controller.
Note; This mode is not available when Lossnay is interlocked with Mr.Slim or C/M indoor unit via TM2①~③.



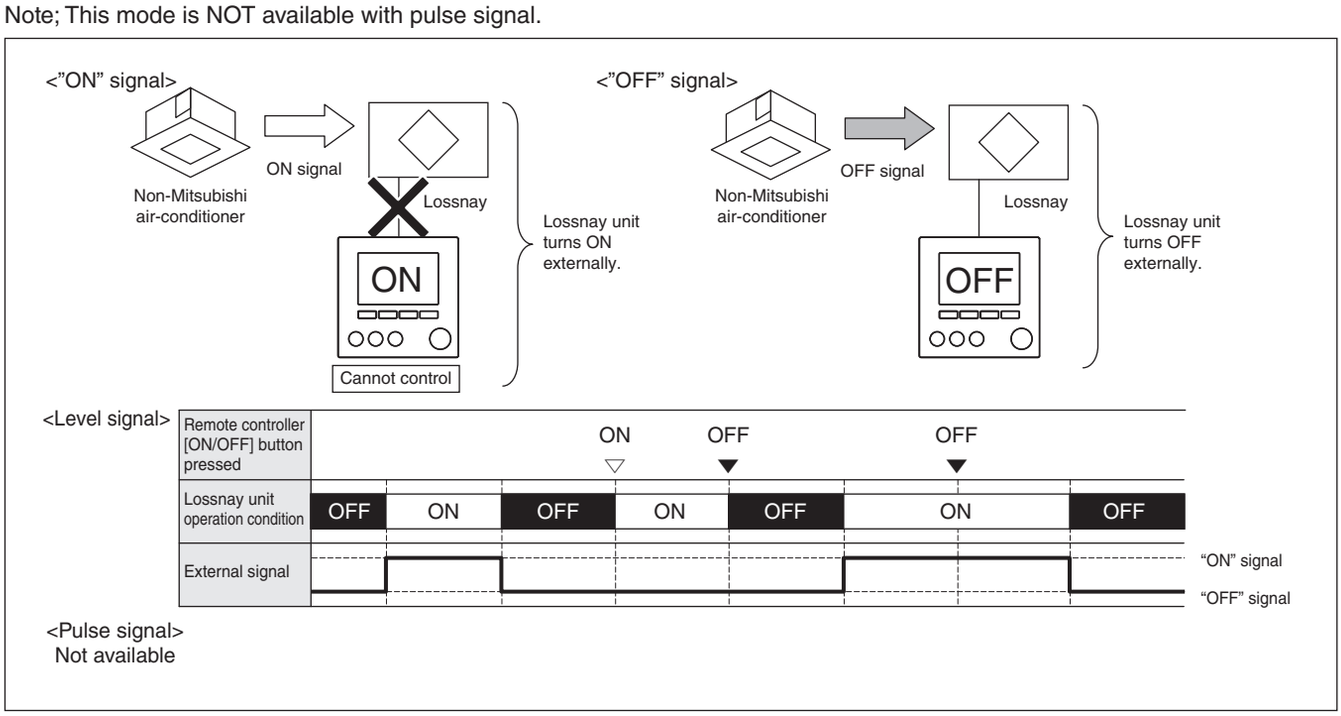
c) OFF interlock mode

Lossnay unit does not turn ON externally.
Lossnay unit turns OFF externally.
Regardless of the signal of external device, Lossnay unit can be controlled by Lossnay remote controller and MELANS controller.
Note; This mode is not available when Lossnay is interlocked with Mr.Slim or C/M indoor unit via TM2①~③.



d) External priority ON/OFF interlock mode

Lossnay unit turns ON externally.
Lossnay unit turns OFF externally.
During Lossnay unit is operating by signal of external device, Lossnay can NOT be turned OFF by Lossnay remote controller or MELANS controller.
Note; This mode is NOT available with pulse signal.



CHAPTER 2

Function

1. Comparison of Lossnay remote controller

LGH-RVX-E series can be connected to 2 types of Lossnay remote controllers.

<Appearance>

Lossnay remote controller	PZ-61DR-E	PZ-43SMF-E
Exterior		
Size	120×120×19mm	120×70×15mm
Color	Munsell 1.0Y9.2/0.2	Munsell 1.0Y9.2/0.2

<Installation>

Remote controller	PZ-61DR-E	PZ-43SMF-E
M-NET address	No need	No need
Main/Sub setting	Necessary when using 2 remote controllers in a group	No need
Lossnay connection	Any Lossnay unit is OK as long as it is in the same group.	
Group change	・Not available from Lossnay RC. Setting from system controller is necessary. ・Also the wiring between Lossnay units and RC should be rechecked and modified.	
Max No. of remote controller in a group	2	2
Features	・Same face with Mitsubishi A/C RC ・Various functions like weekly timer Night-purge, Bypass free setting etc. are available.	・Basic functions like ON/OFF, fan speed switching and ventilation mode selecting are available. ・Small installation space

*It is NOT available to use both PZ-61DR-E and PZ-43SMF-E in a group.

<Function>

Function (Communicating mode)	PZ-61DR-E	PZ-43SMF-E
Fan speed selection	4 fan speeds	2 of 4 fan speeds
Ventilation mode selection	Energy recovery / Bypass / Automatic	Energy recovery / Bypass / Automatic
Night-purge (time)	Any time selectable	No
Night-purge (fan speed)	Selectable from 4 fan speeds	No
DIP-SW setting and function setting from RC	Yes	No
Bypass temp. free setting	Yes	No
Pre-heater control free setting	Yes	No
Fan power up after installation	Yes	No
0 - 10VDC external input	Yes	Yes
ON/OFF timer	Yes	Yes*
Auto-Off timer	Yes	No
Weekly timer	Yes	No
Operation restrictions (ON/OFF, Ventilation mode, fan speed)	Yes	No
Operation restrictions (Fan speed skip setting)	Yes	No
Screen contrast adjustment	Yes	No
Language selection	Yes (8 languages)	No (English only)
Initializing remote controller	Yes	No
Filter cleaning sign	Yes	Yes
Lossnay core cleaning sign	Yes	No
Error indication	Yes	Yes
Error history	Yes	No
OA/RA/SA temp. display	Yes	No

*ON/OFF timer of PZ-43SMF-E : count-down timer to Lossnay ON/OFF

2. Function setting

2.1 Model selection switch

DIP-SW 6 is to identify the model for PCB. When replacing to new PCB, set the same setting as old one.

DIP-SW6

	DIP-SW6-1	DIP-SW6-2	DIP-SW6-3	DIP-SW6-4
LGH-15RVX-E	ON	OFF	OFF	OFF
LGH-25RVX-E	OFF	ON	OFF	OFF
LGH-35RVX-E	ON	ON	OFF	OFF
LGH-50RVX-E	OFF	OFF	ON	OFF
LGH-65RVX-E	ON	OFF	ON	OFF
LGH-80RVX-E	OFF	ON	ON	OFF
LGH-100RVX-E	ON	ON	ON	OFF
LGH-150RVX-E	OFF	OFF	OFF	ON
LGH-200RVX-E	ON	OFF	OFF	ON

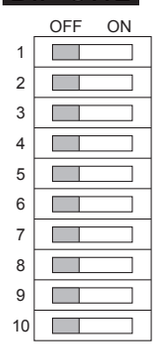
* Do not change from factory setting. If changed, please set as factory setting.

2.2 Function selection switches (DIP-SW 2, 5)

Set the selection switches (DIP-SW 2, 5) to perform the appropriate function.

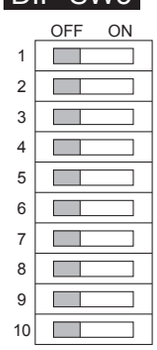
- All function except trial operation and main unit setting can be set also from PZ-61DR-E.
  If the function is switched by PZ-61DR-E. Setting from PZ-61DR-E has priority to DIP-SW except "DIP-SW priority" setting of PZ-61DR-E.
- Shut down the power supply before setting the switches (except DIP-SW2-1).
- Depending on system configuration, some functions may be not available.
- When replacing to new PCB, set the same setting as old one.

DIP-SW2



1 Trial operation
2 No. 28 Pulse input setting
3 No. 63 External fan speed input setting (0 - 10 VDC)
4 No. 6 Indoor negative pressure setting
5 No. 7 Indoor positive pressure setting
6 No. 63 External fan speed input setting (0 - 10 VDC)
7 No. 51 Automatic ventilation mode setting
8 No. 57 Operation monitor output synchronized with exhaust fan or supply fan
9 No. 61 Fan speed for air volume “High” input
10 No. 62 Fan speed for air volume “Low” input

DIP-SW5



1 No. 9 Delay start setting for air conditioner starting
2 No. 57 Operation monitor output synchronized with exhaust fan or supply fan
3 No. 13, No. 14 Exhaust fan setting
4 No. 5 Automatic recovery setting after power interruption
5 No. 1 Filter maintenance and fan power up setting against filter choking
6 No. 58 Bypass monitor output or pre-heater output setting
7 No. 15 Interlock mode setting
8 No. 15 Interlock mode setting
9 No. 14 Exhaust fan setting at OA temperature lower than -15˚C
10 Main unit setting (Refer to page C-9)

No. ** Shows the function No. which can be set from remote controller PZ-61DR-E

2.3 Function setting from PZ-61DR-E

2.3.1 Function list

No	Function	Setting Data								Factory setting	DIP-SW No.	Reference page	Individual setting
		0	1	2	3	4	5	6	7				
*1	Filter maintenance and fan power up setting against filter choking	DIP-SW priority	Indicator available Fan power up N/A	Indicator N/A Fan power up N/A	Indicator available Fan power up available	-	-	-	-	0	5-5	C-31	-
2	Lossnay core maintenance indicator setting	N/A	Available	-	-	-	-	-	-	0	N/A	C-31	-
5	Automatic recovery setting after power interruption	DIP-SW priority	Stop when the power is ON	Start when the power is ON	Return to the state before interruption	-	-	-	-	0	5-4	C-31	-
6	Indoor negative pressure setting	DIP-SW priority	N/A	Supply 1 down	Supply 2 down	-	-	-	-	0	2-4	C-37	○
7	Indoor positive pressure setting	DIP-SW priority	N/A	Exhaust 1 down	Exhaust 2 down	-	-	-	-	0	2-5	C-38	○
8	Max. fan speed setting during the first 30 minutes	N/A	Available	-	-	-	-	-	-	0	N/A	C-38	○
9	Delay start setting for air conditioner starting	DIP-SW priority	N/A	15 min	30 min	-	-	-	-	0	5-1	C-38	-
13	Exhaust fan setting during air conditioner defrosting	DIP-SW priority	Stop	No change	-	-	-	-	-	0	5-3	C-39	-
14	Exhaust fan setting at OA temperature lower than -15 ˚C	DIP-SW priority	Stop	Fan speed 1 or 2	No change	-	-	-	-	0	5-3 5-9	C-39	-
15	Interlock mode setting	DIP-SW priority	ON/OFF interlock	ON interlock	OFF interlock	External input given priority	-	-	-	0	5-7 5-8	C-23	-
28	Pulse input setting	DIP-SW priority	Non-pulse input	Pulse input	-	-	-	-	-	0	2-2	C-20	-
*30	Night-purge setting 1) Air volume	N/A	Fan speed 1	Fan speed 2	Fan speed 3	Fan speed 4	-	-	-	0	N/A	C-47	-
*31	Night-purge setting 2) Outdoor and indoor temperature difference	0 ˚C	1 ˚C	2 ˚C	3 ˚C	4 ˚C	5 ˚C	6 ˚C	7 ˚C	5	N/A	C-47	-
*32	Night-purge setting 3) Threshold of outdoor temperature	Setting Data 0 to 15 --> Threshold temperature for Night-purge 15 ˚C to 30 ˚C								2	N/A	C-47	-
*34	Input priority setting	Main unit input priority	Individual input priority	-	-	-	-	-	-	0	N/A	C-57	○
36	Outdoor temperature display setting	N/A	Available	-	-	-	-	-	-	0	N/A	C-33	-
37	Indoor temperature display setting	N/A	Available	-	-	-	-	-	-	0	N/A	C-33	-
38	Calculated supply air temperature display setting	N/A	Available	-	-	-	-	-	-	0	N/A	C-33	-
39	Temperature exchange efficiency setting (tens digit)	Setting Data 0 to 9 --> tens digit of temperature exchange efficiency 0 to 9								7	N/A	C-34	-
40	Temperature exchange efficiency setting (ones digit)	Setting Data 0 to 9 --> ones digit of temperature exchange efficiency 0 to 9								0	N/A	C-34	-
*41	Outdoor temperature correction	Setting Data 0 to 14 --> Outdoor temperature correction -7 ˚C to 7 ˚C								7	N/A	C-35	-
*42	Indoor temperature correction	Setting Data 0 to 14 --> Room temperature correction -7 ˚C to 7 ˚C								7	N/A	C-35	-
*51	Automatic mode setting	DIP-SW priority	Pattern A	Pattern B	Free setting	-	-	-	-	0	2-7	C-43	-
*52	Automatic mode setting 1) Outdoor and indoor temperature difference	Setting Data 0 to 7 --> Temperature difference 0 ˚C to 7 ˚C								0	N/A	C-44	-
*53	Automatic mode setting 2) The lowest outdoor temperature setting	Setting Data 0 to 15 --> Lowest outdoor temperature 10 ˚C to 25 ˚C								6	N/A	C-44	-
*54	Automatic mode setting 3) The lowest indoor temperature setting	Setting Data 0 to 15 --> Lowest indoor temperature 15 ˚C to 30 ˚C								1	N/A	C-44	-
*55	Supply fan power up setting	N/A	1 level up	2 level up	3 level up	4 level up	-	-	-	0	N/A	C-40	○
*56	Exhaust fan power up setting	N/A	1 level up	2 level up	3 level up	4 level up	-	-	-	0	N/A	C-40	○
57	Operation monitor output synchronized with exhaust fan or supply fan	DIP-SW priority	Operation monitor output	SA fan monitor output	SA fan monitor with delay operation	-	-	-	-	0	2-8 5-2	C-52	○
58	Bypass monitor output or pre-heater output setting	DIP-SW priority	Bypass monitor output	Operation monitor output for pre-heater	-	-	-	-	-	0	5-6	C-51	○
*59	Pre-heater output setting 1) ON temperature	0 ˚C	-1 ˚C	-2 ˚C	-3 ˚C	-4 ˚C	-5 ˚C	-6 ˚C	-7 ˚C	0	N/A	C-48	○
*60	Pre-heater output setting 2) OFF interval	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	-	-	-	0	N/A	C-49	○
*61	Fan speed for air volume “High” input	DIP-SW priority	Fan speed 4	Fan speed 3	-	-	-	-	-	0	2-9	C-40	-
*62	Fan speed for air volume “Low” input	DIP-SW priority	Fan speed 2	Fan speed 1	-	-	-	-	-	0	2-10	C-40	-
*63	External fan speed input setting (0 - 10 VDC)	DIP-SW priority	N/A	Pattern X	Pattern Y	Pattern Z	-	-	-	0	2-3 2-6	C-54	○
100	Initialization	-	Initialize	-	-	-	-	-	-	0	N/A	C-36	-

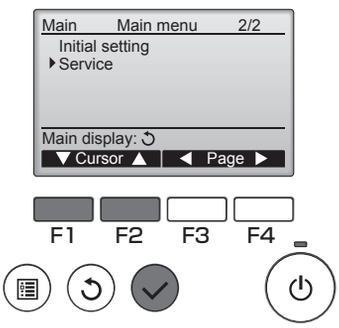
This table shows the summary of function settings. Please refer to the following pages for more details.
The functions indicated with * are newly added or modified from Lossnay LGH-RX_5-E series.
The functions indicated with “N/A” in the “DIP-SW No.” column are available only when using with remote controller PZ-61DR-E.
The functions indicated with “ ○ ” in the “Individual setting” column are avilable to set the data for each Lossnay in the multiple Lossnay group individually. Refer to page C-30.

2.3.2 How to set function setting from PZ-61DR-E

Make the Lossnay units' function settings from PZ-61DR-E as necessary (Not available from PZ-43SMF-E).
Every modified setting needs to be recorded to trace.

<Button operation>

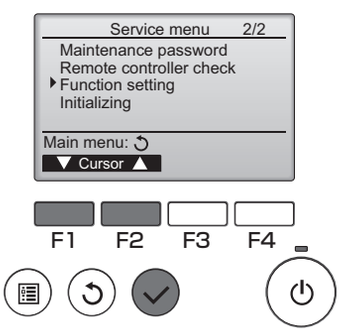
1



Press the MENU button.
The main menu will appear.
Select Service on the Main menu and press the SELECT button.

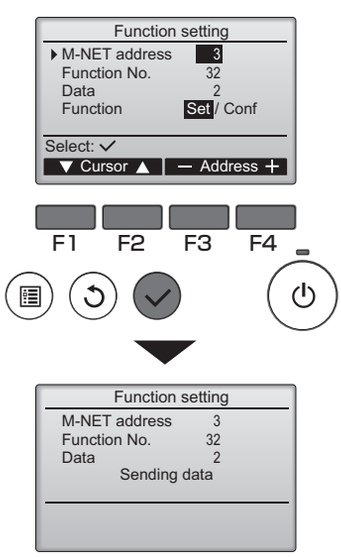
: ON/OFF button
: SELECT button
: RETURN button
: MENU button

2



Select Function Setting on the Service Menu screen, and press the SELECT button.

3

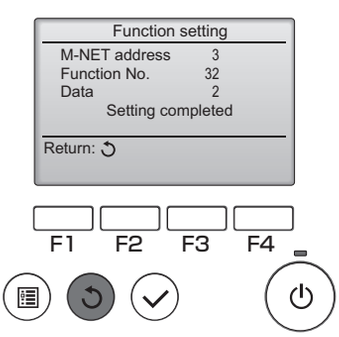


The Function Setting screen will appear.
Press the F1 or F2 button to move the cursor to one of the following: M-NET address, function setting number, or setting value. Then, press the F3 or F4 button to change the settings to the desired settings.

Once the settings have been completed, press the SELECT button.
A screen will appear that indicates that the settings information is being sent.

To check the current settings of a given unit, enter the setting for its M-NET address and function setting number, select Conf for the Function, and press the SELECT button.
A screen will appear that indicates that the settings are being searched for. When the search is done, the current settings will appear.

4



When the settings information has been sent, a screen will appear that indicates its completion.

To make additional settings, press the RETURN button to return to the screen shown in Step 3 above. Set the function numbers for other Lossnay units by following the same steps.

Navigating through the screens
- To return to the Service Menu screen ..... MENU button
- To return to the previous screen ..... RETURN button

<Cautions of M-NET address setting>

Only when each Lossnay has individual M-NET address, it is possible to do individual function setting by selecting its M-NET address. In other cases when address setting is not done, "All" should be selected for "M-NET address". In the case of multiple Lossnay units system, both "Bulk setting" and "Individual setting" is possible. Use "Bulk setting" for the functions which cannot be available to use "Individual setting". Refer to the table in page C-28.

- Bulk setting: Function setting data of all Lossnay units in a group become the same.
- Individual setting: Function setting data of each Lossnay unit can be set individually.
- To use "Bulk setting", select "All" for "M-NET address".
- To use "Individual setting", select address of the unit to be changed for "M-NET address".
- If the address setting is not done, only "Bulk setting" is available.
- Function setting data will be reset when address number is changed.

Note;

- By pressing F3 button, "M-NET address" is decreased by 1. (· · · 2 → 1 → 0 → All → 127 → 126 · · ·)
- By pressing F4 button, "M-NET address" is increased by 1. (· · · 126 → 127 → All → 0 → 1 → 2 · · ·)

3. Function setting contents

3.1 Trial Operation

After the system has been installed and before the ceiling panel is installed, make sure that wires are properly connected, then test the system's operation, referring to the operation manual for the remote controller.

3.1.1 Trial operation using the remote controllers (PZ-61DR-E)

Follow the procedure shown in the operation manual for the remote controller the functions below.

(1) Start operation.

(2) Fan speed selection.

(3) Ventilation mode selection.

(4) Stop operation.

3.1.2 Lossnay trial operation

This function can be used in the following situations.

- When there is no remote controller installed for operating the Lossnay.
- When heater output, malfunction monitor output, operation monitor output, and other output are connected.
- When the outdoor temperature is 8°C or lower. (To check Bypass damper operation)

(1)Supply power to the Lossnay unit.

(2)Turn the trial operation switch (DIP-SW2-1) "ON."

Terminal	DIP-SW	Setting	Minutes / Seconds	0 / 0 10 20 30 40 50	1 / 0 10 20 30 40 50	2 / 0 10 20 30 40 50	3 / 0 10 20 30 40 50	4 / 0 10 20 30 40 50
-	-	-	FanSpeed	STOP 4	STOP 4			
-	-	-	Ventilation mode	Bypass	Lossnay			
TM3⑦⑩	SW5-6	OFF	Bypass monitor output	OFF ON	OFF			
		ON	Pre-heater output	OFF				ON
TM3⑨⑩	SW2-8/ SW5-2	OFF/OFF	EA fan monitor output	ON				
		OFF/ON	SA fan monitor output	ON				
		ON/OFF or ON/ON	SA fan monitor output delay operation	OFF			ON	
TM3⑧⑩	-	-	Malfunction monitor output	ON				

Error code "0900" appears on the remote controller.

(3)Check each function is operating normally.

(4)Turn the trial operation switch (DIP-SW2-1) "OFF."

3.1.3 Complete system trial operation

- Interlock system containing an indoor unit and/or external device
  - Use the remote controller for the indoor unit or the operating switches for the external device and confirm that the indoor unit and Lossnay are interlocked.
  - If delay time has been set, check that the Lossnay operates after the delay time has passed.
- If MELANS System
  - Use MELANS to confirm the operation of the Lossnay.

3.2 Pulse input setting

Refer to page C-20

3.3 Filter maintenance and fan power up setting against filter choking

Set the schedule for filter cleaning based on the estimated concentration of dust in the air.
When fan power up is available, exhaust and supply fans power up at 1,000 hours and 2,000 hours gradually.
If function No.55 or No.56 is already worked, fan power up function may not be available.
Estimated hour differs by actual operated fan speed.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Filter maintenance indicator	Fan power UP
SW No.	Setting		Function No.	Setting Data			
SW5-5	-	-	1	0 (Factory setting)		DIP-SW priority	
	-	-		1		Indicate at estimated 3,000 hrs	N/A
	OFF (Factory setting)			2		N/A	N/A
	ON			3		Indicate at estimated 3,000 hrs	Available

<Caution>

- When the setting for the cumulative operation time of the Lossnay is exceeded, the filter cleaning icon will appear on the indoor unit remote controller or the Lossnay remote controller.
  After cleaning the filter, the filter cleaning icon can be reset. Refer to the Instruction book for the remote controller.
- When PZ-43SMF-E is connected, DIP-SW 5-5 should be turned ON to display filter sign and fan power up function also becomes effective.

3.4 Lossnay core maintenance indicator setting

Set to enable Lossnay core maintenance indicator. Estimated hour differs by actual operated fan speed.
This function is N/A from Lossnay unit DIP-SW.
Estimated hour differs by actual operated fan speed.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Lossnay core maintenance indicator
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	2	0 (Factory setting)		N/A
	-	-		1		Indicate at estimated 6,000 hrs

3.5 Automatic recovery setting after power interruption

Set for automatic recovery following power interruption.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Automatic recovery
SW No.	Setting		Function No.	Setting Data		
SW5-4	-	-	5	0 (Factory setting)		DIP-SW priority
	OFF (Factory setting)			1		Stop when the power is on
	-	-		2		Start when the power is on
	ON			3		Lossnay returns to the state before interruption

3.6 Indoor negative pressure setting

Refer to “Fan speed control ”(C-37).

3.7 Indoor positive pressure setting

Refer to “Fan speed control ”(C-38).

3.8 Max. fan speed setting during the first 30 minutes

Refer to “Fan speed control ”(C-38).

3.9 Delay start setting for air conditioner starting

Refer to “Fan speed control ”(C-38).

3.10 Exhaust fan setting during air conditioner defrosting or at OA temperature lower than -15 ˚C

Refer to “Fan speed control ”(C-39).

3.11 Interlock mode setting

Refer to “Interlocked system with an external device”(C-23).

3.12 Pulse input setting

Refer to “4.5 Interlocked system with an external device”(C-20).

3.13 Night-purge setting 1) Air volume

Refer to “Night-purge function ”(C-47).

3.14 Night-purge setting 2) Outdoor and indoor temperature difference

Refer to “Night-purge function ”(C-47).

3.15 Night-purge setting 3) Threshold of outdoor temperature

Refer to “Night-purge function ”(C-47).

3.16 Input priority setting

Refer to “Input terminal ”(C-57).

3.17 Outdoor temperature display setting

Set to display outdoor temperature detected by Lossnay unit thermistor or not.
It is also necessary that "Temp. display" is selected as "Yes" on initial setting menu of PZ-61DR-E. Refer to the installation manual of PZ-61DR-E
(During Night-purge, outdoor temperature is not displayed.)

DIP-SW		Setting check	PZ-61DR-E		Setting check	Outdoor temperature display
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	36	0 (Factory setting)		N/A
	-	-		1		Display on the screen of PZ-61DR-E

*Outdoor temp. display flashes when 0˚C or lower and 38˚C or higher.

3.18 Indoor temperature display setting

Set to display indoor temperature detected by Lossnay unit thermistor or not.
It is also necessary that "Temp. display" is selected as "Yes" on initial setting menu of PZ-61DR-E. Refer to the installation manual of PZ-61DR-E
(During Bypass ventilation and Night-purge, indoor temperature is not displayed.)

DIP-SW		Setting check	PZ-61DR-E		Setting check	Indoor temperature display
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	37	0 (Factory setting)		N/A
	-	-		1		Display on the screen of PZ-61DR-E

*Indoor temp. display flashes when 8˚C or lower and 38˚C or higher

3.19 Calculated supply air temperature display setting

Set to display calculated supply air temperature or not.
It is also necessary that "Temp. display" is selected as "Yes" on initial setting menu of PZ-61DR-E. Refer to the installation manual of PZ-61DR-E
(During Bypass ventilation and Night-purge, calculated supply air temperature is not displayed.)

DIP-SW		Setting check	PZ-61DR-E		Setting check	Calculated supply air temperature display
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	38	0 (Factory setting)		N/A
	-	-		1		Display on the screen of PZ-61DR-E

*Supply air temp. display flashes when 8˚C or lower and 38˚C or higher.

3.20 Temperature exchange efficiency setting

Set the tens digit of temperature exchange efficiency which is used to calculate supply air temperature.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Tens digit of temperature exchange efficiency
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	39	0		0
	-	-		1		1
	-	-		2		2
	-	-		3		3
	-	-		4		4
	-	-		5		5
	-	-		6		6
	-	-		7 (Factory setting)		7
	-	-		8		8
	-	-		9		9

Set the ones digit of temperature exchange efficiency which is used to calculate supply air temperature.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Ones digit of temperature exchange efficiency
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	40	0 (Factory setting)		0
	-	-		1		1
	-	-		2		2
	-	-		3		3
	-	-		4		4
	-	-		5		5
	-	-		6		6
	-	-		7		7
	-	-		8		8
	-	-		9		9

Note;

- Factory setting is 70%. 0~99% is selectable to set.
- For example, in the case that setting data of No.39 is 8 and setting data of No.40 is 5, the temperature exchange efficiency is 85%.

3.21 Outdoor temperature correction

Set the correction for the outdoor temperature displayed on the PZ-61DR-E screen by function No.36.

DIP-SW		Setting check	PZ-61DR-E		Setting check	The correction to thermistor detection
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	41	0		-7 ˚C
	-	-		1		-6 ˚C
	-	-		2		-5 ˚C
	-	-		3		-4 ˚C
	-	-		4		-3 ˚C
	-	-		5		-2 ˚C
	-	-		6		-1 ˚C
	-	-		7 (Factory setting)		0 ˚C
	-	-		8		+1 ˚C
	-	-		9		+2 ˚C
	-	-		10		+3 ˚C
	-	-		11		+4 ˚C
	-	-		12		+5 ˚C
	-	-		13		+6 ˚C
	-	-		14		+7 ˚C

For example, in the case that setting data is 10, when the detected temp. is 20˚C, the display temp. becomes 23˚C.

<Caution>

- The temperature displayed on PZ-61DR-E is corrected, but the temperature used in the control software is not corrected.
- It is also necessary that "Temp. display" is selected as "Yes" on initial setting menu of PZ-61DR-E. Refer to the installation manual of PZ-61DR-E

3.22 Indoor temperature correction

Set the correction for the indoor temperature displayed on the PZ-61DR-E screen by function No.37.

DIP-SW		Setting check	PZ-61DR-E		Setting check	The correction to thermistor detection
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	42	0		-7 ˚C
	-	-		1		-6 ˚C
	-	-		2		-5 ˚C
	-	-		3		-4 ˚C
	-	-		4		-3 ˚C
	-	-		5		-2 ˚C
	-	-		6		-1 ˚C
	-	-		7 (Factory setting)		0 ˚C
	-	-		8		+1 ˚C
	-	-		9		+2 ˚C
	-	-		10		+3 ˚C
	-	-		11		+4 ˚C
	-	-		12		+5 ˚C
	-	-		13		+6 ˚C
	-	-		14		+7 ˚C

For example, in the case that setting data is 10, when the detected temp is 20˚C, the display temp. becomes 23˚C.

<Caution>

- The temperature displayed on PZ-61DR-E is corrected, but the temperature used in the control software is not corrected.
- It is also necessary that "Temp. display" is selected as "Yes" on initial setting menu of PZ-61DR-E. Refer to the installation manual of PZ-61DR-E

3.23 Automatic ventilation mode setting

Refer to “Ventilation mode control” (C-43)

3.24 Automatic mode setting 1) Outdoor and indoor temperature difference

Refer to “Ventilation mode control” (C-44)

3.25 Automatic mode setting 2) The lowest outdoor temperature

Refer to “Ventilation mode control” (C-44)

3.26 Automatic mode setting 3) The lowest indoor temperature setting

Refer to “Ventilation mode control” (C-44)

3.27 Supply fan power up setting and Exhaust fan power up setting

Refer to “Fan speed control” (C-40)

3.28 Operation monitor output synchronized with exhaust fan or supply fan

Refer to “External input / output terminal” (C-52)

3.29 Bypass monitor output or Pre-heater output setting

Refer to “External input / output terminal“ (C-51)

3.30 Pre-heater output setting 1) ON temperature

Refer to “Cautions of Lossnay operation in cold region“ (C-48)

3.31 Pre-heater output setting 2) OFF interval

Refer to “Cautions of Lossnay operation in cold region“ (C-49)

3.32 Fan speed for air volume “High” input

Refer to “Fan speed control” (C-40).

3.33 Fan speed for air volume “Low” input

Refer to “Fan speed control” (C-40).

3.34 External fan speed input setting (0 - 10 VDC)

Refer to “External input / output terminal” (C-54).

3.35 Initialization

Set to initialize the remote controller PZ-61DR-E function setting.
All function settings which are changed by users are cancelled.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Initialization
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	100	0		N/A
	-	-		1		Available

4. Fan speed control

4.1 Fan speed control for each system

Following controls can be performed according to system configuration.

System		Remote controllers System controllers	Air volume
Basic System	Stand-alone/multiple Lossnay and Lossnay remote controller: PZ-61DR-E	Lossnay remote controller PZ-61DR-E	Fan speed 4 / 3 / 2 / 1 are selectable by the "Fan" button of the remote controller.
	Stand-alone/multiple Lossnay and Lossnay remote controller: PZ-43SMF-E	Lossnay remote controller PZ-43SMF-E	Fan speed High / Low are selectable by "Fan speed" button of the remote controller.
	System interlocked with Mr.Slim	MA remote controller PAR-31MAA (Remote controller connection prohibited with Lossnay)	Fan speed High / Low are selectable by ventilation operation of the remote controller.
	Level signal/pulse signal output device and external device only	None	Fixed to fan speed 4
M-NET Control	Stand-alone/multiple Lossnay and Lossnay remote controller: PZ-61DR-E	Lossnay remote controller PZ-61DR-E	Fan speed 4 / 3 / 2 / 1 are selectable by the "Fan" button of the remote controller
	Stand-alone/multiple Lossnay and Lossnay remote controller: PZ-43SMF-E	Lossnay remote controller PZ-43SMF-E	Fan speed High / Low are selectable by "Fan speed" button of the remote controller.
	M-NET Lossnay central control system	M-NET controller	Selectable fan speed depends on the remote controller.
	M-NET System interlocked with City Multi indoor units	Smart ME Controller PAR-U02MEDA MA remote controller PAR-31MAA	Fan speed High / Low are selectable by ventilation operation of the remote controller.

4.2 Fan speed control by function settings

Fan speed controls listed below can be set by function setting of remote controller PZ-61DR-E or DIP-SW 2, 5.

4.2.1 Indoor negative pressure setting

Exhaust fan speed is bigger than supply fan speed.
Remote controller indicates fan speed of exhaust fan.

Fan speed Display	Exhaust fan	Supply fan	
		1 down	2 down
4	4	3	2
3	3	2	1
2	2	1	1
1	1	1	1

DIP-SW		Setting check	PZ-61DR-E		Setting check	Down level of supply fan speed
SW No.	Setting		Function No.	Setting Data		
SW2-4	-	-	6	0 (Factory setting)		DIP-SW priority
	OFF (Factory setting)			1		N/A
	ON			2		Supply fan speed is 1 down to exhaust fan speed
	-	-		3		Supply fan speed is 2 down to exhaust fan speed

Note;

- In the case of multiple Lossnay units and PZ-61DR-E, setting from PZ-61DR-E is available only when Lossnay units have individual address.

4.2.2 Indoor positive pressure setting

Supply fan speed is bigger than exhaust fan speed.
Remote controller indicates fan speed of supply fan.

Fan speed Display	Supply fan	Exhaust fan	
		1 down	2 down
4	4	3	2
3	3	2	1
2	2	1	1
1	1	1	1

DIP-SW		Setting check	PZ-61DR-E		Setting check	Down level of exhaust fan speed
SW No.	Setting		Function No.	Setting Data		
SW2-5	-	-	7	0 (Factory setting)		DIP-SW priority
	OFF (Factory setting)			1		N/A
	ON			2		Exhaust fan speed is 1 down to supply fan speed
	-	-		3		Exhaust fan speed is 2 down to supply fan speed

Note;
- In the case of multiple Lossnay units and PZ-61DR-E, setting from PZ-61DR-E is available only when Lossnay units have individual address.

4.2.3 Max. fan speed setting during the first 30 minutes

This sets the fan to run forcibly for 30 minutes when operation starts to ventilate the indoor area. After 30 minutes, fan speed can be changed.
Use this setting if the indoor air is contaminated at night when the system is shut down and you desire to ventilate the indoor area quickly when operation is started in the morning.
When this function is working, is displayed on PZ-61DR-E and selected fan speed is displayed.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Max. fan speed setting during the first 30 minutes
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	8	0 (Factory setting)		N/A
	-	-		1		Available

4.2.4 Delay start setting for air conditioner starting

Delays Lossnay operation for 15 or 30 minutes when City Multi or Mr. Slim starts operating or when a external device starts operating.
This function is not available during Night-purge or with pulse input setting.
When this function is working, is displayed on PZ-61DR-E and "AFTER 00:30 Hr ON" is displayed on PZ-43SMF-E.
When not using Lossnay remote controller, it is possible to check the delay duration by seeing the LED1 on PCB.
When the interval from the last Lossnay operation is 2hrs or less, Lossnay ignores this function.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Lossnay delay start
SW No.	Setting		Function No.	Setting Data		
SW5-1	-	-	9	0 (Factory setting)		DIP-SW priority
	OFF (Factory setting)			1		N/A
	-	-		2		15 min
	ON			3		30 min

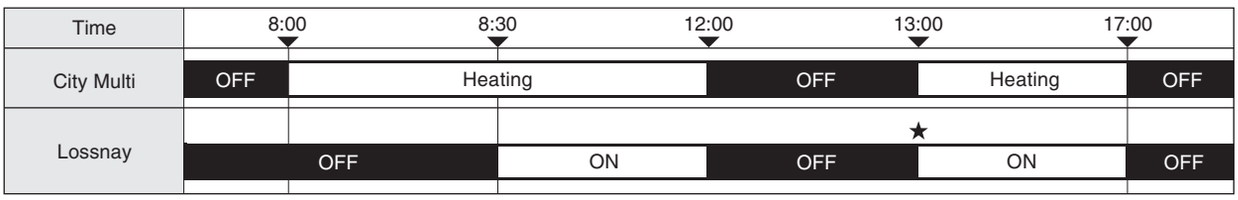
(1)Initiation condition

This function is available when MITSUBISHI air conditioner starts at cooling (drying) or heating mode or non-MITSUBISHI air conditioner starts.

(2)Usage example

Following example shows the conditions when interlocked with City Multi (delay time is set to 30min).

- City Multi starts heating operation at 8:00. In order to enhance heating effectiveness, Lossnay starts 30 min. later.
- Both City Multi and Lossnay is stopped during 12:00 to 13:00 due to lunch break.
  When City Multi turns ON again at 13:00, Lossnay start operation immediately.



★ Delay start function does not be activate, because the interval is less than 2 hours.

4.2.5 Exhaust fan setting during air conditioner defrosting or at OA temperature lower than -15 ˚C

When the Lossnay unit is interlocked with Mr.Slim or City Multi indoor units and supply duct of Lossnay is connected to the indoor unit, the supply fan of the Lossnay unit will be forced to stop during air conditioner defrosting or stopping by error.
This function is to set the operation of the exhaust fan during defrosting of the air conditioner.
To enable this function, it is necessary to set the DIP-SW of the indoor unit also. Please refer to its manual.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Exhaust fan operation during air conditioner defrosting
SW No.	Setting		Function No.	Setting Data		
SW5-3	-	-	13	0 (Factory setting)		DIP-SW priority
	ON			1		Stop
	OFF (Factory setting)			2		No change

Set the operation of the exhaust fan when the outdoor air is lower than -15 ˚C (when supply fan stop).

DIP-SW		Setting check	PZ-61DR-E		Setting check	Exhaust fan operation at outdoor temp. -15 ˚C or less
SW No.	Setting		Function No.	Setting Data		
SW5-3 SW5-9	-	-	14	0 (Factory setting)		DIP-SW priority
	5-3 OFF 5-9 ON			1		Stop
	5-3 ON 5-9 OFF			2		Forced to fan speed 2 or less*
	5-3 OFF 5-9 OFF (Factory setting)			3		No change
	5-3 ON 5-9 ON					

* In case Lossnay is operating at fan speed 1, exhaust fan keeps fan speed 1.
Function No.13 and No.14 are included in DIP-SW 5-3, then it is impossible to set independently without PZ-61DR-E.

4.2.6 Supply fan power up setting / Exhaust fan power up setting

Use these functions when the air volume needs to be increased after installation.
Function No.55 is for supply fan power up and function No.56 is for exhaust fan power up.
When function No.1 is ON and fan speed already reached the maximum power, this function is N/A.
The air volume at "4 level up" is increased by about 5-10% from the original.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Supply fan power up
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	55	0 (Factory setting)		N/A
	-	-		1		1 level up
	-	-		2		2 level up
	-	-		3		3 level up
	-	-		4		4 level up

DIP-SW		Setting check	PZ-61DR-E		Setting check	Exhaust fan power up
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	56	0 (Factory setting)		N/A
	-	-		1		1 level up
	-	-		2		2 level up
	-	-		3		3 level up
	-	-		4		4 level up

4.2.7 Fan speed for air volume “High” input

Set the fan speed setting when receiving “High” signal from remote controllers (e.g. remote controller of City Multi and Mr. Slim, PZ-43SMF-E) that have High/Low or High/Middle/Low air volume.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Operating fan speed
SW No.	Setting		Function No.	Setting Data		
SW2-9	-	-	61	0 (Factory setting)		DIP-SW priority
	OFF (Factory setting)			1		Fan speed 4
	ON			2		Fan speed 3

<Caution>
• In the case of multiple Lossnay units system, all Lossnay should be the same setting.

4.2.8 Fan speed for air volume “Low” input

Set the fan speed setting when receiving “Low” signal from remote controllers (e.g. remote controller of City Multi and Mr. Slim, PZ-43SMF-E) that have High/Low.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Operating fan speed
SW No.	Setting		Function No.	Setting Data		
SW2-10	-	-	62	0 (Factory setting)		DIP-SW priority
	OFF (Factory setting)			1		Fan speed 2
	ON			2		Fan speed 1

<Caution>
• In the case of multiple Lossnay units system, all Lossnay should be the same setting.

4.2.9 External fan speed input setting (0-10VDC)

Refer to page C-54

5. Ventilation mode control

5.1 Effect of Bypass Ventilation

The automatic mode provides the correct ventilation for the room conditions. It eliminates the need for troublesome switch operations when setting the Lossnay to Bypass mode. The following shows the effect of Bypass mode.

1. Reduces cooling load

If the air outside is cooler than the air inside the building during the cooling season (such as early morning or night), Bypass mode will intake the cooler outside air without energy recovery and reduce the cooling load of air conditioner.

2. Free cooling

Bypass mode can be used to cool inside the building with cooler outside air in the season when cooling load is not so big like spring or autumn.

3. Night-purge

Bypass ventilation can be used to release any accumulated hot air from inside the building during the hot summer season.

4. Office equipment room cooling

During cold season, outdoor air can be drawn in and used as is to cool rooms where the temperature has risen due to office equipment use. (Only when interlocked with City Multi and Mr. Slim indoor unit)

5.2 Ventilation mode

There are 3 ventilation modes.

1	Energy recovery mode	Energy recovery mode is performed regularly via the Lossnay core.
2	Bypass (non-energy recovery) mode	Ventilation is performed regularly without going through the Lossnay core.
3	Automatic mode	A temperature sensor built into the unit provides automatic ventilation to a suitable ventilation mode. In addition, energy saving ventilation is provided by interlocking with a Mr. Slim or City Multi indoor unit.

• Maximun 30 sec. delay exists from button operation or external input to the start of damper operation.

<Caution>

The fan motor stops approx. 20 sec. prior to the damper operation for switching ventilation mode.

5.3 Prohibition conditions of Bypass mode during Bypass mode operation

When the conditions described below are applicable, the ventilation mode will be changed to energy recovery mode. The RC display keeps "⇆" indicator even when actual operation is energy recovery.

• When the outdoor temperature is 8˚C or lower. (Product condensation prevention)
• When there is an outdoor temperature (Outdoor Air) thermistor fault.
• When pre-heater is ON and for one hour after that pre-heater becomes OFF.
• When City Multi or Mr. Slim indoor unit which is interlocked with Lossnay is defrosting.

5.4 Ventilation mode control for each system

Following controls can be performed according to system configuration.

System		Remote controllers System controllers	Ventilation mode
Basic System	Stand-alone/multiple Lossnay and Lossnay remote controller: PZ-61DR-E	Lossnay remote controller PZ-61DR-E	The "Mode" button of the remote controller permits ventilation mode switching for automatic, energy recovery and Bypass mode. Bypass mode is set at the time of Night-purge operation, and mode switching is not possible.
	Stand-alone/multiple Lossnay and Lossnay remote controller: PZ-43SMF-E	Lossnay remote controller PZ-43SMF-E	The "Ventilation mode" button of the remote controller permits mode switching for automatic, energy recovery, and Bypass mode.
	System interlocked with Mr.Slim	MA remote controller PAR-31MAA (Remote controller connection prohibited with Lossnay)	Fixed to automatic mode.
	Level signal/pulse signal output device and external device only	None	Fixed to automatic mode.
M-NET Control	Stand-alone/multiple Lossnay and Lossnay remote controller: PZ-61DR-E	Lossnay remote controller PZ-61DR-E	The "Mode" button of the remote controller permits ventilation mode switching for automatic, energy recovery and Bypass mode. Bypass mode is set at the time of Night-purge operation, and mode switching is not possible.
	Stand-alone/multiple Lossnay and Lossnay remote controller: PZ-43SMF-E	Lossnay remote controller PZ-43SMF-E	The "Ventilation mode" button of the remote controller permits ventilation mode switching for automatic, energy recovery, and Bypass mode.
	M-NET Lossnay central control system	M-NET controller	The "Operation mode" button of the system remote controller and the centralized controller permits ventilation mode switching for automatic, energy recovery, and Bypass mode. (The schedule timer, ON/OFF remote controller, and the group remote controller do not permit ventilation mode selection.)
	M-NET System interlocked with City Multi indoor units	Smart ME Controller PAR-U02MEDA MA remote controller PAR-31MAA	Fixed to automatic mode.

5.5 Automatic mode algorithm temperature map

In automatic mode, energy recovery mode and Bypass mode switches in accordance with room temp. (RA) and outdoor temp. (OA).

5.5.1 Prohibition conditions of Bypass mode during automatic mode operation

When the conditions described below are applicable, the ventilation mode will be fixed at energy recovery mode.

- When the outdoor temperature is 8˚C or lower. (Product condensation prevention)
- When Lossnay, interlocked with Mr.Slim or City Multi indoor unit, is set to the automatic mode and A/C is operating at the fan operation mode or heating mode.
- When there is an outdoor temperature (Outdoor Air) thermistor fault.
- When there is a room temperature (Return Air) thermistor fault.

5.5.2 Automatic mode [Pattern A, Pattern B, Free setting]

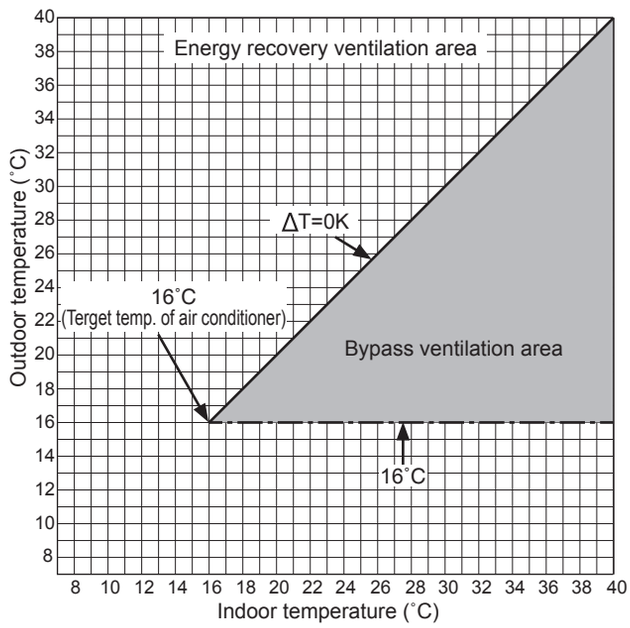
LGH-RVX-E decides Bypass mode or energy recovery mode by the temperature of OA and RA every 30 minutes. Set the pattern of conditions to go into Bypass mode in automatic mode from Pattern A, Pattern B or Free setting by the following table. Pattern A is more likely to go into Bypass mode than Pattern B.
When setting data of function No.51 is set "3" by PZ-61DR-E, function No.52, No.53, and No.54 are available.

No.51 Automatic mode setting

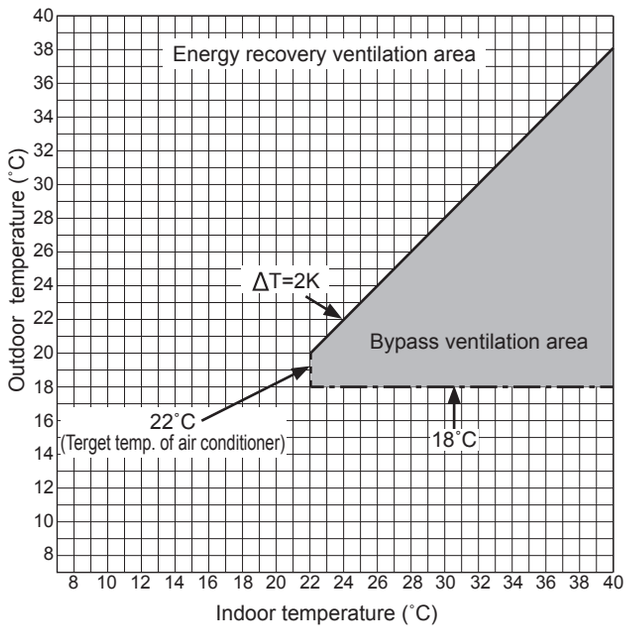
DIP-SW		Setting check	PZ-61DR-E		Setting check	Automatic mode
SW No.	Setting		Function No.	Setting Data		
SW2-7	-	-	51	0 (Factory setting)		DIP-SW priority
	OFF (Factory setting)			1		Pattern A Indoor temperature is 16 ˚C or more Outdoor temperature is 16 ˚C or more Indoor temperature - outdoor temperature ≥ 0K
	ON			2		Pattern B Indoor temperature is 22 ˚C or more Outdoor temperature is 18 ˚C or more Indoor temperature - outdoor temperature ≥ 2K
	-	-		3		Free setting

Pre-defined Pattern A and B are the following maps.
By using "Free setting", it is possible to make a free Bypass ventilation area like following examples.

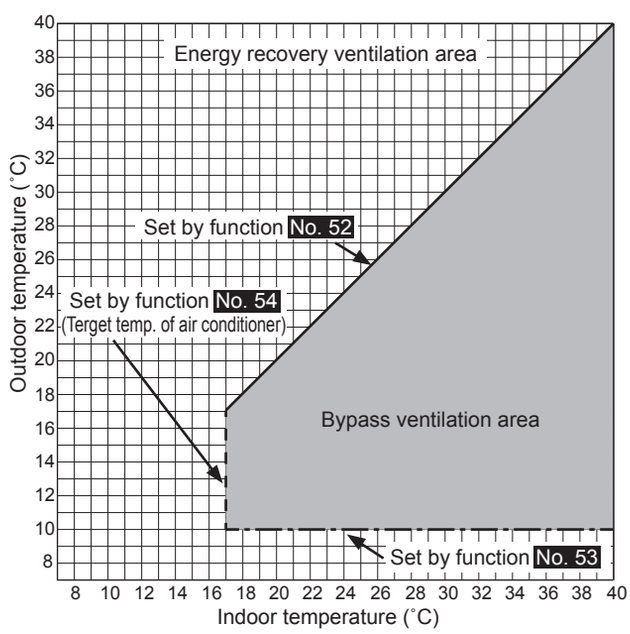
Pattern A



Pattern B

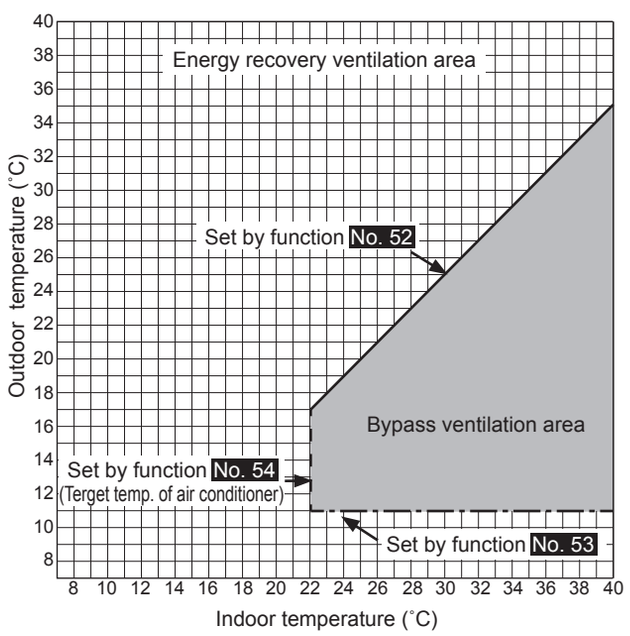


Free setting example 1



Function No.	Setting Data
52	0 (0 K)
53	0 (10 ˚C)
54	2 (17 ˚C)

Free setting example 2



Function No.	Setting Data
52	5 (5 K)
53	1 (11 ˚C)
54	7 (22 ˚C)

Note;

- When Lossnay is interlocked to Mr. Slim or City Multi indoor unit, the lowest indoor temperature for Bypass mode is the average target temperature of indoor units.

5.5.3 How to set Free setting from PZ-61DR-E

The details of function No.52 to No.54 are as followings

No.52 Automatic mode setting 1) Outdoor and indoor temperature difference

DIP-SW		Setting check	PZ-61DR-E		Setting check	Indoor temperature - outdoor temperature
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	52	0 (Factory setting)		0 K or more
	-	-		1		1 K or more
	-	-		2		2 K or more
	-	-		3		3 K or more
	-	-		4		4 K or more
	-	-		5		5 K or more
	-	-		6		6 K or more
	-	-		7		7 K or more

No.53 Automatic mode setting 2) The lowest outdoor temperature

DIP-SW		Setting check	PZ-61DR-E		Setting check	Outdoor temperature
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	53	0		10 ˚C or more
	-	-		1		11 ˚C or more
	-	-		2		12 ˚C or more
	-	-		3		13 ˚C or more
	-	-		4		14 ˚C or more
	-	-		5		15 ˚C or more
	-	-		6 (Factory setting)		16 ˚C or more
	-	-		7		17 ˚C or more
	-	-		8		18 ˚C or more
	-	-		9		19 ˚C or more
	-	-		10		20 ˚C or more
	-	-		11		21 ˚C or more
	-	-		12		22 ˚C or more
	-	-		13		23 ˚C or more
	-	-		14		24 ˚C or more
	-	-		15		25 ˚C or more

No.54 Automatic mode setting 3) The lowest indoor temperature setting

When Lossnay is interlocked to Mr. Slim or City Multi indoor unit, the lowest indoor temperature for Bypass mode is the average target temperature of indoor units.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Indoor temperature
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	54	0		15 ˚C or more
	-	-		1 (Factory setting)		16 ˚C or more
	-	-		2		17 ˚C or more
	-	-		3		18 ˚C or more
	-	-		4		19 ˚C or more
	-	-		5		20 ˚C or more
	-	-		6		21 ˚C or more
	-	-		7		22 ˚C or more
	-	-		8		23 ˚C or more
	-	-		9		24 ˚C or more
	-	-		10		25 ˚C or more
	-	-		11		26 ˚C or more
	-	-		12		27 ˚C or more
	-	-		13		28 ˚C or more
	-	-		14		29 ˚C or more
	-	-		15		30 ˚C or more

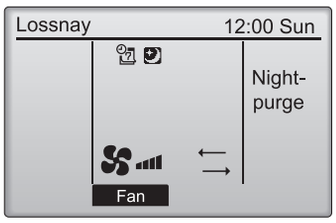
Note;

- This "Free setting" function is available only when Lossnay is used with PZ-61DR-E and is N/A from Lossnay unit DIP-SW.
- When the setting of Function No.53 is low, and using with pre-heater, the outdoor temperature may be detected as higher and the mode may change to Bypass mode even in winter. Set the setting 16˚C or more, or use energy recovery mode.

6. Night-purge function

6.1 Descriptions of Night-purge function.

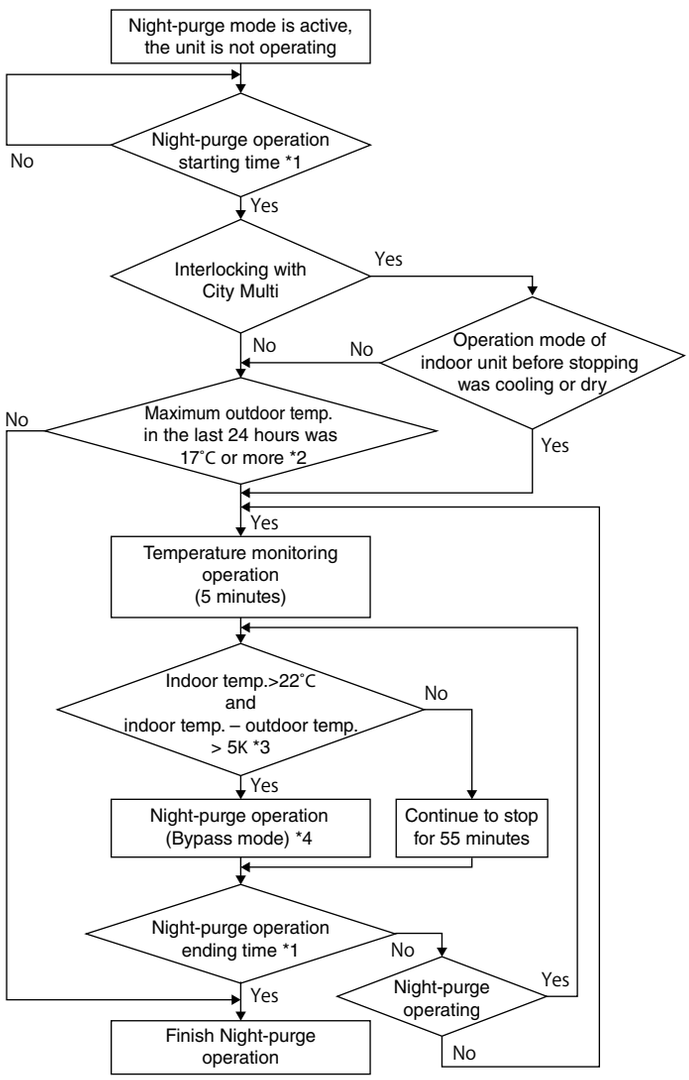
During the summer season, the Night-purge mode draws cooler outside air into the room at night. This energy conservation mode reduces the starting load of the air conditioner the next morning.
PZ-61DR-E or centralized controller is necessary for Night-purge function.
appears on the PZ-61DR-E when the Night-purge function is available.
It is possible to freely set the Night-purge operation for the start conditions, fan speed, and operation time. (Settings can be made by PZ-61DR-E or AE-200E (Ver.7.30~))



<Night-purge starting condition>

No.	Content
1	Lossnay is OFF
2	The time display is between operation starting time and end time. *1
3	Summer condition judgement (correspond to any of the following) • Outdoor temperature was detected more than 17˚C within 24 hours. *2 • The Lossnay unit is interlocked with City Multi and operation mode of indoor unit was “cool” or “dry”.
4	Indoor temperature is higher than 22˚C
5	Indoor temperature is 5K higher than outdoor temperature. *3

*1 Night-purge starting time and ending time are settable by a controller. Refer to “How to set Night-purge from the remote controller”(C-47). (for PZ-61DR-E)
*2 The threshold of outdoor temperature can be set to between 15˚C and 30˚C (1K increments). Factory setting is 17˚C.
If the maximum outdoor temperature in the last 24 hours exceeded this temperature value (threshold), Lossnay starts the temperature monitoring operation.
By setting the lower threshold, Lossnay is more likely to start Night-purge operation.
Refer to “Night-purge setting 3) Threshold of outdoor temperature” (C-47) (for PZ-61DR-E)
*3 Outdoor and indoor temperature difference can be set to between 0K and 7K (1K increments). Factory setting is 5K
Refer to Night-purge setting 2) Outdoor and indoor temperature difference”(C-47) (for PZ-61DR-E)
*4 Fan speed during Night-purge must be set.
*5 Outdoor and indoor temperature are sensed by Lossnay unit. Those are different from actual outdoor / indoor temperature



- When time display is equal to Night-purge starting time, if starting condition No.1 and No.3 are satisfied, temperature monitor operation starts for 5 minutes to detect outdoor and indoor temperature. If not, the unit stops.
- The unit stops if starting condition No.2, No.4 and No.5 aren't satisfied during Night-purge operation.
- If starting condition No.4 and No.5 are not satisfied during Night-purge active time, the unit perform temperature monitoring operation for 5 minutes every 1 hour. If starting condition No.2 and No.3 are satisfied after that monitoring operation, Night-purge operation will start. If not, the unit will stop.
- If Lossnay unit is turned ON by controller button, Night-purge will not operate until next time.

Note;
- Fan speed can be selected by function setting, but cannot be selected in the Weekly timer. If you change fan speed during Night-purge by the remote controller (PZ-61DR-E), Lossnay follows it.
- If the Night-purge function is not enabled, Lossnay will not operate it properly even if it is set in the Weekly timer.
- Night-purge operation is always Bypass mode so that if the temperature conditions and others are the prohibition conditions of Bypass mode (5.5.1, page C-42), Night-purge operation does not start.
- If ventilation mode is switched by system controller during Night-purge operation, Lossnay will end the Night-purge and continue to operate normally.

For more details about settable functions by each controller, see the below tables.

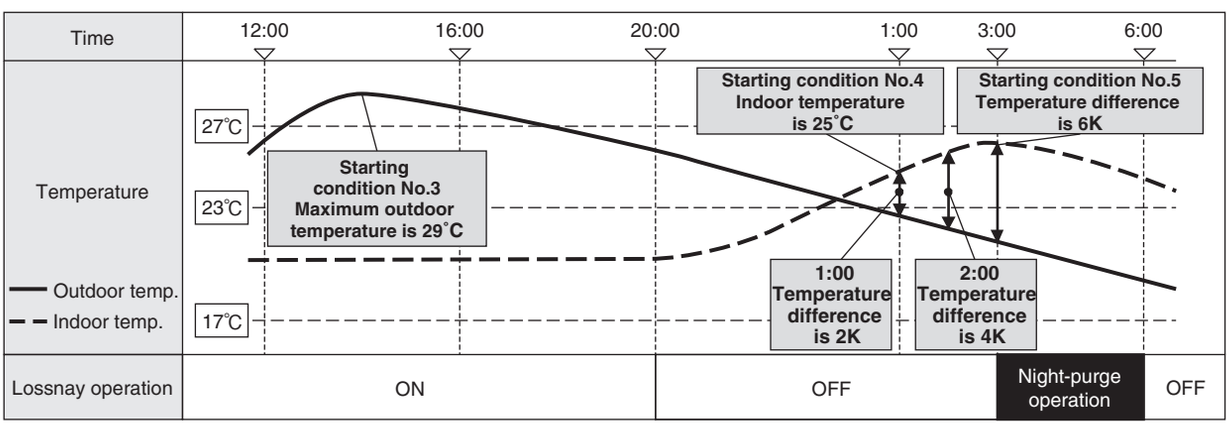
	PZ-61DR-E alone	PZ-61DR-E + AG-150A or AE-200E (~ Ver. 7.11)	PZ-61DR-E + AE-200E (Ver. 7.20) *6	PZ-61DR-E + AE-200E (Ver. 7.30 ~) *6	AG-150A or AE-200E (~ Ver. 7.11) alone	AE-200E (Ver. 7.20) alone	AE-200E (Ver. 7.30 ~) alone
Setting Night-purge starting / ending time	○	△ (Fixed to 1:00-6:00)	○	○	Night-purge Not Available	○	○
Setting fan speed during Night-purge	○	×	△ (Fan speed 1, 2 and 3 or 4)	○		△ (Fan speed 1, 2 and 3 or 4)	○
Setting the threshold of outdoor temperature to start Night-purge	○	×	○	○		○	○
Setting outdoor and indoor temperature difference condition	○	×	○	○		○	○

*6 When using PZ-61DR-E and AE-200E (Ver. 7.20 ~) together, set all conditions from AE-200E.

- This information is based on the schedule at Jan. 2015. Please confirm to the latest AE-200E manuals.

<Night-purge time chart>

- This example shows when Night-purge function is active, starting condition No.2 and No.5 are factory setting and timer is set as follows.
  20:00 Off ; (next day) 1:00 Night-purge start ; 6:00 Off
- When time is 1:00 and 2:00, Night-purge operation does not start because the difference between indoor and outdoor temperature is less than 5K.
- When time is 3:00, Lossnay start Night-purge operation because the difference between indoor and outdoor temperature exceeds 5K.



This graph is only an illustration, not an actual representation

6.2 How to set Night-purge from the remote controller (PZ-61DR-E)

<STEP 1> Night-purge setting 1) Air volume

Set fan speed during Night-purge.
When setting data is "0", Night-purge function is not available.
This function is N/A from Lossnay unit DIP-SW.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Air volume
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	30	0 (Factory setting)		N/A (Night-purge function is not available)
	-	-		1		Fan speed 1
	-	-		2		Fan speed 2
	-	-		3		Fan speed 3
	-	-		4		Fan speed 4

<STEP 2> Night-purge setting 2) Outdoor and indoor temperature difference

Set one of the conditions for Night-purge start, temperature difference between indoor and outdoor.
When the actual difference between indoor
and outdoor becomes bigger than the setting, Night-purge starts.
This function is N/A from Lossnay unit DIP-SW.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Indoor temperature - outdoor temperature
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	31	0		0 K or more
	-	-		1		1 K or more
	-	-		2		2 K or more
	-	-		3		3 K or more
	-	-		4		4 K or more
	-	-		5 (Factory setting)		5 K or more
	-	-		6		6 K or more
	-	-		7		7 K or more

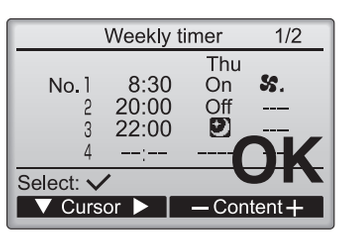
<STEP 3> Night-purge setting 3) Threshold of outdoor temperature

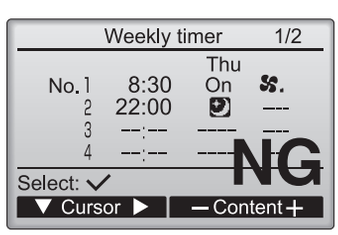
Set one of the conditions for Night-purge start, maximum outdoor temperature within 24 hours.
When this setting temperature is low, it is likely to start Night-purge.
This function is N/A from Lossnay unit DIP-SW.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Threshold of outdoor temperature
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	32	0		15 ˚C or more
	-	-		1		16 ˚C or more
	-	-		2 (Factory setting)		17 ˚C or more
	-	-		3		18 ˚C or more
	-	-		4		19 ˚C or more
	-	-		5		20 ˚C or more
	-	-		6		21 ˚C or more
	-	-		7		22 ˚C or more
	-	-		8		23 ˚C or more
	-	-		9		24 ˚C or more
	-	-		10		25 ˚C or more
	-	-		11		26 ˚C or more
	-	-		12		27 ˚C or more
	-	-		13		28 ˚C or more
	-	-		14		29 ˚C or more
	-	-		15		30 ˚C or more

<STEP 4> Night-purge schedule setting

Set the "Night-purge schedule" after "Off schedule" like the example on the right (upper).
Off setting is necessary before Night-purge setting.
If not, Night-purge does not start.
For example, the setting as shown on the right (lower) is NOT correct.
Night-purge operation continues until next "Off schedule" or "On schedule" time which is set in the weekly timer.
Then be sure to set "Off schedule" or " On schedule" after "Night-purge schedule".
*If there is no schedule after a Night-purge, Lossnay will stop after 24 hours of Night-purge operation.





Note;
How to set Night-purge from the centralized controller (AE-200E, ver. 7.30 or later), refer to the manual of the centralized controller.

7. Cautions of Lossnay Operation in cold region

7.1 Intermittent operation in cold region

In the event of the following, continuous fan operation for drawing in supply air is cancelled and intermittent operation starts.
-10˚C to -15˚C : Intermittent operation 60 min ON, 10 min OFF.
-15˚C or less : Intermittent operation 55 min OFF, 5 min ON. This is sensing operation for OA temp.
The icon is displayed on PZ-61DR-E when the supply fan is stopping.

7.2 Pre-heater control from Lossnay

Lossnay can output a signal to a pre-heater.

<Output setting>
• Pre-heater output can be set at function setting No.58 or DIP-SW5-6. (refer to page C-51)

<Output condition>
• Pre-heater output basically corresponds with supply fan operation, but 10 sec. delay exists at the start.
• When pre-heater output is set, supply fan continues operation for 3 min. extra for cooling down after OFF button pushed or OFF signal input.
• Pre-heater output starts when OA temp. becomes lower than the threshold temp. selectable between -7˚C and 0˚C. (C-48)
• Pre-heater output stops when OA temp. becomes higher than 15˚C.
• Pre-heater output stops 1~5 hours after output start. The interval is selectable between 1 hour and 5 hours. (C-49)
• Note; When pre-heater output is activated, low temperature intermittent operation is not available.

<Error>
• Error code is displayed on the monitor and malfunction monitor is output in the following cases.
1) OA thermistor detects higher than 15˚C within 15 minutes after the output starts.
2) OA thermistor detects -10˚C or lower, 60 minutes after the output starts.

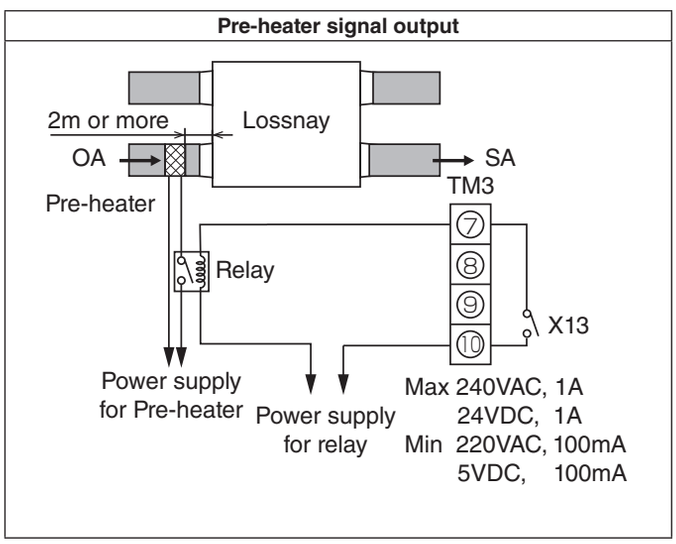
7.2.1 Pre-heater output setting 1) ON temperature

DIP-SW		Setting check	PZ-61DR-E		Setting check	Outdoor temp. for Preheater output ON
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	59	0 (Factory setting)		0 ˚C or less
	-	-		1		-1 ˚C or less
	-	-		2		-2 ˚C or less
	-	-		3		-3 ˚C or less
	-	-		4		-4 ˚C or less
	-	-		5		-5 ˚C or less
	-	-		6		-6 ˚C or less
	-	-		7		-7 ˚C or less

7.2.2 Pre-heater output setting 2) OFF interval

DIP-SW		Setting check	PZ-61DR-E		Setting check	Pre-heater output OFF interval
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	60	0 (Factory setting)		1hr
	-	-		1		2hrs
	-	-		2		3hrs
	-	-		3		4hrs
	-	-		4		5hrs

7.2.3 Wiring



7.2.4 Cautions of selecting a pre-heater

- Select a duct heater in compliance with local and national laws, ordinances, and standards. Select a duct heater that has obtained the CE mark.
- Always select a heater that is equipped with a non-self-resetting safety device. Do not directly supply power from the Lossnay unit to the duct heater. (Doing so could cause fire.)
- Install a circuit breaker for the duct heater in compliance with all applicable laws, ordinances, and standards.
- Install the duct heater separated from the product by a distance of 2 m or more. (Failure to do so may result in equipment damage due to the transmission of residual heat from the heater.)
- When using a heater without a temperature control function, select a heater with a capacity that is matched to the air volume.
- Do not use the heater outside the set air volume. (If the heater's capacity is too larger, this may result in the heater frequently turning ON/OFF.) (If the heater's capacity is too small, this may result in an inability to heat.)
- Ensure that the duct heater and Lossnay are wired and that the Lossnay function settings have been configured, and then always check operation by trial operation.
- When set to automatic mode while using the pre-heater function, the outdoor temperature may be detected as higher and the mode may change to Bypass mode, even in winter.
- When the pre-heater is ON, Lossnay does not go to fan speed 1. Even remote controller displays fan speed 1, Lossnay is operated at fan speed 2.
- When the Lossnay unit has duct connections and is interlocked with Mr. Slim or City Multi indoor units, the supply fan and pre-heater output stop during air conditioner defrosting.

7.2.5 Reference of heater capacity

Heater capacity can be calculated by the following formula.

$W1 = Sf \times Q \times \gamma \times C \times (Toa2\text{-}Toa1) \div 3600$

$= 1.0 \times Q \times 1.2 \times 1.0 \times (Toa2\text{-}Toa1) \div 3600$ [kW] ..... ①

Q [m^3/h] : Air volume

γ [kg/m^3] : Specific air density, 1.2

C [kJ/kg] : Specific heat of air, 1.0

Toa1 [°C] : Primary temp.

Toa2 [°C] : Secondly temp.

Sf : Safety ratio, 1.0 ..... Safety ratio is 1.0 to prevent selecting too big capacity.

Quick reference for heater capacity calculation for each model.

When heater capacity is calculated with fan speed 2

[kW]

Model		LGH-15RVX-E	LGH-25RVX-E	LGH-35RVX-E	LGH-50RVX-E	LGH-65RVX-E	LGH-80RVX-E	LGH-100RVX-E	LGH-150RVX-E	LGH-200RVX-E
Air flow rate m^3/h		75	125	175	250	325	400	500	750	1000
Heater capacity	Target OA temp. increase 5K	0.13	0.21	0.29	0.42	0.54	0.67	0.83	1.25	1.67
	Target OA temp. increase 10K	0.25	0.42	0.58	0.83	1.08	1.33	1.67	2.50	3.33

When heater capacity is calculated with fan speed 3

[kW]

Model		LGH-15RVX-E	LGH-25RVX-E	LGH-35RVX-E	LGH-50RVX-E	LGH-65RVX-E	LGH-80RVX-E	LGH-100RVX-E	LGH-150RVX-E	LGH-200RVX-E
Air flow rate m^3/h		113	188	263	375	488	600	750	1125	1500
Heater capacity	Target OA temp. increase 5K	0.19	0.31	0.44	0.63	0.81	1.00	1.25	1.88	2.50
	Target OA temp. increase 10K	0.38	0.63	0.88	1.25	1.63	2.00	2.50	3.75	5.00

When heater capacity is calculated with fan speed 4

[kW]

Model		LGH-15RVX-E	LGH-25RVX-E	LGH-35RVX-E	LGH-50RVX-E	LGH-65RVX-E	LGH-80RVX-E	LGH-100RVX-E	LGH-150RVX-E	LGH-200RVX-E
Air flow rate m^3/h		150	250	350	500	650	800	1000	1500	2000
Heater capacity	Target OA temp. increase 5K	0.25	0.42	0.58	0.83	1.08	1.33	1.67	2.50	3.33
	Target OA temp. increase 10K	0.50	0.83	1.17	1.67	2.17	2.67	3.33	5.00	6.67

8. External Input/output terminal

There are terminals and connectors on the PCB to output operating conditions of Lossnay to an external device and to recieve signals to switch ON/OFF, fan speed and ventilation mode from an external device.

8.1 Output terminal

Output	Terminal block	Signal form	Contact rating	
			Maximum	Minimum
Bypass monitor or pre-heater signal output	TM3⑦⑩	Volt-free contact signal	240 VAC, 1A 24 VDC, 1A	220 VAC, 100mA 5 VDC, 100mA
Malfunction monitor output	TM3⑧⑩			
Operation monitor output	TM3⑨⑩			

*TM3 ⑩ is common terminal for each output.

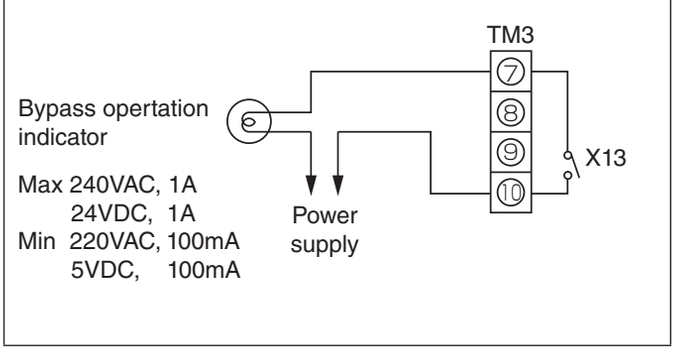
8.1.1 Bypass monitor output or pre-heater output setting

Bypass monitor or pre-heater signal can be selected at DIP-SW5-6 or PZ-61DR-E
Always check that it is the intended setting.
Set Bypass monitor or pre-heater output from TM3⑦⑩ synchronized with supply of exhaust fan.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Output setting from TM3⑦⑩
SW No.	Setting		Function No.	Setting Data		
SW5-6	-	-	58	0 (Factory setting)		DIP-SW priority
	OFF (Factory setting)			1		Bypass monitor output. Corresponds to operation mode output of Bypass damper.
	ON			2		Pre-heater signal output Refer to 7.2 (C-48)

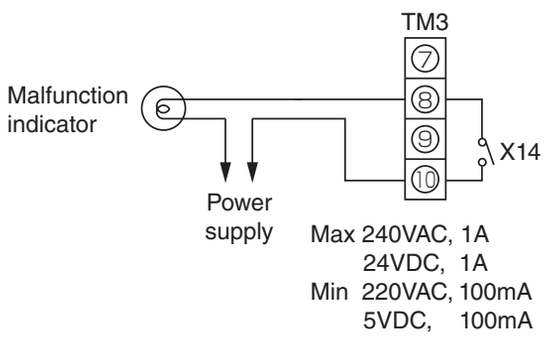
<Wiring>

Bypass monitor output



8.1.2 Malfunction monitor output

This function is to enable Lossnay error display when there is no remote controller which can display error.

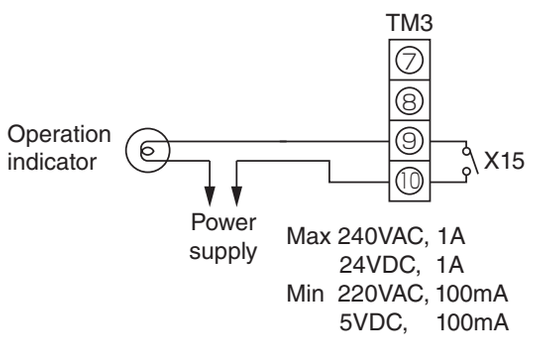


8.1.3 Operation monitor output

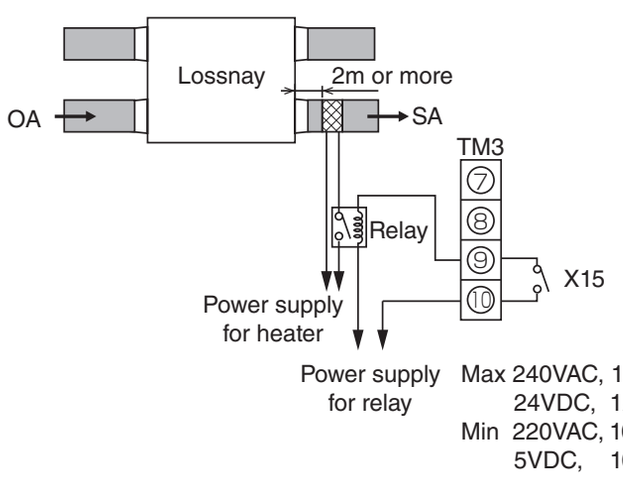
Operation monitor output can be selected for exhaust fan or supply fan.
Also supply fan delay operation, ex. for after-heater, can be set.
Always check that it is the intended setting.

DIP-SW		Setting check	PZ-61DR-E		Setting check	Operation monitor output from TM3⑨⑩
SW No.	Setting		Function No.	Setting Data		
SW2-8 SW5-2	-	-	57	0 (Factory setting)		DIP-SW priority
	2-8 OFF 5-2 OFF (Factory setting)			1		Operation monitor output
	2-8 OFF 5-2 ON			2		SA fan monitor output * When supply fan stops during cold outdoor temp. or defrosting, output stops.
	2-8 ON (Either 5-2 ON or OFF)			3		SA fan operation monitor output with delayed operation.

<Operation monitor output>



<Supply fan operation monitor output with delayed operation>



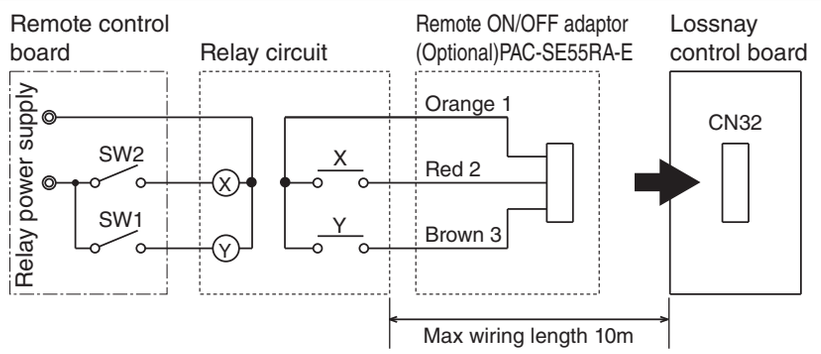
To use operation monitor output for a supply after-heater, use the supply fan operation monitor output with delayed operation.
Starts the output 10 seconds after supply fan operates.
The supply fan continues to operate for 3 min after stopping the output.
For the heater, observe the cautions listed in C-49.

8.2 Input terminal

8.2.1 ON/OFF switching by using CN32 (When using the remote/local switching and the ON/OFF input)

Use when intending to prohibit switching ON/OFF from remote controller or centralized controller.

■ In the case of using 2 switches (field supply) for ON/OFF

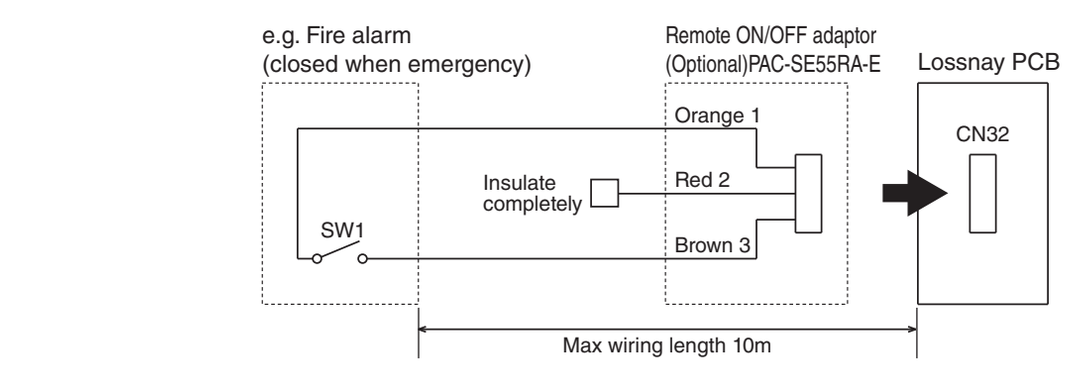


SW1: When this is ON, Lossnay cannot turn ON/OFF by the remote controller or centralized controller.
SW2: When SW1 is ON, Lossnay can be turned ON by setting SW2 at ON or turned OFF by setting SW2 at OFF.

SW1: Remote/local selector switch
SW2: ON/OFF switch
X, Y : Relay (Contactor rating minimum applicable load DC 1 mA)

Note;
Cannot use together with external input signal by TM2.
When using in a group of multiple Lossnay units, be sure to connect to main unit. Refer to page C-9.
Connect the TM4①② of each Lossnay unit.
In the case that Lossnay is connected to MELANS, operation lock from system controller has a priority.

■ In the case of forcing stop



8.2.2 External fan speed control (Volt-free contact, CN17)

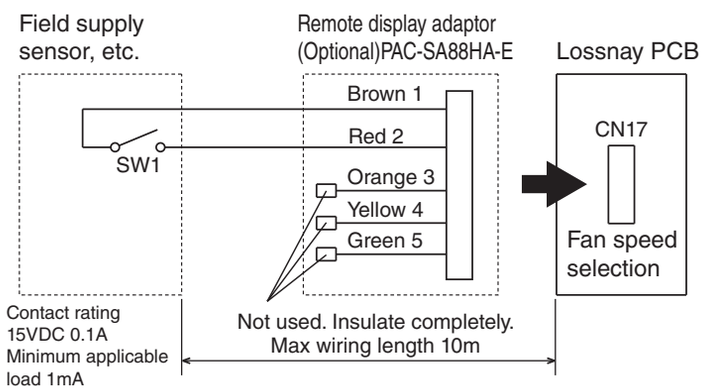
Lossnay changes fan speed by external input from field supply CO_2 sensor, etc.
Using a field supply sensor, etc., make connection by inserting the optional remote display adaptor (PAC-SA88HA-E) in the connector CN17 (Red) as shown by the figure.

<Operation>
When external fan speed control is activated, the icon will be displayed on PZ-61DR-E and it is not possible to change fan speed from PZ-61DR-E. In the case of using the other remote controller, it is possible to change the display of fan speed, however the actual fan speed is the fan speed that is set by the external control, i.e. the external fan speed control has higher priority.

<How to set>
Lossnay will operate the fan speed as shown in the table below, regardless of the remote controller setting.

CN17(Red)	Fan speed
1-2 (Brown-Red)	4
1-3 (Brown-Orange)	3
1-4 (Brown-Yellow)	2
1-5 (Brown-Green)	1

<Wining example of "Fan speed 4">



Use this in such a way that it ventilates at fan speed 1, 2 or 3 normally, and when the external sensor detects contamination of indoor air, it changes to fan speed 4 operation.

<Multiple Lossnay units control>
Refer to 8.2.5 (page C-57)

8.2.3 External fan speed control (Analogue input 0 - 10 VDC, CN26)

Lossnay changes fan speed according to input voltage to CN26 from a field supply CO_2 sensor or a BMS (Building Management System) etc. When using this function, the external fan speed control by volt-free contact (CN17) is not available.

<Operation>
When external fan speed control is activated, the icon will be displayed on PZ-61DR-E and it is not possible to change fan speed from PZ-61DR-E. In the case of using the other remote controller, it is possible to change the display of fan speed, however the actual fan speed is the fan speed that is set by the external control, i.e. the external fan speed control has higher priority.
When pattern X or Y is selected, it is not possible to change fan speed from remote controllers. (External input has higher priority)

<How to select pattern>
Set external fan speed input setting by DIP-SW or function No.63 from PZ-61DR as following table.

DIP-SW		Setting check	PZ-61DR-E		Setting check	External fan speed control using CN26
SW No.	Setting		Function No.	Setting Data		
SW2-3 SW2-6	-	-	63	0 (Factory setting)		DIP-SW priority
	2-3 OFF 2-6 OFF (Factory setting)			1		External fan speed control is N/A.
	2-3 ON 2-6 OFF			2		Refer to Pattern X
	2-3 OFF 2-6 ON			3		Refer to Pattern Y
	2-3 ON 2-6 ON			4		Refer to Pattern Z

<Differentiation of each pattern>

[Pattern X]

When the input voltage is more than 6.0 VDC, Lossnay operates at fan speed 4 (maximum air volume). Lower voltage than 6.0 VDC, Lossnay operate at lower fan speed. (Connection example: if you use a CO_2 sensor which 0 - 10 VDC equals to 0 - 2000 ppm, 6.0 VDC equals to 1200 ppm)

Input voltage [VDC]	CO_2 concentration [ppm]	Fan speed
0 - 2.6	0 - 520	1
3.0 - 4.1	600 - 820	2
4.5 - 5.6	900 - 1120	3
6.0 or mote	1200 or mote	4

Note;

- Input voltage and CO_2 concentration are guidelines, not guaranteed values.
  When the input voltage is in-between, operating fan speed depends on the situations.
- Please select a CO_2 sensor which the relationship formula between CO_2 concentration and output voltage is "2000ppm=10VDC."

[Pattern Y]

When the input voltage is more than 5.0 VDC, Lossnay operates at fan speed 4 (maximum air volume). Lower voltage than 5.0 VDC, Lossnay operate at lower fan speed. (Connection example: if you use a CO_2 sensor which 0 - 10 VDC equals to 0 -2000 ppm, 5.0 VDC equals to 1000 ppm)

Input voltage [VDC]	CO_2 concentration [ppm]	Fan speed
0 - 2.1	0 - 420	1
2.5 - 3.4	500 - 680	2
3.8 - 4.6	760 - 920	3
5.0 or mote	1000 or mote	4

Note;

- Input voltage and CO_2 concentration are guidelines, not guaranteed values.
  When the input voltage is in-between, operating fan speed depends on the situations.
- Please select a CO_2 sensor which the relationship formula between CO_2 concentration and output voltage is "2000ppm=10VDC."

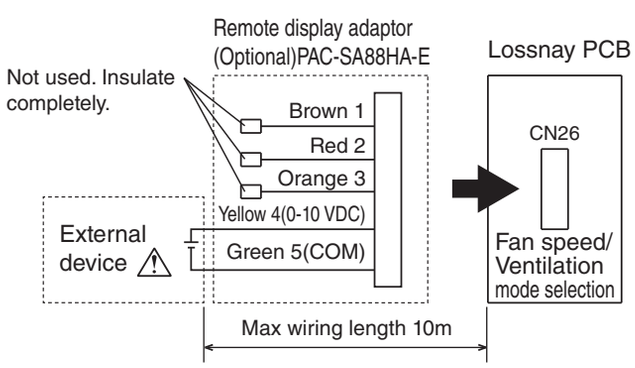
[Pattern Z]

Lossnay changes fan speed as the table below.

Input voltage [VDC]	Fan speed	Fan speed changing from Remote controller
0 - 1.0	-	Available
1.5 - 2.5	1	Not available
3.5 - 4.5	2	Not available
5.5 - 7	3	Not available
8.5 - 10	4	Not available

When the input voltage is in-between, it will cause unstable operation.
When the input voltage is 0 - 1.0 VDC, control from the remote controller is available.

<Wiring>



⚠CAUTION

- Make sure of correct polarity.

<Multiple Lossnay units control>

Refer to 8.2.5 (page C-57)

8.2.4 External Bypass control (CN26)

The ventilation mode of Lossnay is changed to Bypass mode by input from external switch, etc. When SW1 is "ON", the ventilation mode of Lossnay is changed to the Bypass mode regardless of the setting on the remote controller.

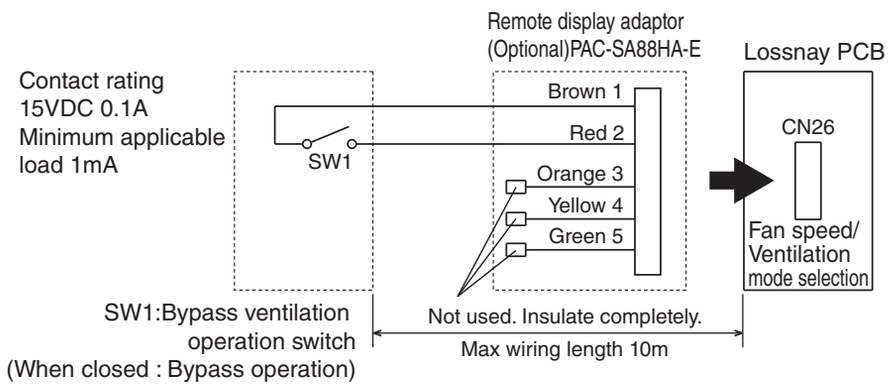
<Operation>

When external ventilation mode control is activated, the icon will be displayed on PZ-61DR-E and it is not possible to change ventilation mode from PZ-61DR-E. When using other remote controllers it is also not possible to change ventilation mode (Once changed, but return automatically). In other word, the external ventilation mode control has higher priority.

Note;

- When the outdoor air temperature drops lower than 8˚C, it changes to the energy recovery mode in spite of the input. (Display of the remote controller does not change.)

<Wining>



<Multiple Lossnay units control>

Refer to 8.2.5 (page C-57)

8.2.5 Sub unit setting (Multiple Lossnay units control by external input)

When using PZ-61DR-E, it is necessary for sub unit to select 'Main unit input priority' or 'Individual input priority'. This function is available to the following external input;

-External fan speed control (CN17 and CN26)

-External Bypass control (CN26)

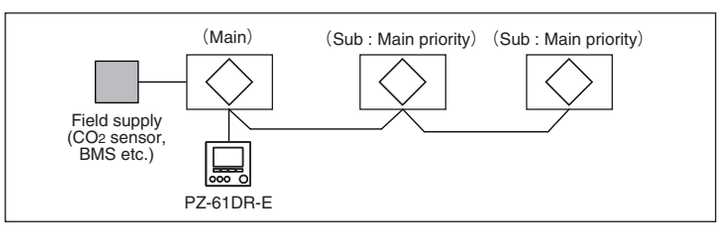
When not using PZ-61DR-E, sub unit does not follow the main unit. See the case 3 below.

<How to set>

DIP-SW		Setting check	PZ-61DR-E		Setting check	Input priority setting
SW No.	Setting		Function No.	Setting Data		
N/A	-	-	34	0 (Factory setting)		Main unit input priority
	-	-		1		Individual input priority

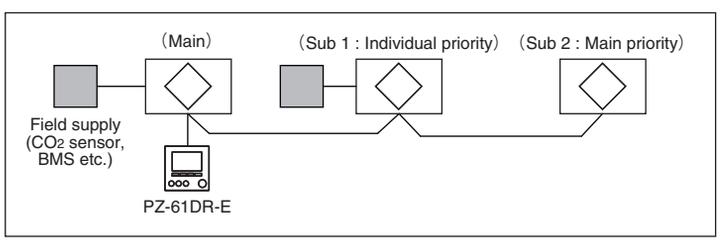
<Usage examples>

Case 1 Sub units follow the main unit

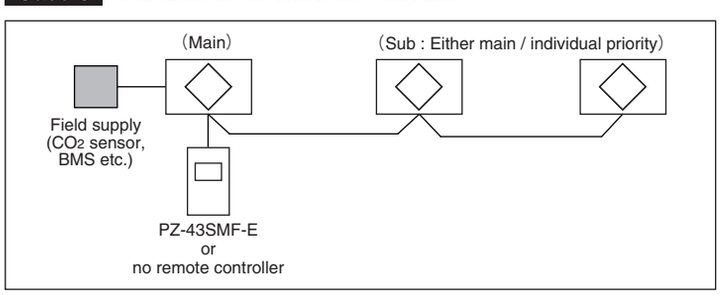


Note; To control sub units by one CO_2 sensor, PZ-61DR-E is necessary.

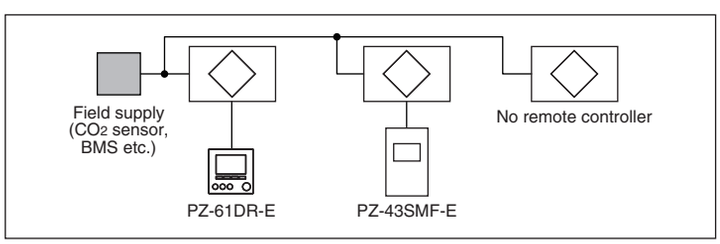
Case 2 Sub 1 unit follows the individual input from CO_2 sensor, sub 2 unit follows the main unit



Case 3 Sub units do not follow the main unit



DO NOT make a system like below.



<Caution>

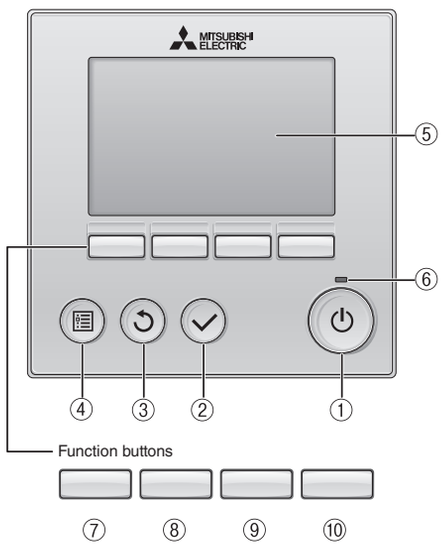
- To input volt-free contact and analogue voltage from one contact or voltage supply into multiple Lossnay PCB is prohibited. Some mulfunction will occur.

CHAPTER 3

Remote controller

1. Lossnay Remote Controller (PZ-61DR-E)

1.1 Controller interface



① ON/OFF button

Press to turn ON/OFF the Lossnay unit.

② SELECT button

Press to save the setting.

③ RETURN button

Press to return to the previous screen.

④ MENU button

Press to bring up the Main menu.

⑤ Backlit LCD

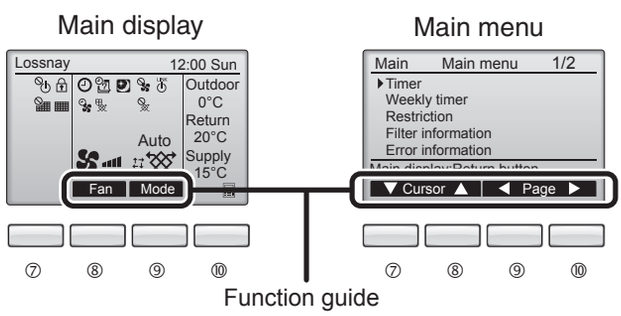
Operation settings will appear.
When the backlight is off, pressing any button turns the backlight on and it will stay lit for a certain period of time depending on the screen.

> When the backlight is off, pressing any button turns the backlight on and does not perform its function. (except for the ON/OFF button)

⑥ ON/OFF lamp

This lamp lights up in green while the unit is in operation. It blinks while the remote controller is starting up or when there is an error.

The functions of the function buttons change depending on the screen. Refer to the button function guide that appears at the bottom of the LCD for the functions they serve on a given screen.
When the system is centrally controlled, the button function guide that corresponds to the locked button will not appear.



⑦ Function button F1

Main menu: Press to move the cursor down.

⑧ Function button F2

Main display: Press to change the fan speed.
Main menu: Press to move the cursor up.

⑨ Function button F3

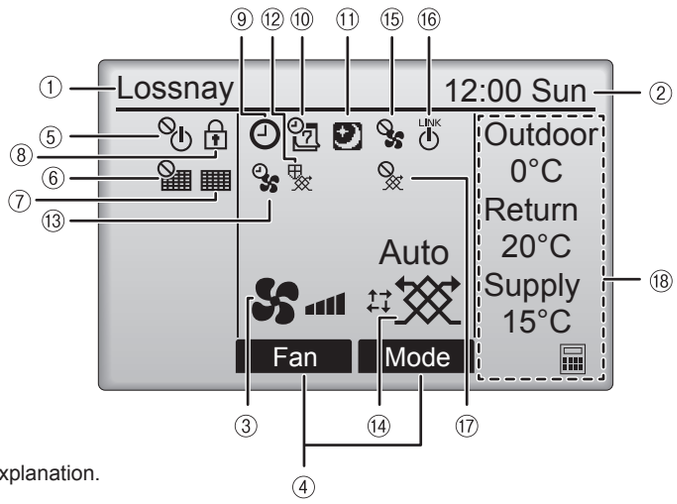
Main display: Press to change the ventilation mode
Main menu: Press to go to the previous page.

⑩ Function button F4

Main menu: Press to go to the next page.

* If LOSSNAY does not have the function or operation is not possible, the operation guide is not displayed.

1.2 Display



* All icons are displayed for explanation.

① Remote controller name

Lossnay is always displayed.

② Clock (See the Installation Manual.)

Current time appears here.

③ Fan speed

Fan speed setting appears here.

④ Button function guide

Functions of the corresponding buttons appear here.

⑤

Appears when the ON/OFF operation is centrally controlled.

⑥

Appears when the filter reset function is centrally controlled.

⑦

Indicates when filter and/or Lossnay core needs maintenance.

⑧

Appears when the buttons are locked and/or a fan speed is skipped.

⑨

Appears when the On/Off timer, or Auto-off timer function is enabled.

⑩

Appears when the Weekly timer is enabled.

⑪

Appears when the night-purge function is available.

⑫

Appears when performing operation to protect the equipment.

⑬

Appears when performing the power supply/exhaust function or the delay operation at the start of operation.

⑭ Ventilation mode

Indicates the ventilation mode setting.

⑮

Appears when external fan speed operation.

⑯

Appears when operation interlocked with external unit.

⑰

Appears when external ventilation mode operation.

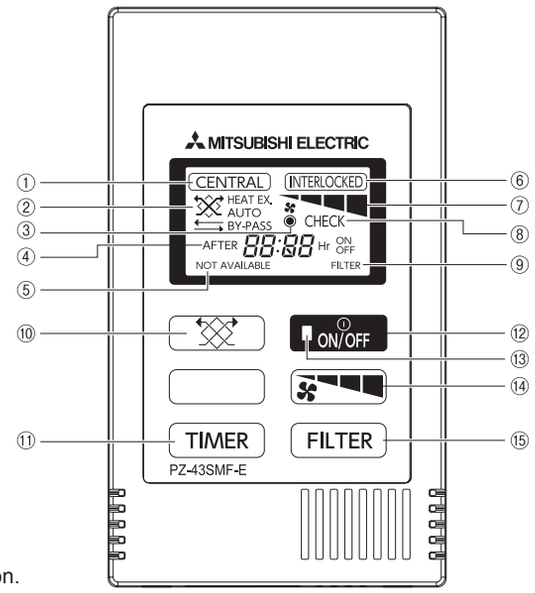
⑱ Temperature

Displays the outdoor temperature, return temperature, and supply temperature (calculated value).

The outdoor temperature indication flashes when 0˚C or lower or 38˚C or higher.
The return temperature and supply temperature (calculated value) indications flash when 8˚C or lower or 38˚C or higher.

Most settings (except ON/OFF, fan speed, ventilation mode) can be made from the Menu screen.

2. Lossnay Remote Controller (PZ-43SMF-E)



* All icons are displayed for explanation.

① [CENTRAL] Display

Displayed during remote operation prohibited by centralized control unit, etc.

② Ventilation mode

Displayed the ventilation mode status.

Heat exchange	HEAT EX.
Bypass	BY-PASS
Automatic (HEAT EX./Bypass)	HEAT EX. AUTO or AUTO BY-PASS

③ Power Display

Displayed while the Lossnay remote controller is powered on.

④ [TIMER] Display

Displayed on-timer or off-timer duration.

⑤ [NOT AVAILABLE] Display

When a button is pressed for a function which the Lossnay unit cannot perform, this display flashes concurrently with the display of the function.

⑥ [INTERLOCKED] Display

Displayed when the Lossnay starts off by interlocked indoor unit or external signal.

⑦ Fan speed Display

Displayed the selected fan speed.

⑧ [CHECK] Display

Displayed together with the malfunctioning unit (3 digits) and an error code (4 digits).

⑨ [FILTER] Display

Displayed when the accumulated operating time reaches at the time set for filter maintenance.

⑩ [Ventilation mode] Button

Used to select the ventilation mode among heat exchange, Bypass or automatic.

⑪ [TIMER] Button

Increasing 0:30 by pressing it once.
Keep pressing the button for fast-forwarding.

⑫ [ON/OFF] Button

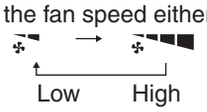
Switch for start and stop.

⑬ Operation lamp

On during operation. Flashes when a malfunction occurs.

⑭ [Fan Speed] Button

Used to select the fan speed either “Low” or “High”.



Note: If this button is pressed when trying to switch the fan speed of a Lossnay unit which is not equipped with the fan speed adjustment, the fan speed display and NOT AVAILABLE display flash and the unit's fan speed does not change.

⑮ [FILTER] Button

Press twice to reset the filter sign display.

Note:

-When power is restored after an outage or when the corresponding breaker for the distribution box is reset, all models will return to the condition before the supply of power was interrupted.

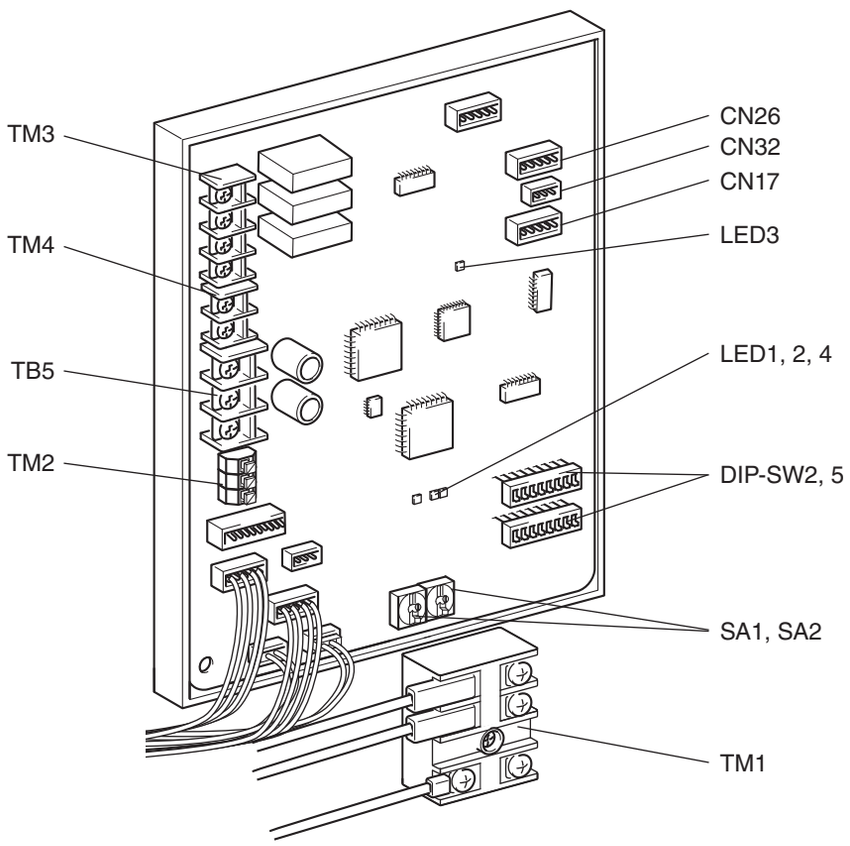
-When the back light is off, the first pressing any button (except “ON/OFF” button) will not activate but make the back light on.

CHAPTER 4

Wiring Diagram

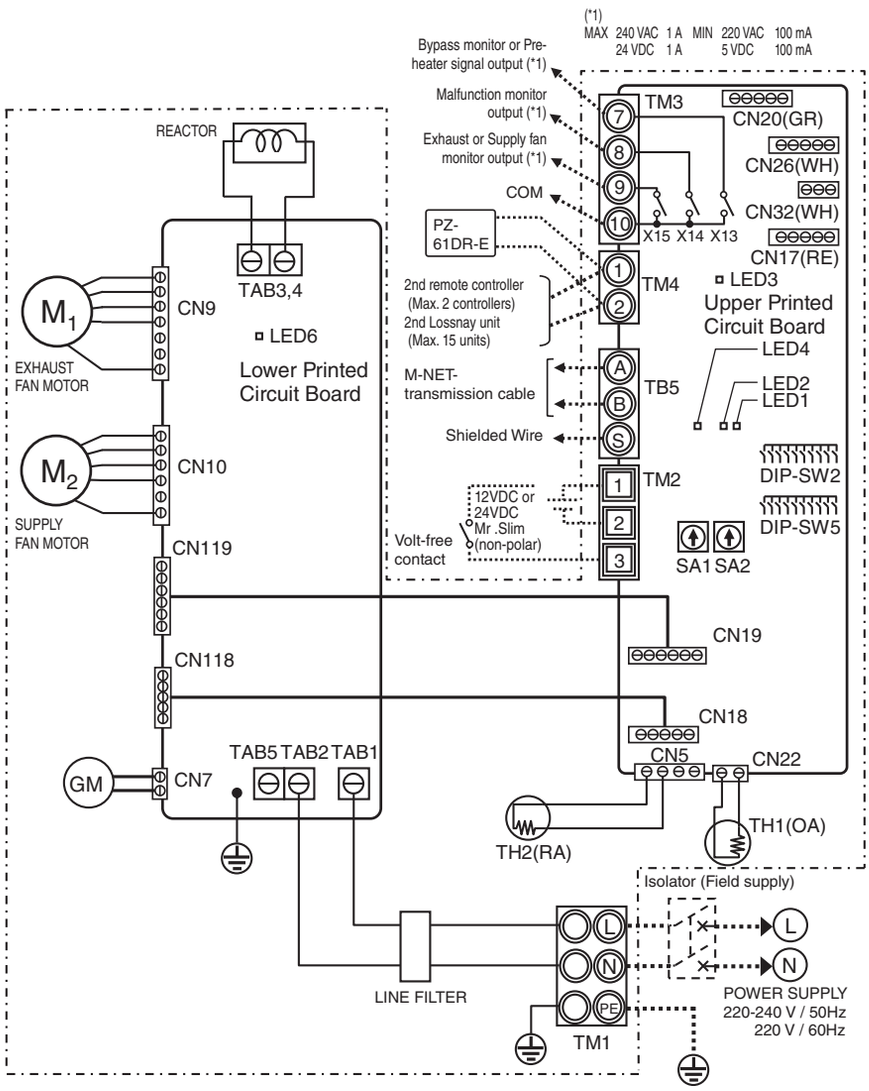
1. Name of components in control box

With this product, the wiring installation method will vary according to the design of the system.
Perform electrical installation to meet local electrical regulations.
* Always use double insulated PVC cable for the transmission cables.
* Wiring work must be performed by qualified professionals.
* All supply circuits must be disconnected before obtaining access to the terminal devices.



2. Wiring diagram --- Models LGH-15 to 100 RVX-E

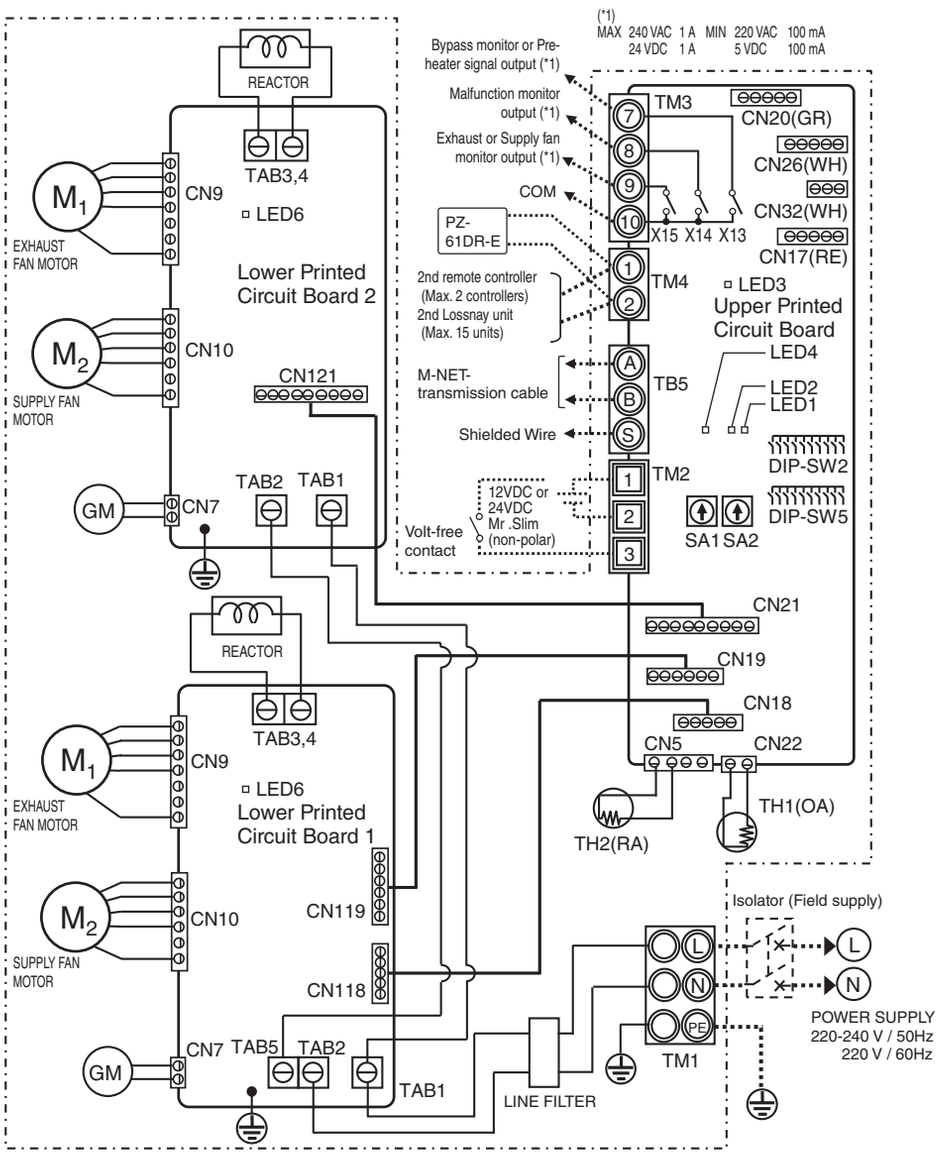
* TM1, TM2, TM3, TM4, TB5 shown in dotted lines are field work.
* Be sure to connect the ground wire.
* A power supply isolator must be installed.
* Always use an isolator for the main switch power connection.



Definition of symbols		
M1: Motor for exhaust fan	X13: Relay contact	CN26: Connector (Bypass, 0 - 10 VDC Fan speed control)
M2: Motor for supply fan	X14: Relay contact	CN32: Connector (Remote control selection)
GM: Motor for Bypass damper	X15: Relay contact	SA1: Address setting rotary switch (10 digit)
TH1: Thermistor for outside air	CN5: Connector (Thermistor RA)	SA2: Address setting rotary switch (1 digit)
TH2: Thermistor for return air	CN7: Connector (Motor for Bypass damper)	LED1 to LED3: Inspection indicator lamp
SW2,5: Switch (Function selection)	CN9: Connector (Fan motor)	LED4, LED6: Power supply indicator lamp
TM1: Terminal block (Power supply)	CN10: Connector (Fan motor)	SYMBOL ◎ ▣: Terminal block
TM2: Terminal block (External control input)	CN17: Connector (Fan speed 1/2/3/4)	▣ : Connector on PCB
TM3: Terminal block (Monitor output)	CN18: Connector	
TM4: Terminal block (Transmission cable)	CN118: Connector	
TB5: Terminal block (M-NET Transmission cable)	CN19: Connector	
TAB1, TAB2, (TAB5): Connector (Power supply)	CN119: Connector	
TAB3,TAB4: Connector (Reactor)	CN22: Connector (Thermistor OA)	

3. Wiring diagram --- Models LGH-150 and 200 RVX-E

* TM1, TM2, TM3, TM4, TB5 shown in dotted lines are field work.
* Be sure to connect the ground wire.
* A power supply isolator must be installed.
* Always use an isolator for the main switch power connection.



Definition of symbols		
M1: Motor for exhaust fan	X13: Relay contact	CN21: Connector
M2: Motor for supply fan	X14: Relay contact	CN121: Connector
GM: Motor for Bypass damper	X15: Relay contact	CN22: Connector (Thermistor OA)
TH1: Thermistor for outside air	CN5: Connector (Thermistor RA)	CN26: Connector (Bypass, 0 - 10 VDC Fan speed control)
TH2: Thermistor for return air	CN7: Connector (Motor for Bypass damper)	
SW2, 5: Switch (Function selection)	CN9: Connector (Fan motor)	CN32: Connector (Remote control selection)
TM1: Terminal block (Power supply)	CN10: Connector (Fan motor)	SA1: Address setting rotary switch (10 digit)
TM2: Terminal block (External control input)	CN17: Connector (Fan speed 1/2/3/4)	SA2: Address setting rotary switch (1 digit)
TM3: Terminal block (Monitor output)	CN18: Connector	LED1 to LED3: Inspection indicator lamp
TM4: Terminal block (Transmission cable)	CN118: Connector	LED4, LED6: Power supply indicator lamp
TB5: Terminal block (M-NET Transmission cable)	CN19: Connector	SYMBOL ◎ □: Terminal block
TAB1, TAB2, TAB5: Connector (Power supply)	CN119: Connector	⊡ : Connector on PCB
TAB3, TAB4: Connector (Reactor)		

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