

# Fan Instruction Manual

**Axial fan** with adjustable-at-rest blades

**快流**®

(KAIRYU / smooth flow)

[Instruction manual for motor direct drive type]



# Fan Instruction Manual

## Introduction

Thank you for purchasing a Showa Denki KAIRYU fan. As a specialized manufacturer of fans and dust collectors, Showa Denki works diligently to manufacture products with our flow technology and rotary equipment technology at their cores. The KAIRYU series are high-performance, low-energy-consumption axial fans based on these core technologies. In order to obtain the best performance from this product and use it safely for a long time without problems, please handle and operate this product according to this instruction manual. Store this instruction manual carefully for future reference.



## Applicable types for this instruction manual

This manual provides instructions on how to set up and use the following fan types:

Fan type:	KAIRYU series (Axial fan with adjustable-at-rest blades)
Fan models:	<b>A□□□□-□□□□</b> The characters in □ will vary according to the fan specifications, including size, compatible motor, performance, etc. For details, refer to p. 5 "Types and meanings of model indications".
Fan drive system:	Motor direct drive type

## Marks used in this manual

The marks used in this manual have the following meaning:

 <b>Warning</b>	Indicates a point, action, etc. for which improper handling may result in death or serious injury.
 <b>Caution</b>	Indicates a point, action, etc. for which improper handling may result in injury or damage to property.



indicates a prohibited action.



indicates a point requiring care.



indicates a compulsory action.

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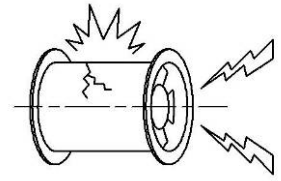
# 1 Safety precautions

## Warning



### **Intake of dangerous gases or installation in dangerous locations is prohibited.**

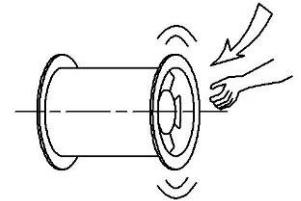
This product does not have an explosion-proof structure. Intake of flammable gases or operation in an explosive atmosphere may result in an explosion caused by sparks due to static electricity, electrical devices, metal contact, etc.



### **Attach metal screens to the inlets and outlets of fans and ducts.**

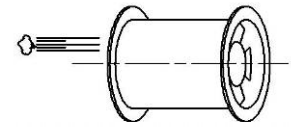
If ducts are not attached to the inlets and outlets of fans or if the ends of the attached ducts are left open, be sure to attach a screen to cover the opening.

If no screen is attached, parts of a person's body or objects may get sucked in or sucked-in objects may be blown out, leading to a serious accident.



### **Do not place your face close to the outlet.**

Small debris, etc. sucked in by the fan may fly out of the outlet at high speed. If such objects get in the eye, it may result in loss of eyesight. Because of this, do not place your face close to the outlet.



### **When hanging, be sure to use the holes labeled "つり位置" (Hang here).**

Hanging by other parts may result in deformation of the fan, or cause an accident by tipping over or falling down.

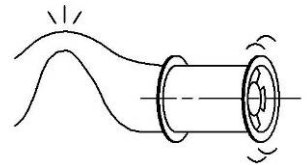


### **Do not increase speed using an inverter, etc.**

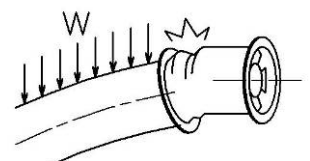
Doing so increases the centrifugal force and air flow pressure force on the rotator, which may cause the impeller to break, burnout of the motor due to excessive loads, etc.

## Caution

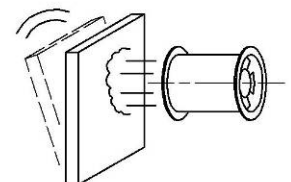
When planning ductwork layout, plan it so that resistance is extremely low and air can flow smoothly through the ducts. If fan is operated with duct shaped so that it is blocked, it may result in stall operation. Abnormal vibrations due to stall operation may cause impeller blades to be broken.



Do not transfer the load of the ductwork to the fan. Doing so may result in deformation of the fan, causing the rotator to come in contact with the housing, resulting in a fire or breakage.



Be sure that there are no objects which may tip over or fall due to vibrations or air flow force in the area around fans or ducts. Such objects may result in an accident in such cases.





Wiring of the motor should be performed according to Electrical Installation Technology Standards and Internal Wiring Standards by a licensed electrician. (Also refer to the instruction manual of the motor.)

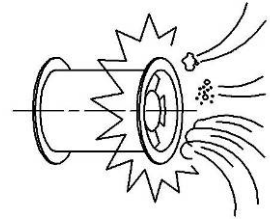


Before performing test operation, make sure that there are no materials, bolts, nuts, tools, etc. left behind after installation inside the connected ducts or casing or near the inlet or outlet. If such objects are left behind, they may be sucked in or blown out during test operation, resulting in damage.



Do not climb or stand on the fan. Doing so may result in deformation and damage of the fan or falling off of the worker.

Intake of gases at temperatures outside the specified temperature range may result in failure of the motor or wiring section or in breakage of the impeller.  
(Temperature range: -10 to 40°C; Relative humidity: 90% or less)



Solid objects, dust, or liquids cannot be sucked in. Doing so may result in damage.



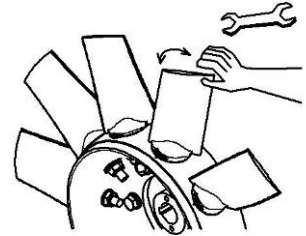
When speed is reduced using an inverter, etc., vibration amplification or sound may occur at specific frequencies (rotation speeds) due to resonance between the fan body, surrounding ductwork, and mounting plates. If this occurs, avoid operation at those frequencies. Shipment inspection\* of the fan is performed only at the rated rotation speed. Operation at other speeds (frequencies) is not guaranteed.

\* Operation testing cannot be performed for non-standard products or parts in some cases.



**Cautions regarding adjustable-at-rest impeller blades**

Although with this fan the angle at which the blades are attached to the impeller can be changed to achieve other performance characteristics, it is also possible that problems may occur due to the following factors if the blade angle is changed by the customer. There is a danger of damage. The blade attachment angles are set at the factory to meet the performance requirements of customers; if the blade angle must be changed later, please consult our company's service personnel. (Service charges will apply.) For details, please contact your dealer or sales office.



**Factors causing problems due to angle change**

- Power may be increased, causing the motor to become overloaded and burned out.
- Changes in the attachment positions of blades may make the impeller unbalanced.
- If the angle change is non-uniform, abnormal flow may occur, causing malfunctions due to abnormal noise or vibration.
- If nut tightening torque is insufficient, the nut may become loose, allowing the blade to rattle and causing a malfunction.



**Precautions for the use of an inverter to operate the blower.**

- 1) The standard motor may not be used for the operation in some cases as shown below.
  - In the case of no margin for temperature rise in the motor
- 2) At factory shipment, the setting of a commercial inverter is not suitable for the blower. Change the following values at least.
  - Base frequency: Adjust to the rated frequency of the blower (50 Hz or 60 Hz).
  - Highest frequency: Adjust to the rated frequency of the blower.
  - Maximum output voltage: Adjust to the rated voltage of the motor.
  - Upper-limit frequency: Highest frequency: Adjust to the rated frequency of the blower.
  - Lower-limit frequency: 25 to 30 Hz (based on the cooling characteristics of the motor).
  - V/f characteristics: Change to square reduction torque.
  - Acceleration time: 30 to 60 sec. or more If the acceleration time is short, an over-current error may occur.
  - Deceleration time: 30 to 60 sec. or more If the deceleration time is short, a regenerative current error may occur.
- 3) Other precautions
  - Vibrations of components (belt, casing, etc.) making up the blower may increase at a specific frequency. If the increase in vibration cannot be eliminated even after other set values are changed, a resonance point may be causing it. In such a case, set the jump frequency to prevent the increase in frequency.
  - If the blower is installed on a vibration isolation table (rubber, spring, etc.), a decrease in frequency may become a resonance frequency. In such a case, set the jump frequency to prevent this symptom (otherwise, the blower and motor are individually affected).
  - If the carrier frequency is set higher, current leakage may increase, and the earth leakage breaker may be activated.
  - Do not use the inverter output power for applications other than electric motors.

For details, see "Use of inverter (frequency converter)" on page 20.

## 2 Product overview

### 2.1 Types and meanings of model indications

The types and meanings of model indications for standard specifications are shown in the table below. The model indication is shown on the product nameplate on the side of the fan body (casing).

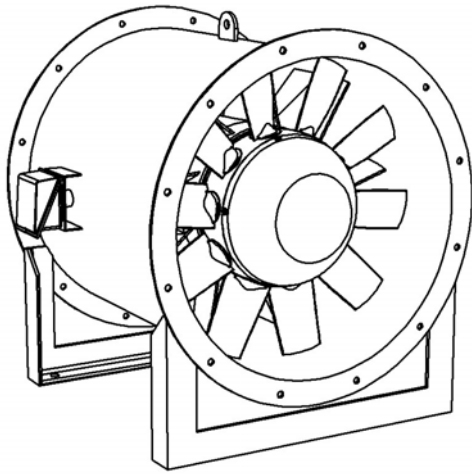
	1	2	3	4	5	6	7	8	9	
Indication example	<b>A</b>	<b>1</b>	<b>D</b>	<b>6</b>	<b>E</b>	<b>-</b>	<b>4</b>	<b>1</b>	<b>2</b>	
Indication meaning	Classification	Type (Motor rotation speed)	Drive system	Casing diameter (mm) / 100	Motor output (kW)	-	Performance number (Blade angle number)	Voltage (V)	Frequency (Hz)	
Indication types/contents	A Axial fan	1 Low-noise type (low-speed specifications)	D Motor direct drive type	3 300	A 0.4	-	1 2 3 4 5 6 7 Large → Air volume → Small	1 200	1 50	
		2 High-pressure type (high-speed specifications)		V V-belt drive type	4 400			B 0.75		2 230
5 500	C 1.5	3 346								
6 630	D 2.2	4 380								
7 710	E 3.7	5 400	2 60							
8 800	F 5.5	6 460								
9 900	G 7.5	7								
10 1000	H 11									
				I 15						
				J 18.5						
				K 22						
				L 30						
				M 37						
				N 45						

The combination of type (motor rotation speed) indication and motor pole count are shown below.

Indication	Motor pole count	
	Small type; Diameter: ≤7	Large type; Diameter >7
1	4P	6P
2	2P	4P

## 2.2 Product structure and names of parts

### 2.2.1 Outline view

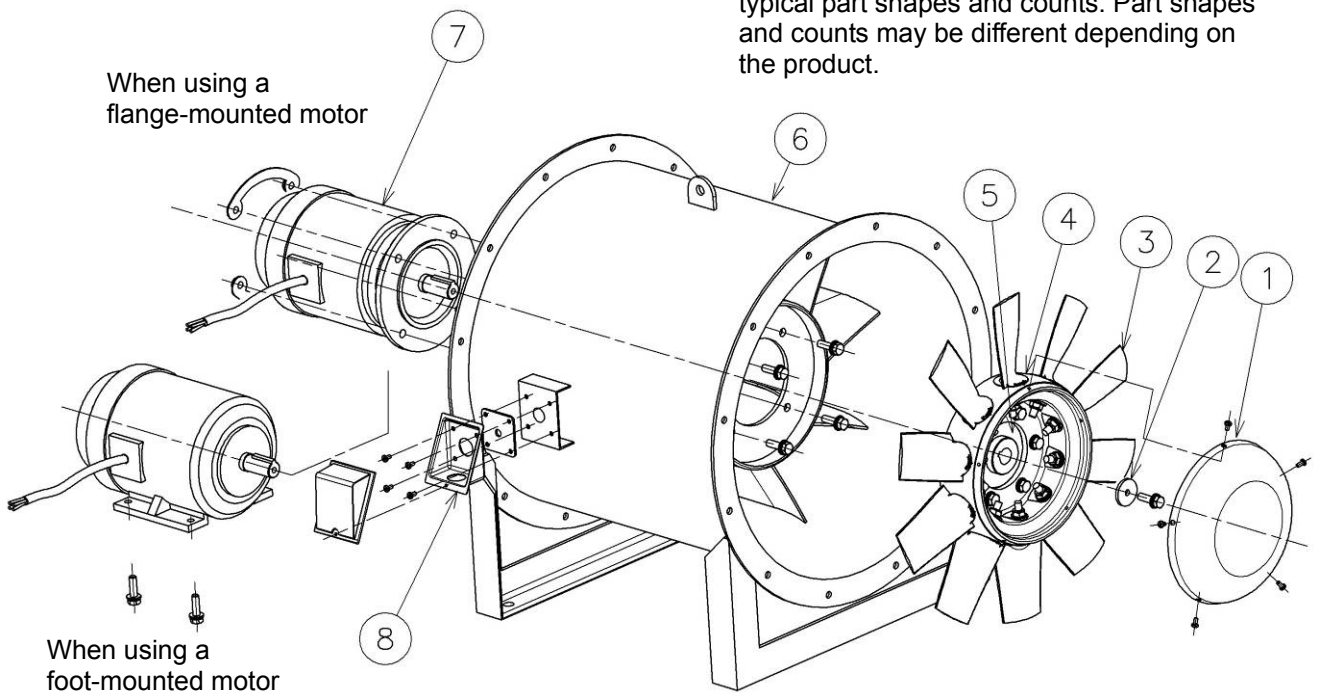


### 2.2.2 Parts list

No.	Part name	Material
1	End cover	A1050P
2	Holder	SS400
3	Impeller blade	AC4A or AC4C
4	Wheel hub	AC4A or AC4C
5	Impeller hub	FC200
6	Casing	SS400, SPHC
7	Motor	-
8	Terminal box	-

### 2.2.3 Exploded view

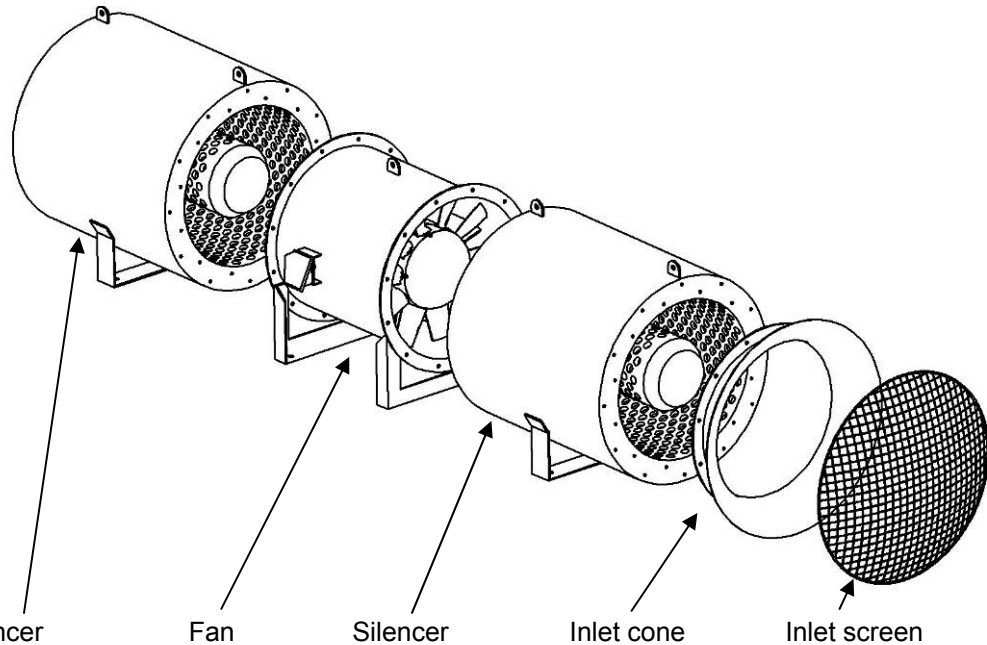
Note: The diagram is an example and shows typical part shapes and counts. Part shapes and counts may be different depending on the product.



Models which casing diameter is under  $\phi 400$  are one casting type for the part No.3, 4 and 5 on upper diagram (some models are excluded).



## Options



Silencer: Reduces drive noise by approximately 10dB\*.

Inlet cone: When using fan with inlet side open, this cone should be attached to maintain performance.

Inlet screen: When using fan with inlet side open, this screen should be attached to ensure safety.

\* Degree of sound reduction depends on installation conditions.

## 3 Receiving

### 3.1 Unloading upon receipt and product verification

Although each product undergoes thorough inspection and only products that pass inspection are shipped, please verify the following points upon receipt of the product:

- \* Fan is as ordered.
- \* No abnormalities such as breakage, deformation, etc. occurred during shipment.
- \* All accessories are included.
- \* Bolts and nuts have not loosened.

### 3.2 Movement/transportation

When lifting the fan to move or transport it, always be sure to use the holes labeled "つり位置" (Hang here) for lifting. For safety, the fan should be lifted by at least 2 labeled hangers (except for products with only 1 hanger). Lifting should be performed by licensed personnel only.

### 3.3 Storage until installation

When fan will be stored until installation, even if the storage location is indoors, cover the entire unit with waterproof sheeting. (This is also true for outdoor specifications.) Also, to prevent rusting of the bearings, etc., turn the impeller about 10 times once per month. If turning by hand, be careful that your hand does not get caught.

## 4 Installation

### 4.1 Mounting

#### 4.1.1 Selecting mounting location



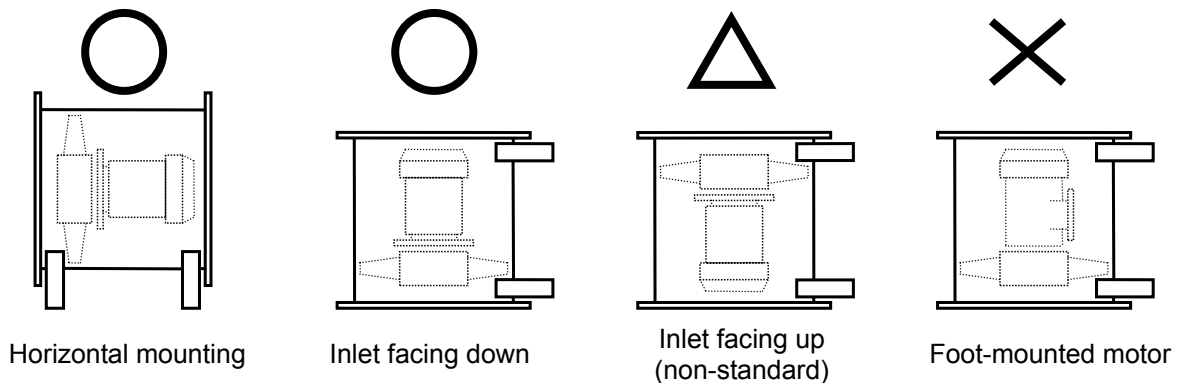
The fan should be installed in locations that meet the following conditions:

- ◇ Locations which are within the temperature range where condensation does not occur. (Temperature range: -10 to 40°C; Relative humidity: 90% or less)
- ◇ Location where daily inspection and maintenance can be performed easily.
- ◇ Indoors where rain water will not fall on it.
- ◇ Stable location which is not subject to vibrations.

- ◇ Location where no dangerous chemicals are present.

#### 4.1.2 Foundation and mounting

- ◇ For the amount of foundation concrete to use, a general reference is that an amount equal to 3 times the weight of the fan is suitable.
- ◇ When mounting on top of a frame, be sure to mount it on a surface having sufficient structural strength.
- ◇ If there is a gap between the fan and the foundation surface, use liner plates (steel plates for filling gaps) to fill the gap and verify that the fan does not rock before tightening the foundation bolts.
- ◇ When mounting in the middle of a duct, take the weight of the fan into consideration and be sure to use duct having sufficient strength. In addition, if necessary use hanging bolts, wire cables, etc. to support the weight of the fan.
- ◇ Be sure to fully tighten bolts and nuts.
- ◇ Mounting orientation should be horizontal or with the inlet facing down. Mounting with inlet facing upward is non-standard. In addition, vertical mounting of fans with foot-mounted motors is not correct.

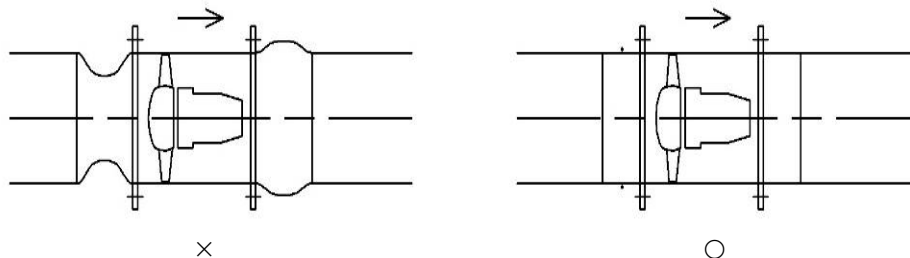


- ◇ If the fan will be mounted in a high location and especially frequent inspection or repairs are expected, lifting equipment should be installed.

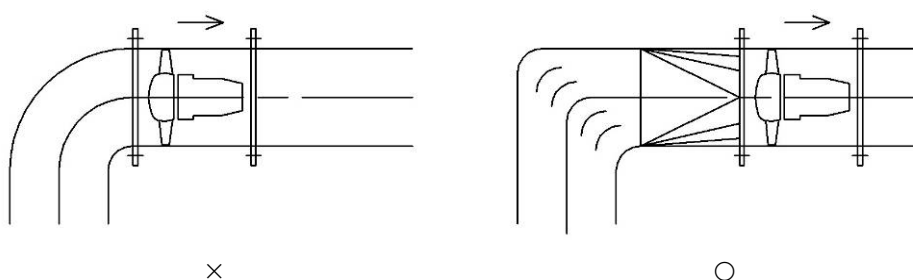
#### 4.2 Connection to ducts

- ◇ Install removable ducts for maintenance and inspection holes before and/or after the fan. (Be sure to provide enough space for removing ducts and performing inspection.)
- ◇ Install screens at the duct inlet and/or outlet for safety. (Screens are optional accessories.)
- ◇ If the ductwork is not suitable, not only will resistance be increased and air flow be insufficient, the fan may operate stalled. This may result in breakage. Be careful of the following points when installing ductwork.

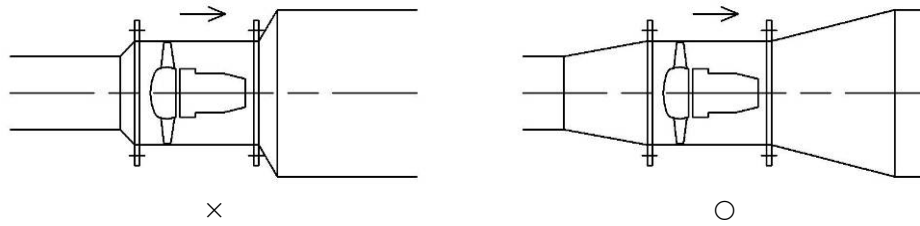
- (1) When using expansion/contraction joints, be sure to apply sufficient tension. In particular, install a collapse-prevention reinforcement ring on the inlet-side expansion/contraction joint so that it does not collapse due to vacuum and use the minimum possible length.



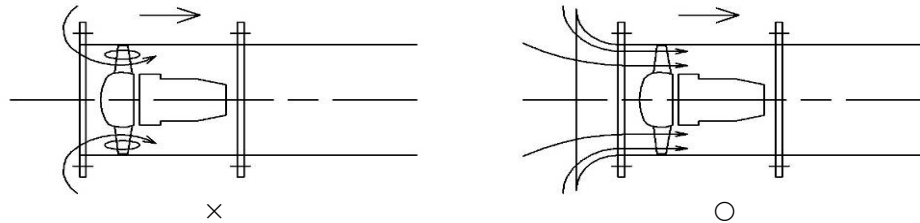
- (2) For small-radius-curve elbows, install corner vanes.



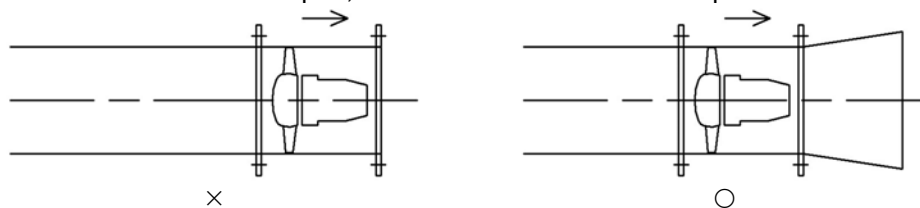
- (3) Avoid sudden expansions or shrinkage in diameter.



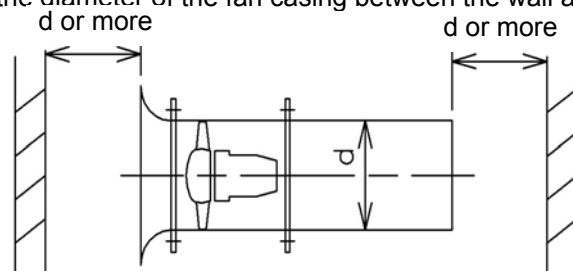
- (4) When the inlet will be left open, install the inlet cone to maintain performance.



- (5) When the outlet will be left open, install the diffuser to maintain performance.



- (6) Leave at least the diameter of the fan casing between the wall and the fan inlet or outlet.



### 4.3 Electrical wiring



- ◇ Wiring of the motor should be performed according to Electrical Installation Technology Standards and Internal Wiring Standards by a licensed electrician.
- ◇ For the power source for this fan, check the product nameplate and use the specified power source. If operation is performed using a different power source, there is a danger of malfunction. The product nameplate is attached to the fan casing.
- ◇ Select an earth leakage circuit breaker and/or circuit breaker that is suitable for the starting current.
- ◇ Be sure to connect the earth wire to prevent electrical shock.
- ◇ Also refer to the motor instruction manual.
- ◇ Be sure to wire the fan properly so that the rotation direction is correct. (For details, refer to section 4.4).

### 4.4 Test operation

Before performing test operation, be sure to inspect the following points and verify that there are no abnormalities before starting operation.

- ◇ Make sure that there are no materials, bolts, nuts, tools, etc. left behind after installation inside the connected ducts or casing or near the inlet or outlet.
- ◇ Check that there is no looseness in the mounting and that all bolts and nuts have been securely tightened.
- ◇ If the inlet or outlet is open, be sure that metal screens are installed.
- ◇ Check wiring.
- ◇ After verifying that there are no abnormalities in the above items, switch on the power and immediately switch it off again (momentary operation). In addition to checking whether there are any abnormal vibrations or contact noise, also check the rotation direction. (There is a sticker on the fan casing indicating the rotation direction.) If the rotation direction is opposite, the air from this fan will also flow in the opposite direction.



- ◇ If the rotation direction is opposite, switch off the main power. Swap the connections of two of the three power cables. Then test operation again and check the rotation direction. Since the wire color and power source phase may vary according to the power company, rotation may be opposite even if the matched wire colors are connected. When first applying power, be sure to check the rotation direction.
- ◇ If no abnormalities are found during momentary operation, start continuous operation. Record that there are no abnormal noises, measure and record the vibration value and current value, and check whether they are acceptable or not.
- ◇ When using a flow volume adjustment damper, set it to full open before starting, and then after starting gradually close the opening. When closing and opening the damper, there may be an increase in noise or vibrations or a drop in pressure. If this occurs, do not close the opening further; instead, open it more. These phenomenon are due to stall operation. For these reasons, controlling the flow volume by adjusting the impeller blade angle or by inverter speed control is recommended instead of using a damper.

## 5 Operation

### 5.1 Operation, maintenance, and inspection

Periodic maintenance and inspection are required to operate the blower safely. If the daily inspection is performed on the following items and the results are recorded, abnormalities can be detected early to prevent problems.

- 1) Check for vibration or abnormal sound once every three months and inspect the insulation once a year. Inspect the motor while referring to its instruction manual.
- 2) It is recommended to replace the shaft seal or packing at the same time as the bearing is replaced even though the replacement cycle may vary depending on the deterioration status or operating environment.
- 3) When the blower used is an air-cooling type or quasi-moisture-proofing type blower, or when air containing dust is taken in, gas contact parts (e.g., inside of the casing, impeller, etc.) can be badly corroded and the rotation contact portion can be significantly worn. Therefore, the inspection cycles should be shortened.

Inspection item		Recommended inspection cycle			Inspection contents	
		3 months	6 months	12 months		
Condition inspection	Abnormal noise	Blower	■	□	□	Check for abnormal noise due to rattles. Check for metal contact noise. Check for other noise considered to be abnormal.
		Motor	■	□	□	Check the grease. Check for loose bolts. Check the bearings for abnormal noise.
	Vibration		■	□	□	Check the vibration value and any changes to it.
	Temperature		■	□	□	Check the temperature near the bearing and any changes to it.
	Electrical section		□	■	□	Check the current value and voltage value, and any changes to them.
Component inspection	Coupling Rubber bushing		□	■	□	Check for hardening. Check for wear or cracks.
	Anti-vibration rubber		□	■	□	Check for hardening. Check for wear or cracks.
	Shaft seal		□	□	■	Check for cracks or damage.
	Packing		□	□	■	Check for damage or hardening.

### 5.1.1 Abnormal noise



If an abnormal noise occurs, stop operation immediately and perform inspection.

Possible types and causes of abnormal noise:

- ◇ Bearing noise  
Abnormality or end of service life of motor bearings
- ◇ Contact noise  
Impeller or casing deformation/damage  
Intake of foreign object  
Looseness due to loose bolt
- ◇ Vibration noise  
Please refer to the following section "Vibrations".
- ◇ Pulsating noise (unsteady flow noise)  
Excessive closing off of flow volume  
Excessive resistance of equipment

### 5.1.1 Vibrations



If vibrations exceed the acceptable values, stop operation and perform inspection.

Reference values for acceptable vibration

Motor pole count (P) - Frequency (Hz)	Rotation speed (min <sup>-1</sup> )	Acceptable vibration value (μm; p-p)
6 - 50	Approx. 970	Approx. 118
6 - 60	Approx. 1170	Approx. 97
4 - 50	Approx. 1450	Approx. 79
4 - 60	Approx. 1750	Approx. 65
2 - 50	Approx. 2950	Approx. 38
2 - 60	Approx. 3500	Approx. 32

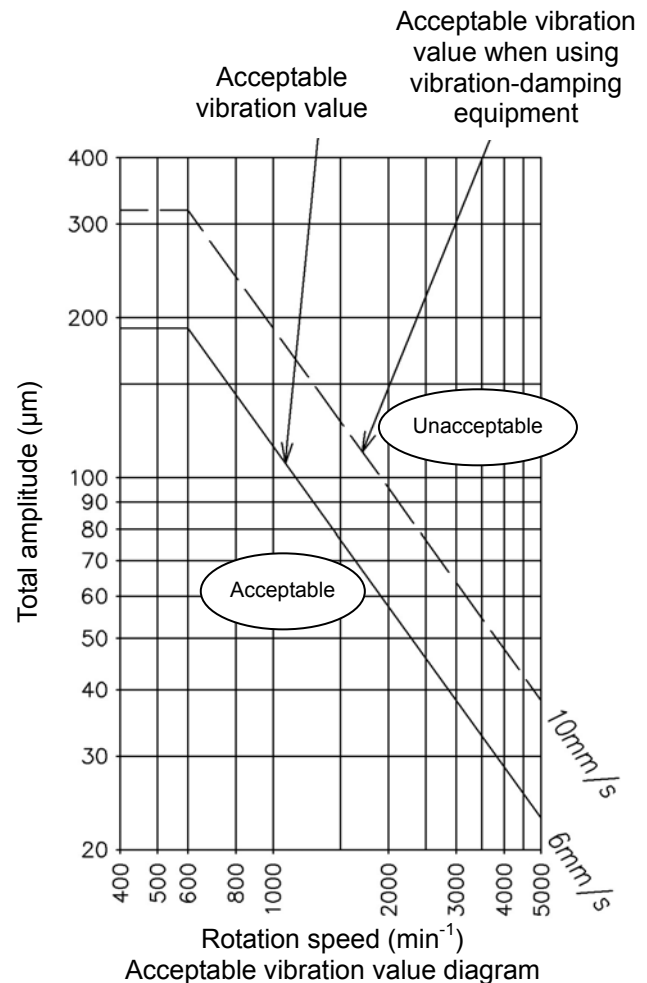
Acceptable value at vibration speed of 6mm/s

Possible causes of vibrations:

- ◇ Unbalance of impeller due to dust adhesion
- ◇ Deformation/damage of impeller or casing
- ◇ Abnormality of motor shaft or bearings
- ◇ Looseness due to loose bolt
- ◇ Stall operation; unsteady flow
- ◇ Transfer or resonance of vibrations from ducts or base
- ◇ Insufficient rigidity of ducts or base

## 5.2 Stopping operation and restarting after stopping

When operation will be stopped, consideration should be given to the storage conditions even if the stopped period will be short. To prevent rusting of the bearings, etc. during the stopped period, turn the impeller by hand about 10 times once per month, or run it empty for about 5 minutes once per month. Also, when restarting operation, be sure to perform the same inspections as were done for test operation. In particular, be sure that nothing is adhered to the impeller and check that there is no corrosion.



## 6 Warranty

### Scope of warranty

Repair service is provided free of charge for a failure during the warranty period, as long as the blower has been used in compliance with these Operating Instructions, labels attached to the body, and other instructions.

In the case that this product is incorporated into other equipment used by the customer, the warranty does not cover costs for removal from such equipment, reattachment to such equipment, costs of other incidental work, costs of transportation etc., resulting opportunity loss incurred by the customer, lost operation, or any other indirect loss or damage suffered by the customer.

- For requests for repair service, please contact our nearest branch or sales office.

### Warranty period

One (1) year from the date of delivery of the product.

**Even during the warranty period, only charged service is provided in principle, if any of the following applies:**

- Failure or damage due to incorrect use that is not compliant with these Operating Instructions, labels attached to the body, or other instructions, and/or unauthorized repair or modification
- Failure or damage due to transportation, dropping, etc. after the purchase
- Failure or damage due to fire, earthquake, storm, flood, lightening or other natural disasters, environmental factors such as salt damage and public pollution, abnormal voltage, use of a power supply (voltage or frequency) other than that specified, or the like
- Failure or damage due to repair or modification (including punching, etc. in the product) not conducted by our company
- Failure or damage due to the use of parts other than those designated by our company
- Failure or damage due to the entry of foreign material
- Discoloration, scratching, natural consumption of consumable parts or other defects due to use or deterioration over time
- Failure or damage caused by neglecting the maintenance and inspection described in the Operating Instructions

**We will not compensate for any loss or damage resulting from defects that occur during the use of this product.**

[Notices]

- (1) The descriptions in these Operating Instructions are subject to change without prior notification in the future.
- (2) We have made all possible efforts to prepare these Operating Instructions. However, if you have any questions about them or find any inquiries, errors, omissions, etc., please contact our nearest branch or sales office.
- (3) If the power supply frequency changes due to a change in the location where the blower is used, it may not be used as it is. We will consider a measure in each case where it is required. In such a case, please contact our nearest branch or sales office.
- (4) At the time of inquiry, please describe the product type and the manufacturing number indicated on the product nameplate.

## 7 Malfunction causes and countermeasures

Fan malfunction causes and countermeasures

<div style="text-align: center;">Malfunction status</div> <div style="text-align: left;">Malfunction cause</div>	Overs and shorts of quantity of wind, the static pressure	Excess/short of motor	Bearing overheat/burnout	Abnormal vibration	Peculiar noise	Corrosion and wear	Abnormal contact	Motor not activated	Measures
Defective installation			○	○	○		○	○	Re-installation
Poor foundation			○	○	○				Renovation
Contact with the rotator?		○	○	○	○		○	○	Processing of contact part, and re-installation
Defective duct/duct joint	○		○	○	○		○	○	Renovation
Defective lubricating oil			○						Replenishment
Inappropriate oil quality, contamination, excessive amount of oil			○						Replacement or recycling
Inappropriate material				○	○	○			Replacement
Unbalanced impeller			○	○	○		○		Correction
Deformation or damage of impeller				○					Repair or replacement
Wear or corrosion of impeller	○			○					Repair or replacement
Operation at a dangerous speed			○	○	○		○		Renovation or remodeling of operation point
Abnormal bearing of the motor			○	○	○				Replacement
Wrong rotation direction	○	○			○		○	○	Change
Malfunction of the motor	○	○		○	○			○	Repair or replacement
Intake of light gas	○								Renovation/replacement of impeller
Intake of heavy gas	○	○							Renovation/replacement of impeller
Mixture of foreign object or adhesion of scale	○	○		○	○	○	○	○	Cleaning
Surging operation	○			○	○				Change of operation point
Resistance to the pipe system	○				○				Renovation
Failure of damper	○	○		○	○			○	Repair
Accumulation in the drain		○		○	○	○		○	Draining
There is less pressure loss than a plan	○	○							Damper adjustment, change of the rotary speed

