Instruction Manual

Centrifugal Fan

Turbo fan Type　CTFⅡ / CTF3
CTF-B / CTF-BⅡ
CTF-A / CTF-HA
Plate fan Type　CPFⅡ/ CPF-BⅡ

Note

Thank you for purchasing a TERAL Fan.
Do not operate, maintain, or inspect the fan until you have read and fully understood this instruction manual.
Retain this manual where it can be consulted at any time of operation, maintenance and inspection of the fan.

To whom is performing the utility work:

Please submit this manual to the customer performing the operation, maintenance and inspection of the fan.

TERAL INC.

Limited warranties

1. In the event of failure or breakage under proper use of the product during the warranty period, equipment supplied by TERAL INC. will be repaired or replaced free of charge within the scope of the relevant part, provided that such failure or breakage is attributable to inadequacy of the design or workmanship of the equipment.
2. The warranty mentioned in the above clause shall be only the mechanical warranty of the defective part, and shall not cover any expenses or other damage arising from the failure or breakage.
3. In the event of the following failures and breakage, the costs of the repairs shall be for the account of the user.
   (1) Failures and breakage attributable to equipment that was not delivered by TERAL INC.
   (2) Failures and breakage after the expiration of the warranty period
   (3) Failures and breakage caused by disasters or force majeure, such as fire, acts of God or earthquakes
   (4) Failures and breakage resulting from repairs or modifications made without the consent of TERAL INC.
   (5) Failures and breakage when parts other than those designated by TERAL INC. are used
4. TERAL INC. shall not be liable for the damage caused by incorrect or reckless use of the fan. Cost and expenses incurred for sending engineer(s) in such a case shall be borne by the user.
5. If the cause of the failure is unclear, necessary actions shall be determined through mutual consultation.

Purpose of this manual

The purpose of this manual is to provide the user with detailed information necessary to properly operate, maintain and inspect the fan.

This manual contains the following information and is intended for persons experienced in the operation of fans, or for those who have been trained by such experienced persons. Only qualified personnel such as electrical engineers are allowed to carry out the electrical wiring work.

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1. Safety precautions

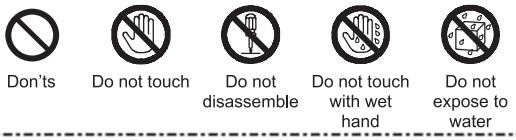
1.1 Types and meanings of warning terms

This instruction manual divides precautions into the following four categories according to the level of hazards (or the severity of the accident).Be sure to understand the meanings of the following terms and comply with the content (instructions) of the instruction manual.

■ Explanation of warnings

Safety sign	Meaning
Danger	Indicates an imminently hazardous situation. Failure to observe this will result in death or serious injury.
Warning	Indicates a potentially hazardous situation. Failure to observe this will result in death or serious injury.
Caution	Indicates a potentially hazardous situation. Failure to observe this will result in minor or moderate injury or property damage.
Note	Indicates information that is in particular to be noted or emphasized.

■ Explanation of the graphic symbols



These graphic symbols indicate prohibited actions (that must NOT be done).

This graphic symbol indicates mandatory actions (that must be done).

These graphic symbols indicate existing hazards to beware of.

1.2 Safety precautions

Warning	
Instruct the vendor to move and carry the fan in consideration of the center of mass and its weight. Otherwise, the fan may fall, thus leading to an injury or damage.	Do not carry out any work with/on the fan that is being lifted. Otherwise, the unit may fall, thus leading to an injury or damage.
Before hoisting the fan, refer to the catalog, dimensional outline drawing, and other documents to check the weight of the units. Do not hoist any unit if its weight exceeds the rated load of the hoisting equipment/devices. Otherwise, the fan may fall, thus leading to an injury or damage.	Do not hoist the whole unit using the main shaft of the fan, the eyebolt on the motor, or any other parts not intended for the purpose. Otherwise, the unit may be damaged.
Only those who are authorized by the site manager are allowed to operate the fan. Operation by unskilled personnel may lead to an unforeseen accident.	Installation, maintenance, and inspection must only be carried out by personnel who have been trained to handle the fan. Operation by unskilled personnel may lead to an unforeseen accident.
Only qualified personnel, such as licensed electrical engineer, is allowed to carry out electric work. Otherwise, it may lead to an electric shock, fire, failure, or other problems.	Use high-quality wiring equipment and devices, and carry out wiring work safely and securely according to the technical standards for electrical facilities, as well as the indoor wiring regulations. Otherwise, it may lead to an electric shock, fire, or other problems.
Do not connect the ground wire to a gas pipe, water pipe or lightning rod. Such a connection is illegal and leads to an electric shock, explosion, or fire.	Securely install the ground wire and ensure to carry out grounding work. Otherwise, it may lead to an electric leak or electric shock.
Do not operate the fan if abnormal condition is observed in any operation, movement, parts, etc. Otherwise, it may lead to an injury, failure, or various accidents.	Correctly and securely connect the wires according to the wiring diagram within the terminal box and the instruction manual. Incorrect wiring may cause a fire, electric shock, failure, or other problems.

⚠ Warning

Be sure to keep the terminal box cover attached before turning on the power. Otherwise, it may lead to an electric shock.	Be sure to install a belt guard, bearing guard, and coupling cover during running the fan. Otherwise, it may lead to an injury or damage.
The main shaft, impeller, V-belt pulley, and V-belt are rotating during operation. Be extra careful not to get your clothes or other parts caught in these parts. Otherwise, it may lead to an injury or damage.	Do not forcibly bend, pull, or pinch the power cable or any lead wires of the product. Otherwise, it may lead to an electric shock or fire.
Check the wiring sections and wires for any looseness. A loose connection may cause a fire or electric shock.	Before starting the maintenance or inspection work, be sure to stop the fan and turn off the main power of the panel board. Otherwise, it may lead to an electric shock, injury, damage, or leakage.
Before starting the fan or carrying out maintenance/inspection work, ensure that all the relevant workers are informed of the operation and that there are no workers in the dangerous zone. Otherwise, it may lead to an unforeseen accident.	Before rotating the fan shaft by hand to check its smooth rotation, be sure to turn off the main power. Otherwise, it may lead to an injury or damage.
After turning on the power, do not touch the fan other than those required for operation. Otherwise, it may lead to an electric shock or injury.	Be sure to install a protective wire mesh on the suction port of the fan if it is open. Otherwise, it may lead to an injury or damage.
If the blowing gas is hot, do not touch the fan body or ducts. Touching the hot surface may result in burns.	Do not use it if the insulation resistance of the motor is 1MΩ or less. Otherwise, it may cause damage to the motor, electric shock or fire.
Do not put your fingers or foreign objects into any openings or rotating part of the motor during operation. Otherwise, it may lead to an injury or damage.	For overhaul, parts replacement, and repairs that involve disassembly, contact TERAL INC. If unskilled personnel carry out work that requires special knowledge, it may lead to an accident or failure.
In the event of a power failure, be sure to turn off the main power supply. Otherwise, the fan may suddenly start up on restoration of the power, thus leading to an injury.	If you leave the fan unused for a long time, be sure to turn off the main power. Otherwise, it may lead to a fire or electric shock.
Be sure to turn off the main power before changing any wiring of the fan. Otherwise, it may lead to an electric shock or injury.	Be sure to install a ground fault interrupter to the main power.
Do not put your fingers or any rods into the suction port or blowout port.	Do not place any objects around the suction port or blowout port of the fan.
Regularly inspect your equipment and perform maintenance on each component.	If motors or control panels are used for more than a certain period of time, it may cause ignition or other accidents due to aging deterioration.
Electric motor or control panel insulation degradation may result in electric leakage, electric shock, or fire. Keep the ambient temperature at 0 to 40°C with sufficient ventilation to prevent damage to the equipment and deterioration of its life. Avoid dust, corrosive or explosive gases, salinity, humidity, condensation. For indoor installations avoid direct sunlight or wind and rain.	

⚠ Caution

Do not use the fan outside the range of the product specifications. Otherwise, it may lead to an electric shock, fire, leakage, failure, or other problems.	Do not use the fan at an incorrect power voltage. An incorrect voltage may damage the motor.
Do not use a single fan unit as the only means of directly operating key facilities or sustaining life. In the event of a failure, necessary ventilation may not be performed due to malfunction. Ensure to make a backup unit available for operation.	Before unpacking the delivered container, check that the container is placed in the correct orientation (not upside down). Carefully unpack the container, while paying special attention to nails. Otherwise, it may lead to an injury or damage.
Do not install the fan anywhere exposed to direct flame or with any other risk of high temperature. Otherwise, it may lead to damage or fire.	Do not install the fan in any humid places such as the bathroom. Otherwise, it may lead to damage or fire.

⚠ Caution

Do not install the fan in any places where toxic gases are produced from acids, alkalis, organic solvent, paint or other substances or where corrosive gases are produced. Otherwise, it may lead to an injury or damage.	Install the open suction port at a position far away from the exhaust vents of combustion gas and other gases. Otherwise, it may lead to damage or fire.
Do not expose the motor to liquid. Otherwise, it may lead to an electric shock, electric leak, failure, or other problems.	If the fan is fitted with a drain port, be sure to drain water. Water leaking through gaps may cause stains and corrosion on the equipment and surrounding areas.
In the event of an alarm or abnormal condition that cannot be resolved, immediately stop the operation, turn off the power, and then contact TERAL INC. Otherwise, it may lead to an accident.	Do not run the fan with tools or other objects placed on the unit. Otherwise, it may lead to an injury or damage.
Check that the delivered items are exactly what you ordered. The use of a wrong product may cause an injury or failure.	Do not place any combustibles around the product. Otherwise, it may lead to a fire.
Check the rotation direction of the fan before connecting it to the duct. Otherwise, it may lead to an injury or damage.	Do not place any obstacles around the product that may hinder ventilation. Otherwise, it may lead to a fire.
The start frequency of air-conditioning fan should be once a day. Otherwise, the fan may be damaged.	
Do not run the fan if it has any defects or faulty parts. Otherwise, it may lead to an injury or damage.	Periodically clean the fan if dust or oil adheres to the machine. Otherwise, it may lead to an injury or damage.
Do not use a 60Hz model in a 50Hz area. Otherwise, the specified performance cannot be obtained.	Do not use a 50Hz model in a 60Hz area. Otherwise the fan may be damaged, and the motor may burn out.
Be sure to install an overcurrent protection device. Installation is obligatory according to the Electrical Equipment Technical Standards. Failure to do so may result in a fire or damage to the product. It is also recommended to install a protective device such as a leakage circuit breaker.	Do not touch any terminals or wires when measuring the insulation resistance. Otherwise, it may lead to an electric shock.
The impeller must not be rotating in reverse when the power is turned on. Otherwise the fan may be damaged.	Do not allow the weight of the duct system to be applied to the fan. Otherwise, it may cause vibration of the fan or damage it.
Do not make the duct significantly thinner than the fan diameter, and do not install a curved part immediately before the duct. Otherwise, an unexpected pressure loss may occur, resulting in insufficient performance.	Dispose of the product as industrial waste.
When you lift the product by hand, pay attention to its weight. Do not allow a single person to lift a product heavier than 15 kg. Otherwise, it may put strain on the body, thus leading to an injury.	Be sure to conduct inspection according to the Maintenance checklist. Otherwise, you cannot prevent potential failures, thus leading to a higher risk of accidents.

1.3 Location of the warning labels

Figure 1 shows the locations to which each warning label should be affixed. If these labels become dirty and hard to read or if they are peeled off, replace with new ones.

> Warning Caution
>
> Follow all warnings on the labels affixed to the fan and those in the instruction manual.

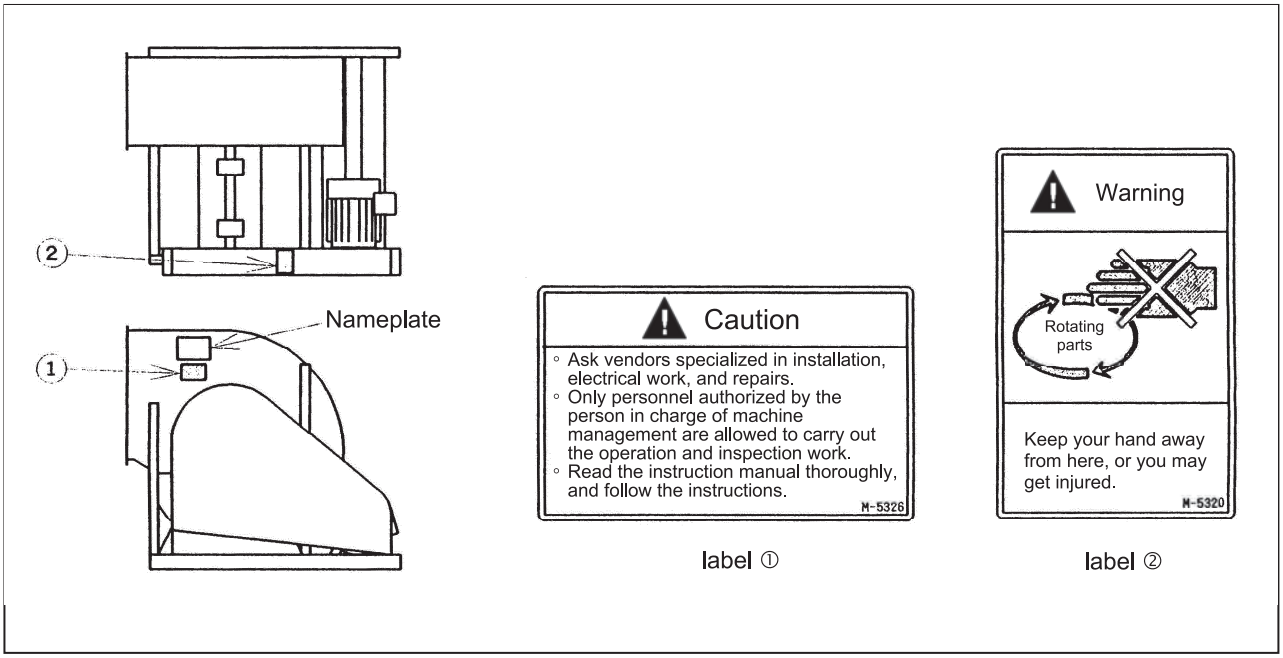
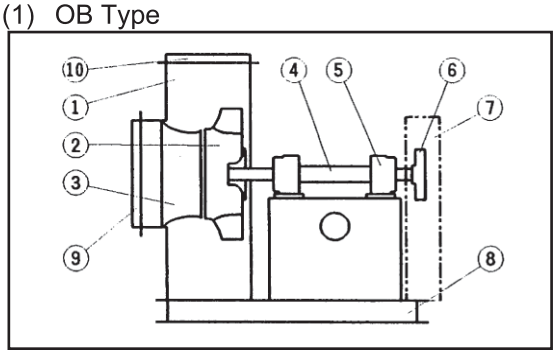


Figure 1 – Example of safety labels and the locations

2. Configuration and overview of the fan

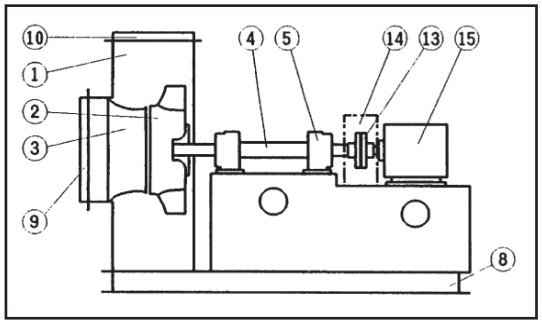
2.1 Construction and name of each part by transmission method

(1) OB Type

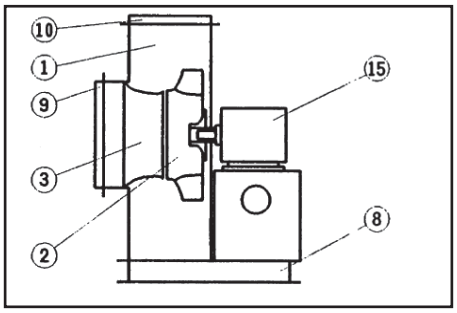


No.	Part name
①	Fan casing
②	Impeller
③	Air intake
④	Main shaft
⑤	Bearing
⑥	V-belt pulley
⑦	Belt guard
⑧	Common base
⑨	Suction flange
⑩	Discharge flange
⑪	Vibration insulating liner
⑫	Vibration insulating base
⑬	Shaft coupling
⑭	Shaft coupling guard
⑮	Motor

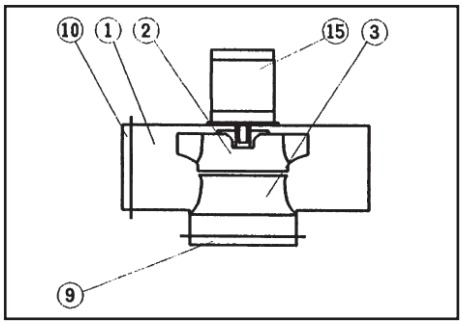
(2) MOB Type



(3) HOH Type



(4) VOH Type



2.2 Specifications and accessories of the fan

If you purchased a standard unit, refer to the standard specifications in the following table. For custom-made units according to special specifications, refer to such specifications including the external dimensions drawing.

Do not use this unit under any conditions other than those provided in the specifications. Failure to observe this may cause an electric shock, fire, and/or product failure.

(1) Standard specifications and special specifications

Standard specifications	Air		Clean air 0°C to 80°C
	Installation location		Indoor (ambient temperature: 0°C to 40°C)
	Installation method		Floor mount
	Motor	Type	Totally closed type (0.4 kW or lower) Drip proof type (0.75 kW or higher)
		Phase, voltage	50Hz, 3 phases, 200V 60Hz, 3 phases, 200/220V
	Painting		Prime and inside coating: Anti-corrosive coating Finish coating: Acrylic alkyd resin paint (Munsell 7.5BG5/1.5)

Special specifications	Structure modifications	Belt guard, with rotation measuring hole (Standard for CTF3)
		Belt guard for outdoor use (Standard for CTF3)
		Belt guard, with rear cover (Standard for CTF3)
		Special orientation of discharge flange
		Casing, upper and lower split
		Hot gas type
	Motor modifications	Totally closed fan-cooled type
		Different voltage
	Paint changes	Painting with polyvinyl chloride resin
		Painting with epoxy resin
		Paint color specified

(2) Standard and special accessories

Standard accessories	Special accessories
Companion flange	Intake mesh
Common base (excluding VOH type)	Intake damper
Vibration insulation base (vibration-proof type only)	Discharge damper
Vibration insulation liner (vibration-proof type only)	Foundation bolt
V-belt pulley on the fan side (only for OB type)	Shaft seal (only for OB and MOB types)
V-belt pulley on the motor side (only for OB type)	Intake filter
V-belt and belt guard (only for OB type)	Connecting pipe
Shaft coupling (only for MOB type)	Expansion joint
Shaft coupling guard (only for MOB type)	
Bearing guard (only for OB and MOB types)	

3. Placement and installation

3.1 Before using the fan

When you receive the delivery of the fan, check the following points first.
If there are any problems, contact the sales agent you purchased the product from.
Handle the motor according to the instruction manual of the motor.
Incorrect handling may result in an accident or failure.

(1) Check the nameplate to verify that the product is the one you ordered.
(2) Check that the discharge direction, rotation direction, and power transmission methods are as ordered.
(3) No parts of the product are damaged during transportation.
(4) All fastening parts including bolts and nuts are securely tightened.
(5) All the accessories that you ordered have been delivered.

3.2 Precautions during transportation and storage

3.2.1. Precautions for transportation

Warning

- Do not step under the suspended fan. The fan may fall onto you.
- For transportation of the unit, ask a specialist company who should move and place it in consideration of the center of gravity and weight.
- Before hoisting the unit, refer to the catalogue or external dimensions drawing etc. to confirm that the weight of the fan does not exceed the rated load limit of the hoisting equipment.
- Do not lift the whole unit using the main shaft of the fan, lifting eyes of the motor, or other parts.

Caution

- Care should be taken to nails especially when opening a wooden box that contains the unit, or you may get injured.

(1) To lift the fan, use the specified lifting eyes on the casing.
(A fan of #61/2 or larger has labels on it to indicate the lifting point.)
(2) If it is difficult to keep the fan level, use the common base etc. when you hoist it.
(3) If the fan is small-sized and has no lifting eyes, lift the fan by running a rope or wire under the common base.
(4) When lifting a split casing or impeller, ensure that the points which a rope or wire would contact are covered with blankets, etc. so that any distortion is prevented.

Note

Any scratches or flaws on coating may cause rusting.
Ensure to carry out repair coating in such a case.

(5) Use as long ropes and wires as possible so that the fan can be lifted at an angle of 90° or less, which prevents the fan from being deformed/damaged by the lifting load.
(6) When the casing surface is covered with lagging (for heat insulation), even a very small load will cause deformation, so ensure that the rope should not contact the lagging surface.

3.2.2. Precautions for storage

(1) Do not allow rust to be formed on the product while you store it before installation. In particular, take measures to prevent any rainwater or dust from entering the inside, particularly the bearing section, for example by covering it with a vinyl sheet.
(2) Store indoor-type motors and other electrical devices indoors. Also for equipment for outdoor use, protect its wiring and cable openings against moisture.
(3) If you store the fan for over one month, remove the V-belt from the unit and avoid a hot, humid, or dusty place.
(4) If a film is wrapped around the fan on shipment and the film is exposed to sunlight or rainwater, it may stick to the product. Pay attention to the location where you store the fan.

3.3 Precautions for the location of installation

Install the fan in a place where the following conditions are satisfied:

(1) This fan is intended for indoor use. If you use it outdoors, either install it in a location not exposed to the wind or rain, or protect the motor, bearing, and other critical parts with covers. Furthermore, install the fan in a location where it will not suck in rain water.
(2) A well-ventilated place with minimum exposure to dust or moisture
If you install the unit in a fully closed room, such as machine room, install a ventilator so that the room temperature does not increase due to the heat generated by the motor.
(3) A place at an ambient temperature of 0°C to 40°C
(4) A place where no unauthorized persons are able to enter or operate the product.
Take measures to prevent unauthorized persons from having access to the fan, for example, by installing a barrier.
(3) A place where the fan can be easily inspected and repaired.
Secure enough space to replace the V-belt pulley and make adjustments for centering (see Figure 2. Installation of the fan [recommended]). If you install the model of a two casing division type, secure enough space to place the upper casing, impeller and other parts as well as to assemble, disassemble and repair the fan.
(5) If you install the fan indoors, ensure that the room has a doorway that is wide enough to allow the fan to pass through.
(6) If it is frequently necessary to replace or repair large-sized fans or impellers due to corrosion or wear, consider using minimal hoisting equipment.

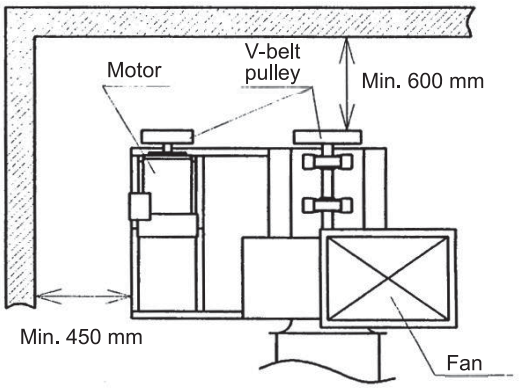


Figure 2 - Installation of the fan (recommended)

Warning

Electric motor or control panel insulation degradation may result in electric leakage, electric shock, or fire.
Keep the ambient temperature at 0 to 40°C with sufficient ventilation to prevent damage to the equipment and deterioration of its life. Avoid dust, corrosive or explosive gases, salinity, humidity, condensation. For indoor installations avoid direct sunlight or wind and rain.

Caution

Do not place any combustibles or objects that may obstruct ventilation around the motor.

The cooling system may be prevented from working, which may result in overheating or fire.

Note

Any scratches or flaws on coating may cause rusting.
Ensure to carry out repair coating in such a case.

3.4 Foundation

(1) The foundation must be strong enough to support the weight and the load and vibration produced by the fan during operation.

(2) The foundation concrete should be constructed such that it keeps its levelness and is not affected by ground subsidence. Reinforce the ground by piling if it is soft or weak.

(3) The weight of the foundation must be two to four times the total weight of the fan including the motor.

(4) The unit's foundation should be isolated from vibrations of the structure's pillars or floor.

(5) When constructing foundations for two or more units, isolate one unit from another so as to prevent the transmission of vibration.

(6) Foundation bolt should be secured using the installation method of a fan, in which, as a standard, box voids are placed in the concrete foundation. Refer to the external dimensions drawing for the positions for the foundation bolt holes.
When setting the foundation bolts before installing the fan, use a template to ensure that the positions are correct.

(7) If the foundation is constructed on the second floor or higher, level the foundation with a beam and keep it as close as possible to the walls.

3.5 Installation

3.5.1. Floor-mount type

The followings are the procedure for installing the foundation bolts (box void method).
(When foundation bolts are installed in advance, follow only the applicable instructions below.)

(1) Clean the foundation concrete surface and check the levelness. According to the site conditions, chipping may be necessary.

(2) Clean the foundation bolt holes and remove any debris.
Although the foundation bolt holes must be wet, there must be no water in the holes. Remove water.

(3) As shown in Figure 3, place one flat liner and two taper liners so that they are displaced to either side around the anchor bolt hole on the fan base.
Use an auxiliary liner (3 mm or thicker) as needed.
If the distance between anchor bolts exceeds 1 m, place additional liners between the anchor bolts.

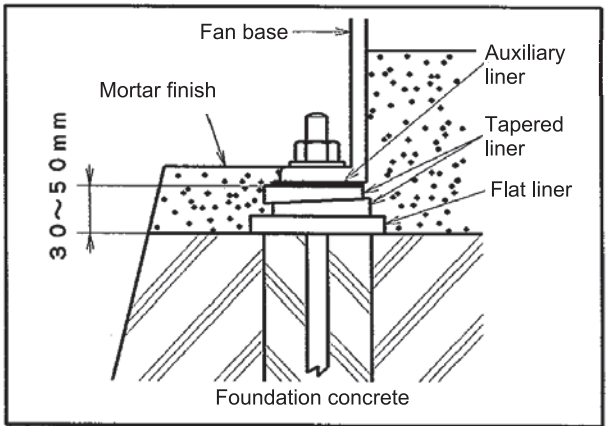


Figure 3 – Example of liner placement

(4) Place the fan base on the liners, and insert the foundation bolts through foundation bolt holes of the fan base into the box voids.
To ensure resistance to earthquake, weld the foundation bolts to the reinforcing iron bars of foundation concrete.

(5) Use the tapered liners to adjust the fan position and height.
As a guide, the levelness of the shaft should be within 0.1 mm per meter.

(6) If the casing is separated from the bearing and the base, set the height and the position in consideration of the clearance (See Figure 4.) between the rotating body and the casing.
Adjust the clearance between the impeller and the air intake and the clearance between the main shaft and the casing (shaft seal) so that they are as even as possible in terms of circumference.
However, if the fan handles a gas at a temperature exceeding 200°C, adjust the height in consideration of thermal expansion of the casing center. Calculate the expansion of the center height by assuming that it expands about 1 mm per meter when temperature increases by 100°C.

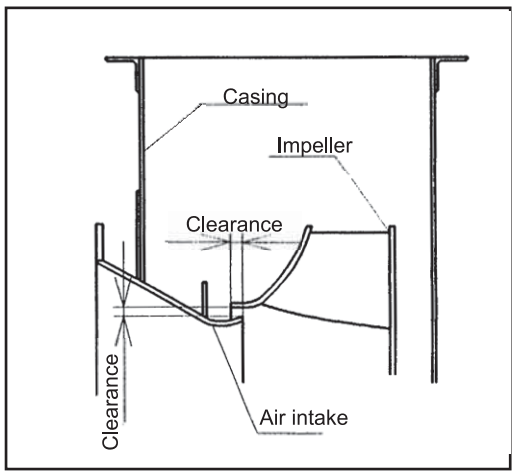


Figure 4 - Internal gap of the blower

(7) After sufficiently roughing the inner surface of foundation bolt holes, fill them with non-shrink mortar. Set the foundation bolts such that they are vertical in the center of the holes.

(8) After the mortar has fully cured, firmly tighten the nuts of the foundation bolts.
Tighten the bolts uniformly.
Weld the liners so that they will not move during the operation of the unit.

(9) Fill the clearance between the fan base and the foundation concrete with mortar to integrate them into a concrete structure.

(10) Check that the mortar has not contracted or cracked.
If the drain piping and/or cooling water for the bearing are required, consider the installation of a sump pit.

(11) When a vibration isolator is equipped, fix the vibration isolation base (lower base) in place with the foundation bolt.
If vibration isolation springs are used in building equipment, install the vibration isolation materials at equal intervals around the center of gravity of the fan assembly.

(12) When the fan is installed and the ducts are connected, carry out the alignment work described in the section 3.6.
Ensure to tighten the foundation bolts before measuring the alignment results.

3.5.2. Ceiling mounted type

(1) By connecting the fan's base to the hanging bolts that are embedded in the ceiling, horizontally suspend the fan. Ensure that the load of the fan is evenly distributed among all the hanging bolts.

(2) Be sure to use hanging bolts that are strong enough to sustain the load (in terms of the strength of the bolt itself as well as the pre-installed condition).

(3) After you have installed the fan, lock the nut on each hanging bolt to prevent them from coming loose.

(4) To make the fan earthquake-resistant, firmly install the fan onto a section steel frame fixed onto a building structure.

(5) As shown in Figure 5, firmly fix the ceiling mounted vibration absorber base onto the ceiling hanging bolts. To prevent the unit from vibrating horizontally, install a vibration isolator bracket at an angle onto each ceiling hanging bolt using a continuous-thread stud, turn buckle, or other parts.

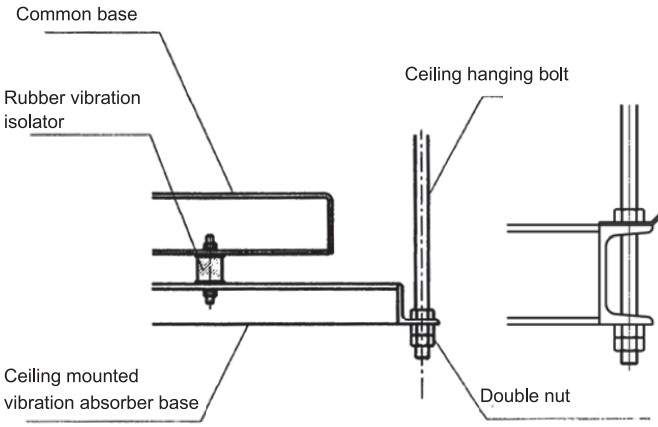


Figure 5 – Installation example of a ceiling mounting type

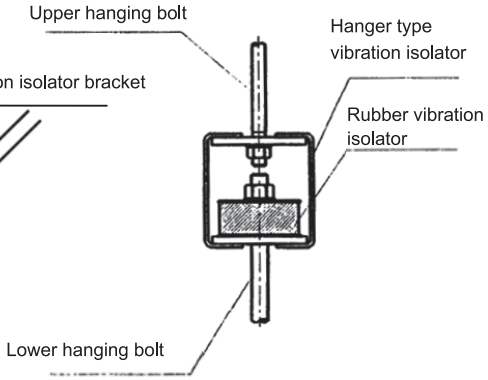


Figure 6 - Structure of the hanger type vibration isolator

3.5.3. Vibration-proof, earthquake-resistant type

(1) If the product has a rubber vibration isolator, make sure that the upper and lower holes are positioned in a vertical line and that no part of the rubber is twisted or distorted, as shown in Figure 7.

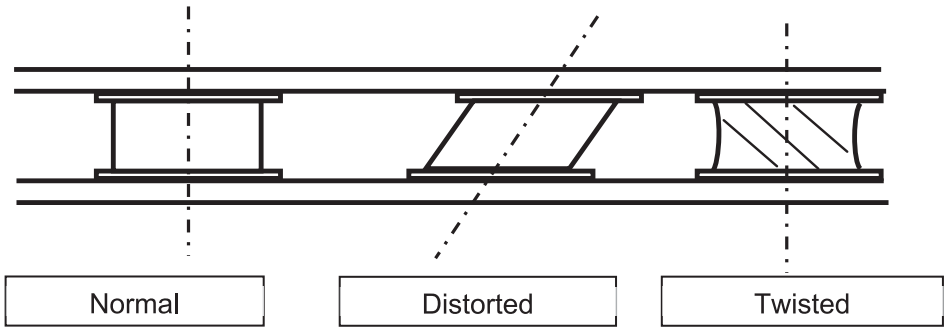


Figure 7 – Installation example of rubber vibration isolator

(1) The product is shipped with the stopper bolts tightened as shown in Fig. 8_"When shipped." After installation of the product at the delivery site, be sure to fix the stopper bolts in the position shown in Fig. 8_"After installation."

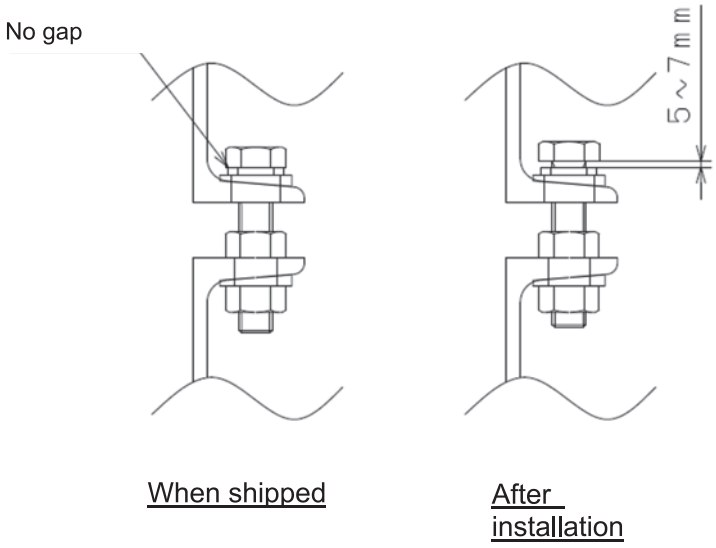


Figure 8 – Stopper bolt adjustment

(2) For fans of a vibration-proof, earthquake-resistant type, be sure to use expansion joints, and do not connect the fan and the duct directly.

Caution

If the fan is operated with the stopper bolts locked (see Figure 8), the expected vibration-proof effect cannot be obtained.

3.6 Alignment

The fan is aligned at the factory before shipping, but should be realigned after installation.

Warning

Alignment work should be carried out without the belt guard and the shaft coupling guard. So they must be re-installed before starting the operation.

If the fan is operated without the belt guard and/or the shaft coupling, you may be caught by the belt/shaft and injured.

Caution

Incorrect alignment may damage the equipment, or cause vibrations and noise. Align the fan correctly.

3.6.1. Alignment of belt drive type

(1) As shown in Figure 9, place a ruler, a piano wire, or other tools onto the outer ends of the V-belt pulleys on the fan and motor sides, and check that the ends of the pulleys are in a straight line and adjust the positions if they are misaligned.

(2) If you can depress the middle of the V-belt with your finger up to about the same depth as the thickness of the V-belt, the tension of general V-belts should be appropriate.
Use the slide base of the motor to adjust the tension of the V-belt.

(3) Stretch the high tension V-belts slightly tighter than general V-belts. Too loose tension may cause the belt to slip during startup, and excessive tension may apply a large load to the shaft and bearing, thus resulting in failure.

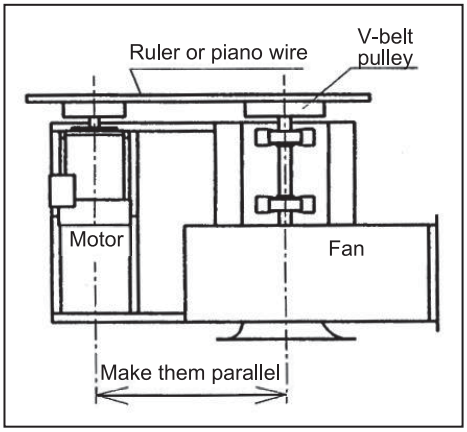


Figure 9 - How to carry out the alignment

(4) Since V-belts tend to loosen at the early stages of its use, ensure to readjust it in several days of use.
[Procedure]
Obtain the deflection δ: 0.016ℓ. (ℓ: Distance between pulleys)
Then use a tension meter to produce the standard deflection (δ mm) in the middle of the V-belt. Re-tension the belt (or adjust the tension) such that the deflection load at that time corresponds to the value given in the following table.

Note

When alignment and belt tension adjustment is performed, the coating film on the sliding part near the motor mounting leg may be peeled off and rust may be generated.
If you install the fan in a humid place or outdoors, apply repair coating to bolts and nuts, including the peeled areas in order to prevent rusting.

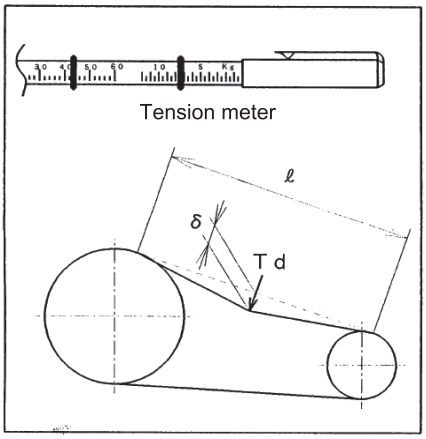


Figure 10 - How to measure the belt deflection load

For standard V-belt and Red seal type

A Type

Qty	Motor output kW	Td for each V-belt Unit : N	
		For new belt	For re-tensioning
1	0.2	9 ~ 11	8 ~ 9
	0.4	9 ~ 11	8 ~ 9
	0.75	12 ~ 14	10 ~ 12
	1.5	17 ~ 19	15 ~ 16
	2.2	21.5 ~ 23.5	18.5 ~ 20.5
	3.7	25.5 ~ 27.5	22 ~ 24
2	0.75	7 ~ 9	6 ~ 8
	1.5	13.5 ~ 15.5	11.5 ~ 13.5
	2.2	15.5 ~ 17.5	13.5 ~ 15.5
	3.7	18.5 ~ 20.5	16 ~ 18
	5.5	22.5 ~ 24.5	19.5 ~ 21.5
3	3.7	14.5 ~ 16.5	12.5 ~ 14.5

B Type

Qty	Motor output kW	Td for each V-belt Unit : N	
		For new belt	For re-tensioning
2	1.5	11 ~ 13	9 ~ 11
	2.2	14.5 ~ 16.5	12.5 ~ 14.5
	3.7	16.5 ~ 18.5	14.5 ~ 16.5
	5.5	21.5 ~ 23.5	18.5 ~ 20.5
	7.5	27.5 ~ 29.5	23.5 ~ 25.5
	11	33.5 ~ 35.5	28.5 ~ 30.5
	15	42 ~ 44	36.5 ~ 38.5
3	5.5	19.5 ~ 21.5	17 ~ 19
	7.5	23.5 ~ 25.5	20 ~ 22
	11	30.5 ~ 32.5	26 ~ 28
	15	35.5 ~ 37.5	30.5 ~ 32.5
	18.5	39 ~ 41	34 ~ 36
4	15	29.5 ~ 31.5	25.5 ~ 27.5
	18.5	33.5 ~ 35.5	28.5 ~ 30.5
	22	35.5 ~ 37.5	30.5 ~ 32.5
	30	43 ~ 45	37 ~ 39

For narrow V-belts

3V Type

Qty	Motor output kW	Td for each V-belt Unit : N	
		For new belt	For re-tensioning
2	2.2	10 ~ 12	8 ~ 10
	3.7	14.5 ~ 16.5	12.5 ~ 14.5
	5.5	17.5 ~ 19.5	15 ~ 17
	7.5	19.5 ~ 21.5	17 ~ 19
	11	23.5 ~ 25.5	20 ~ 22
	15	28.5 ~ 30.5	24.5 ~ 26.5
3	5.5	12.5 ~ 14.5	11 ~ 13
	7.5	17.5 ~ 19.5	15 ~ 17
	11	19.5 ~ 21.5	17 ~ 19
	15	22.5 ~ 24.5	19.5 ~ 21.5
	18.5	23.5 ~ 25.5	20 ~ 22
4	11	14.5 ~ 16.5	12.5 ~ 14.5
	15	18.5 ~ 20.5	16 ~ 18
	18.5	22.5 ~ 24.5	19.5 ~ 21.5
	22	22.5 ~ 24.5	19.5 ~ 21.5

5V Type

Qty	Motor output kW	Td for each V-belt Unit : N	
		For new belt	For re-tensioning
2	11	31.5 ~ 33.5	27 ~ 29
	15	39 ~ 41	34 ~ 36
	18.5	44 ~ 46	38 ~ 40
	22	56 ~ 58	48 ~ 50
	30	67.5 ~ 69.5	58.5 ~ 60.5
3	15	29.5 ~ 31.5	25.5 ~ 27.5
	18.5	33.5 ~ 35.5	28.5 ~ 30.5
	22	40 ~ 42	34.5 ~ 36.5
	30	55 ~ 57	47.5 ~ 49.5
	37	61.5 ~ 63.5	53.5 ~ 55.5
	45	72.5 ~ 74.5	62.5 ~ 64.5
	55	76.5 ~ 78.5	66 ~ 68
4	30	45 ~ 47	39 ~ 41
	37	51 ~ 53	44 ~ 46
	45	59 ~ 61	51 ~ 53
	55	67.5 ~ 69.5	58.5 ~ 60.5

If your belt is not listed in the table above, or if you wish to change the different belt type from the one indicated on the label attached to the belt guard, please contact us.

3.6.2. Alignment of direct type shaft coupling

The following is an example of the case a flange type flexible shaft coupling is used.

(1) Put a parallel ruler at four places on the circumference of the shaft coupling and check the gap between levels of the circumferences.
(2) Measure the clearance between the mating surfaces of the shaft coupling using a taper gauge or a feeler gauge. (See Figure 11.)
The tolerances are within 0.05 mm for the gap between the levels and within 0.1 mm for the unevenness of the clearance.

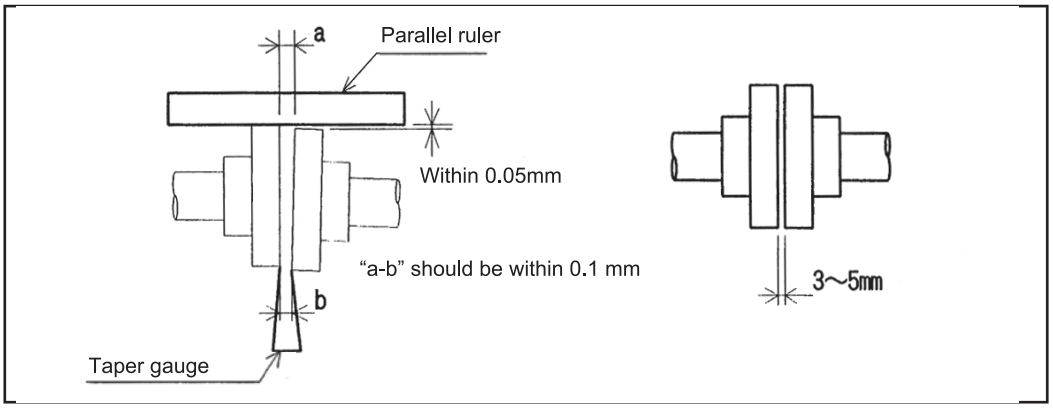


Figure 11 - Alignment method of direct type shaft coupling

Correct the alignment by inserting a shim under the motor.
Use a dial gage for the adjustment of a spring coupling or the like which requires preciseness.

3.7 Precautions for connecting the ducts

Caution

Ensure that the ducts do not apply any load to the fan.
Otherwise, malfunctions, damage or vibration may occur.

(1) Connect the fan's flanges and ducts using expansion joints to avoid the transmission of vibrations or noise to the exterior.
In particular, when handling a high temperature gas, be sure to install expansion joints so that the reaction force from the duct due to thermal expansion will not be applied to the fan.

(2) Before connecting the ducts, check the inside of the ducts and fan, and remove any foreign matters, such as waste cloth and tools.

(3) If the duct diameter is tapered significantly compared to the fan bore, if the duct is fitted with a series of bends, or if bends are provided immediately before or after the fan, pressure loss will increase. Refer to the piping example shown in Figure 12.

(4) Provide a damper for air flow control as needed.

(5) To prevent the suction of foreign matter, install a wire mesh at the duct intake as well as at the fan suction port where the atmospheric air is directly sucked in. In addition, if dust or water droplets are expected to enter the fan, be sure to install a filter to prevent them from entering.

(6) If the fan is exposed to the wind opposite to its blowing direction, install a check valve to prevent reverse rotation of the impeller.
Starting the fan with the impeller rotating in the opposite direction may damage the impeller or cause the motor to burn out.

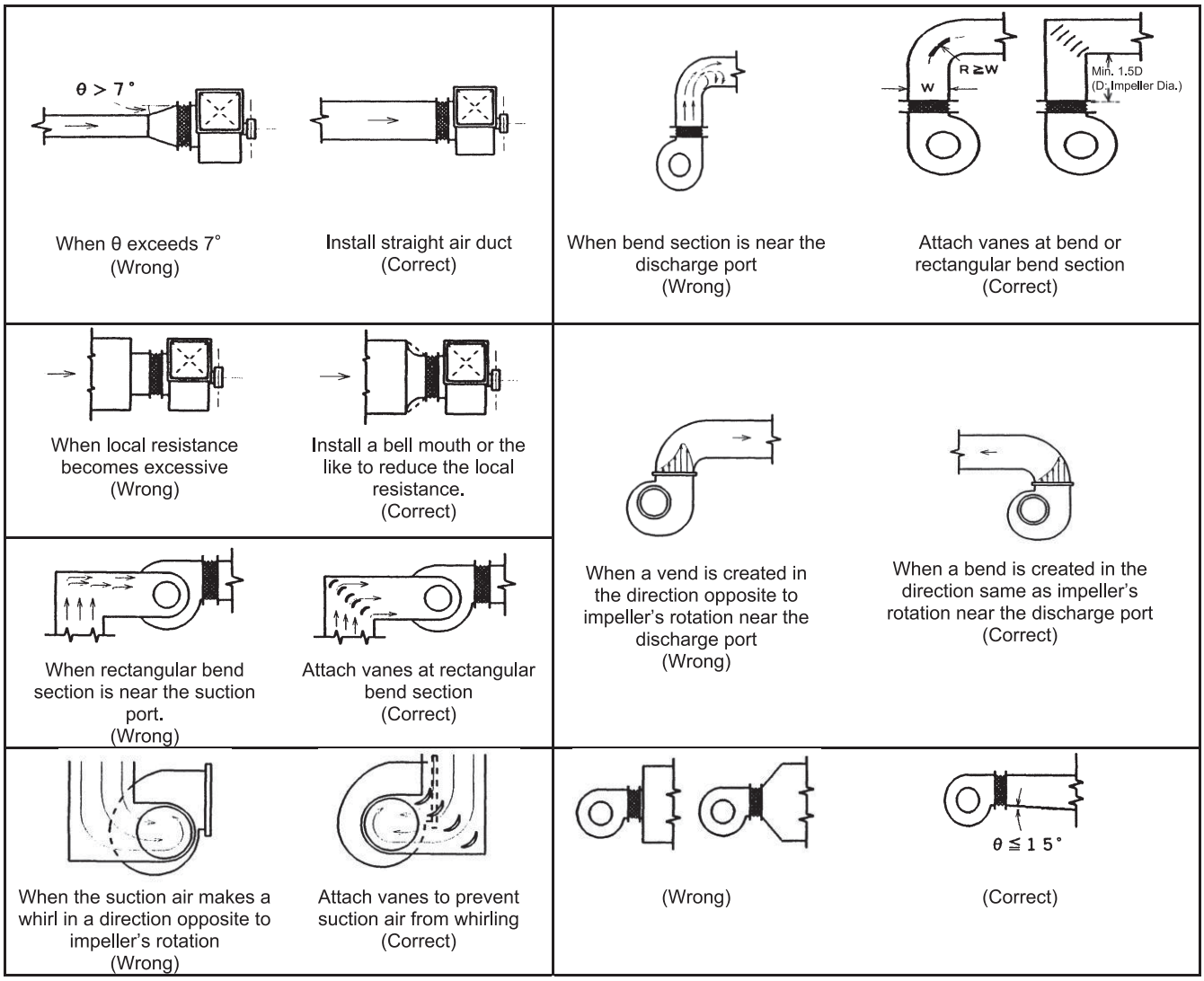


Figure 12 - Examples of duct installation

Warning

Be sure to install a protective wire mesh on any open air intakes for the fan.

Note

If there is a wall in front of the fan, ensure that the gap between the intake and the wall is larger than the diameter of the air intake of the fan.

3.8 Precautions for wiring work

> **Warning**
>
> Use high-quality wiring equipment and devices, and carry out wiring work safely and securely according to the technical standards for electrical facilities and the indoor wiring regulations.
>
> Only qualified personnel such as licensed electrical engineers are allowed to carry out electrical wiring work.
>
> Incomplete wiring work by an unqualified person is prohibited by law and very dangerous.

(1) Be sure to install a ground fault interrupter and an overload protection device on the primary side of the fan.
In case that a thermal relay is used as an overload protection device, the fan may trip at a start-up due to its starting characteristics.

* The starting current of premium efficiency (equivalent to IE3) motors may become higher than that of standard efficiency (IE1) motors. Therefore, it is necessary to verify the applicability of its ground fault interrupter and overload protection device.
If you have any questions, contact your nearest office of TERAL.

(2) Be sure to install a ground wire to prevent an electric shock.

- Connect the ground wire to the ground terminal in the terminal box of the motor.
- Do not connect the ground wire to gas pipes, water pipes, lightening arresters, or ground wires for telephone.

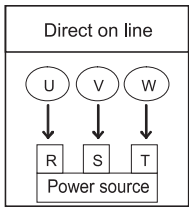
> **Warning**
>
> Incomplete wiring work is prohibited by law and very dangerous.

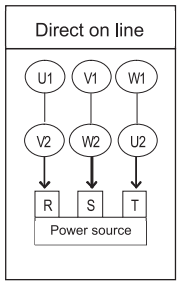
(3) For the connection patterns, see Figure 13.

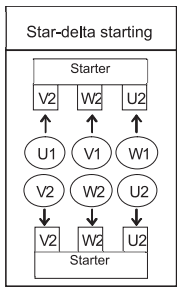
(4) Limit the fluctuations of the power voltage within ±10% of the rated voltage, and also limit the fluctuations of the frequency between –5% and +3% of the rated value. Although you can run the fan in these ranges, avoid the operation for a long time if the voltage is not within ±5% of the rated value or if the frequency is not within ±2% of the rated value. Even if the fluctuations fall within the allowable ranges, the fan characteristics and motor characteristics may differ from those at the rated voltage and frequency.

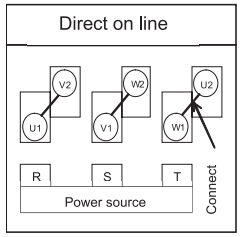
(5) Before running the fan, check the following points again:

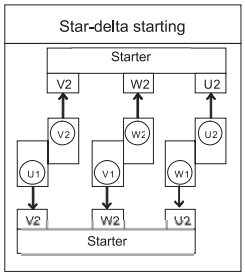
① An appropriate fuse (ground fault interrupter) is installed.
② Wiring is correct.
③ The unit is securely connected to a ground.
④ None of the three terminals of the motor is loosened or disconnected.

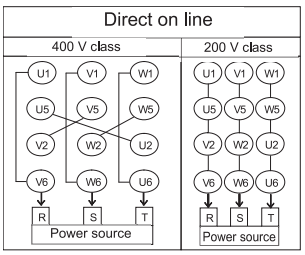
<table>
<tr><td>Number of terminals</td><td>3</td><td colspan="2">6</td><td>12</td></tr>
<tr><td>Connection pattern</td><td> 

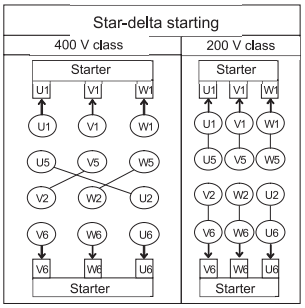
Terminal block type</td><td> 



Terminal block type</td><td> 



Lug terminal type</td><td> 



Lug terminal type</td></tr>
</table>

* The above connection patterns cause the motor to run counterclockwise when viewed from the shaft end of the motor.
If you need to run the motor in reverse direction, reverse the connections to R and T terminals of the power wires.

Figure 13 – Connection patterns of the motor terminals

4. Preparation for operation

4.1 Points to be checked before test running

4.1.1. Checking the electrical system

(1) Check that the fan is correctly wired.
(2) Check the frequency.
Running the fan at a frequency other than the specifications may reduce its performance, burn out the motor, or damage the impeller and main shaft.
(3) Check the terminals for any loose connection.
(4) Check that the unit is securely grounded.
(5) Check that the setup value of the overload protection device is consistent with the rated current value of the motor. The rated current value is indicated on the motor nameplate.

4.1.2. Checking the fan system

(1) Check that water has not accumulated in the fan and that no foreign matters or materials such as tools have been left inside.
(2) Check that all the connections of foundation bolts, the fan, accessories and pipe joints are securely tightened.
(3) Check that the dampers and valves can fully open and close, and that they operate properly.
(4) Check that a specified amount of lubricant is filled (to the specified level in the oil gauge) when the bearing is lubricated in an oil bath.
(5) Check the cooling water when the bearing is cooled in an oil bath or by a water-cooling system.
Supply about 10 to 14 ℓ/min of clean water at a temperature of 25 °C or lower and a water pressure of 0.3 MPa or less.
(6) When using a spring coupling, fill grease into the clearance between the tooth flanks before combining them.
Make sure that an appropriate amount of grease is filled.
(7) Check the alignment of the tension of V-belt.
(8) Rotate the fan by hand or by inching a motor to check that it can rotate smoothly without any internal obstructions.

Be sure to turn OFF the main power before checking the fan by rotating it by hand.

(9) Put an operator in place in advance so that the fan can be turned OFF at any time immediately after the instructions of the person in charge of the operation.

Do not operate the fan if you find any problem such as noise. Be sure to contact a specialist company or a service center of the manufacturer.

4.1.3. Precautions for inverter operation

(1) If you use the fan with an inverter, .please let us know before placing an order.
Inverter operation may not be possible with some standard motors.

(2) The initial settings of off-the-shelf inverters are not tailored for running the fan.
The use of the inverter at its initial settings may cause abnormal vibration or damage of the fan.
Be sure to make the settings of the inverter before operation, referring to the following information. Changing the inverter settings may solve some abnormal condition.

<Inverter setup values (for reference only)>

① Base frequency	:	Set this to the specified frequency (indicated on the nameplate)
② Maximum frequency	:	Set this to the specified frequency (indicated on the nameplate)
③ Maximum output voltage	:	Set this to the rated voltage of the motor.
④ Upper limit frequency	:	Set this to the specified frequency (indicated on the nameplate)
⑤ Lower limit frequency	:	Set this to a value between 25 Hz and 30 Hz. Running the fan at a lower frequency may cause the motor to stall or generate heat or may make the inverter output unstable.
⑥ V/F characteristics	:	Set this to square reduction torque.
⑦ Acceleration / deceleration time	:	Set this to a value between 30 and 40 seconds. Starting/stopping the fan in a shorter period may trip the inverter.
⑧ Carrier frequency	:	The factory settings of the carrier frequency depend on the manufacturer. If the fan produces any abnormal vibration or noise with the current settings, the problem may be solved by changing the carrier frequency setting according to the following table.

Carrier frequency	Low	-	High
Noise from the motor (high-pitched noise)	Loud	-	Small
Noise from the inverter	Small	-	Loud
Number of times surge voltage is applied	Few	-	Frequent

(3) When using the fan with an inverter, check during test operation that the fan runs normally at all the frequencies used. Running the fan under abnormal conditions such as abnormal vibration may damage the fan.
To avoid abnormal vibration, jump the resonance frequency of eigenvalues of the fan, motor, fan + foundation, etc. by setting the inverter.

4.2 Test operation

4.2.1. Precautions in test run

> **Warning**
>
> Be sure to install a belt guard and a shaft coupling guard before operation if the unit is equipped with them.

(1) Close the damper and turn the unit ON and OFF once or twice to confirm that the unit is operating properly without any unusual noise or vibrations. At that time, check the rotation direction of the fan. If the fan rotates in the reverse direction, swap two of the three wires of the power supply cable.

> **Warning**
>
> Be sure to turn off the main power before changing the wiring of the fan.

(2) Turn on the power, and watch the unit carefully until it reaches full speed.
At that time, carefully check for unusual noise, vibrations, current, or any other abnormal condition.

(3) Start the continuous operation, and gradually open the damper.
In order to check the condition of each part, keep the fan running at a low flow rate (light load) for 20 to 30 minutes.
At that time, ensure that the fan does not run at a rate where surging may occur.

(4) Gradually open the damper until the fan reaches the full load operation.
Keep it running under this condition for one to three hours, and check the temperature, vibrations and noise at each section of the fan.
In addition, check that the motor current value is normal.
In particular, note that the (electrical) current value of the models that handle high temperature gasses increases during the operation at room temperature.
The bearing temperature may become slightly higher than usual for about one to two hours after the start of operation. If there are no errors in the machine, however, the temperature stabilizes thereafter.

(5) If the model handles high temperature gasses, misalignment may be caused by thermal expansion after the start of stable operation. Therefore, stop the operation once to check the alignment when the temperature has risen sufficiently after the start of operation.

> **Warning**
>
> Do not touch the body of the fan or the duct if the temperature of the gas is high. Otherwise, it may cause burns.
> Do not place any combustibles near the unit.

> **Note**
>
> When the bearing is cooled by air-cooling method, secure a sufficient space around the air-cooling parts (such as heat fins and heat sinks) so that their heat radiation is not blocked by lagging or the like.

4.2.2. Precautions during operation

(1) Do not start and stop the fan frequently, because it may cause early failure of the fan and motor.
Precautions for test operation and normal operation are as follows.
When starting and stopping the fan repeatedly for a short time during the test operation, keep the starting frequency within the following frequency.

Motor output power	7.5kW or less	11kW - 22kW	30kW or more
Starting frequency	Max. 6 times per hour	Max. 4 times per hour	Max. 3 times per hour

During normal operation, please use the fan for 10 hours of continuous operation per day.
If the fan is to be used under conditions where the starting frequency is high, please consult with us.
The expected design life is based on 10-15 years of 10hours of continuous operation per day and 300 operating days per year.
(The expected design life is not a guaranteed value.)

In the event of a power failure, be sure to turn off the main power. Otherwise, when the power is restored, the fan suddenly starts, and it poses a danger.

4.2.3. Precautions when stopping the operation

(1) When stopping the fan, close the damper slowly and then turn the power off.
(2) If air exceeding 200°C is used, close the damper, cool down the casing slowly and completely while keeping the fan running for a certain period and then stop the operation. Ensure that the fan does not run at a rate where surging may occur.
(3) If cooling water is used for the system, stop the fan and then close the cooling water valve.
(4) Be careful of gas leak at the shaft seal if the fan handles any hazardous gas.

5. Long-term shutdown

5.1 Precautions for long-term shutdown

If you do not use the fan for a long time (1 month or longer), observe the following points:

When you leave the fan unused for a long period of time, be sure to turn off the main power.

(1) If you do not use the fan for a long time, apply appropriate anti-corrosive agent to the areas prone to rust. In addition, refill or change grease to put fresh grease in the bearing.
(2) Take measures to prevent dust or other foreign matter from accumulating on the fan main unit or the motor.
(3) To prevent the entry of dust or other foreign matter into the connected ducts, close the suction port and the discharge port. If a damper is installed, close the damper.
(4) Protect the motor and other electrical devices against moisture.
(5) Detach the V-belt and store it away from high temperature, high humidity, and dusty areas.
(6) Cover the bearing with tarpaulin or other covering to prevent contact with ambient atmosphere and to prevent the entry of dust.
(7) Before you run the fan after a long period of shutdown, inspect each part, and refill or change grease of the bearing.
(8) Once or twice a month, rotate the impeller shaft by hand and protect the bearing.
(9) During the long-term shutdown, take measures to keep unauthorized persons away from the fan, for example by installing a barrier or by locking it out.

6. Maintenance and inspection

> **Warning**
>
> Regularly inspect your equipment and perform maintenance on each component.

6.1 Daily inspection

(1) Check vibration, noise, bearing temperature, the amount and cleanliness of the oil, cooling water, amperage, etc.
If there is any unusual condition, it may be a sign of failure; therefore, take the appropriate measures as soon as possible.
For this purpose, it is recommended to keep an operation log.

> **Warning**
>
> The main shaft, V-belt pulley, and V-belt are rotating during operation. Care should be taken so that your clothing is not caught in these parts.

(2) The bearing temperature must be less than [the normal room temperature plus 40°C] or [70°C], whichever is lower.

(3) If strong vibrations occur, stop the operation and inspect the V-belt alignment, duct connections, tightening of the mounting bolts and anchor bolts, and check for accumulation of dust on the impeller and damage to the bearings. If the vibration is within the region specified as "Acceptable" in JIS B 8330, you can run the fan, although the vibration level is preferable in the region specified as “Good” (see Figure 14). Note that, if your fan comes with a vibration isolation device, the vibration is not transmitted to the foundations, but vibration of the fan itself becomes somewhat stronger. In such a case, a vibration lower than the broken line is considered normal.

(4) In addition to vibrations, noise is an important factor in judging the operating condition.
If you hear a metallic sound possibly made by contact into the rotor, stop the operation immediately.
Continuous roaring or hissing noise of air flowing inside the casing is normal; however, discontinuous hissing or howling noise is caused by surging. An appropriate measure is required in the latter case, for example by changing the damper opening.

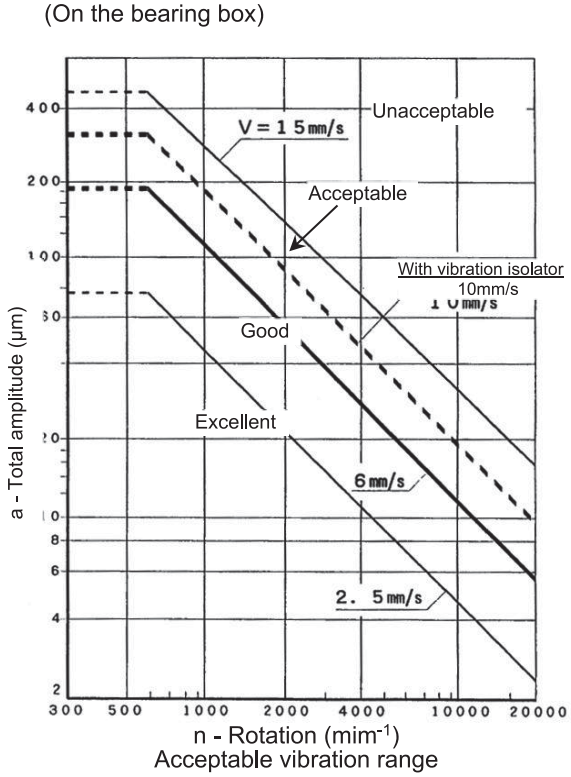


Figure 14 - Acceptable vibration range

(5) Bearings generate some noise even in normal condition.
It is difficult to identify an abnormal noise because bearings produce complicated noise, so learn about the noises thoroughly to prevent any accident.

Normal noise produced at bearings

Type of noise	Normal noise
Noise from race	It is a continuous hissing noise without any sudden change. This noise is generated when a ball rolls on the race surface.
Noise from rolling balls	It is a clattering noise. The balls are loaded in the radial direction (which is mostly the case), and then released in turn repeatedly. This noise is generated when the ball comes to the boundary. It occurs mostly with low speed bearings, but poses no problem.
Noise from retainer	A retainer maintains the relative positions of the balls. There is a small clearance between the retainer and the outer ring, which allows the retainer to rotate; however, a continuous rattling noise is generated when the retainer contacts the outer ring occasionally. It is a slightly annoying noise, but cannot be eliminated easily. It occurs mostly with low speed bearings, but poses no problem.

Abnormal noise produced at bearings

Type of noise	Abnormal noise
Noise due to foreign matters	Dust may get inside a bearing due to careless handling of grease or for other reasons. In such a case, the bearing makes an irregular grinding noise. Thoroughly wash bearings with washing oil, and replace the old grease with new grease.
Noise due to damage	Damage on a ball may generate a discontinuous grinding noise. Damage on the race surface of the inner or outer ring may generate a continuous noise. If the noise is faint or insignificant, the bearing may still be used after being greased. If the nose becomes serious, replace the bearing.
Noise due to rust	The same symptom described in the ”noise due to damage” occurs. If the noise becomes louder, replace the bearing with a new one.
Scraping noise	It is a scraping noise without a regular cycle. This noise is generated when a ball slips on the ring or retainer or the lubrication is not effective between those parts. Use high-quality grease.

6.2 Periodic inspection

If motors or control panels are used for more than a certain period of time, it may cause ignition or other accidents due to aging deterioration.

Before inspecting the fan, be sure to turn off the main power.
Otherwise the fan may suddenly start up during automatic operation etc., exposing personnel to great danger.

Carry out the periodic inspection at least once a year.
The periodic inspection items include the following points, in addition to the daily inspection items.

1. Refill or change the grease or lube oil in the bearing.
2. Inspect the alignment and V-belt
   Inspect the V-belt for wear or damage, and check the tension. If necessary, replace or re-tension the V-belt. Also check the rubber of the shaft coupling for wear.
3. Refill or change the grease in the spring coupling.
4. Inspect the play in the connection between the impeller boss and the shaft.
5. Inspect the impeller and the shaft for corrosion and wear.
6. Clean the inside of the fan, and apply anti-corrosive agent or otherwise repair the part.

7. Periodic inspection items

Part	Inspection item	Inspection method	Acceptance criterion (guide)
Entire fan unit	Noise, vibration	Listen, touch	No noise or vibration significantly larger than the initial state.
Casing	Appearance (such as corrosion, adhesion, deformation, and leakage)	Visual check	No significant adhesion of dust, deformation, flaws, corrosion, or other problems related to appearance.
	Noise, vibration	Listen, touch	No abnormal noise or vibration.
Impeller	Check the running condition	Visual check (rotating by hand)	No contact or abnormal noise.
	Appearance (e.g. corrosion, adhesion, and deformation)	Visual check	No significant corrosion, deformation, or adhesion.
Main shaft	Appearance (e.g. corrosion, adhesion, deformation, and fit)	Visual check	No color change on the shaft. No rust at the fit.
	Looseness of fixing nuts	With a tool	No looseness
Bearing	Amount of grease	Check the hours of operation.	Grease is periodically applied according to this manual.
	Operation status (noise)	Listen	No abnormal noise.
	Operation status (vibration)	Vibration meter	Refer to the “Acceptable vibration range” shown in Figure 14.
	Surface temperature	Surface thermometer	Not higher than [the ambient temperature +40°C] or [70°C], whichever is lower
	Rotation movement	Touch	Can be rotated by hand smoothly and uniformly.
	Appearance (e.g. corrosion, adhesion and wear)	Visual check	No significant corrosion, wear, or deformation.
	Looseness of screws	With a tool	No looseness
V-belt	Check the tension	Tension meter	The amount of deflection and tension load must comply with the values calculated for each case, or must be within the range specified by the V-belt manufacturer.
	Rattling of the V-belt	Visual check	No significant rattling.
	Alignment of V-belt pulleys	Visual check using a straight ruler or piano wire	The parallelism and eccentricity of the V-belt pulleys must be within 1/3°.
	Appearance, wear, flaws	Visual check	No significant twisting, flaws, or cracks.
V-belt pulley	Appearance, flaws	Visual check	No significant flaws or cracks.
	Wear of the groove	Visual check	The new V-belt must not touch the bottom of the groove. No local wear or left/right partial side wear.
	Wear (fit with the main shaft)	Visual check	No significant wear.
	Looseness of fixing screws	With a tool	No displacement or looseness of the V-belt pulleys.
Belt guard	Appearance	Visual check	No significant rust or deformation.
Motor	Insulation	500 V megger Check by smelling	Insulation resistance must comply with the value specified for the motor. No smell of varnish burning.
	Noise	Listen Auscultation rod	No significant noise. No increase in noise level compared to normal values.
	Vibration	Touch Vibration meter	No significant vibration. No increase in vibration amplitude compared to normal vibration amplitude.
	Temperature	Visual check Surface thermometer	No change in coating color. No abnormal heat generation.
	Current	Measure	The measured value may not exceed the value shown on the motor nameplate.
	Smell	Smell	No burning smell.
	Rotation movement	Touch	Can be rotated by hand smoothly.
Vibration isolation device	Appearance	Visual check	No significant degradation such as cracks. No displacement.

Guidelines for periodic inspection interval and part replacement

The guideline of annual operation hours is 10 (hours/day) × 300 (days/year) = 3,000 (hours/year). In addition, the service life of the fan differs significantly depending on factors such as the operating conditions, the status of installation, and the status of maintenance. If you find any abnormal condition, stop the operation, replace the parts, and make repairs.

Part name	Replacement interval (guide)	Elapsed years														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Entire fan unit	15 years	○	○	○	○	○	○	○	○	○	◆	○	○	○	○	Replace the fan unit
Casing	15 years	○	○	○	○	○	○	○	○	○	◆	○	○	○	○	
Impeller	15 years	○	○	○	○	○	○	○	○	○	◆	○	○	○	○	
Main shaft	10 years	○	○	○	○	○	○	○	○	○	◆	○	○	○	○	
Bearing	3 years	○	○	▲	○	○	▲	○	○	▲	◆	○	▲	○	○	
V-belt pulley	5 years	○	○	○	○	▲	○	○	○	○	▲	○	○	○	○	
V-belt	1 year	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	
Belt guard	15 years	○	○	○	○	○	○	○	○	○	◆	○	○	○	○	
Motor	10 years	○	○	○	○	○	○	○	○	○	◆	○	○	○	○	
Vibration isolation device	15 years	○	○	○	○	○	○	○	○	○	◆	○	○	○	○	
Description of symbols		○: Periodic inspection (including cleaning and adjustment). Replace parts and make repairs based on the inspection results. ▲: Periodic replacement of consumables ◆: Replace parts or time-change parts based on the inspection results (perform overhaul as needed)														

6.2.1. Refilling grease into the bearing and replacing the bearing

Warning

The main shaft, impeller, V-belt pulleys, and V-belt are rotating during operation. Be extra careful not to get your clothes or other parts caught in these parts.

Warning

Before turning the fan shaft by hand to check its rotation, be sure to turn off the main power.

(1) If your fan is fitted with the pillow block, you can use the fan without lubrication. For longer use, however, it is recommended to refill grease during periodic inspection.
(2) The following tables show the intervals of refilling grease and the amounts. Do not refill too much. Basically, use Shell Alvania Grease No.3 for refilling. If your fan blows 150°C or hotter gas, the heating resistant pillow block (HR5) will be used; therefore, refill SUPER LUBE No.3 by YUKEN KOGYO CO., LTD. Do not refill any other grease.
(3) Avoid using the fan in a dusty place or a place that could be exposed to moisture. If such use is unavoidable, refill grease more often than the specified intervals.
(4) While the fan is running, apply grease through the grease nipple using the grease pump.
(5) The structure of some fans may not allow grease to be refilled. In such a case, after using bearings for the duration of their service life, replace them with new ones.

Grease refilling interval for the pillow block

Ambient environment	Bearing temperature (°C)	Refilling interval
Clean	50°C or less	1 to 12 months
Dusty	70°C or less	1 to 4 months
Humid		1 week

Amount of refilling grease for the pillow block

Bearing number	Refilling amount g	Bearing number	Refilling amount g	Bearing number	Refilling amount g
UCP204	1.2	UCP214	13.6	UCP314	31.5
UCP205	1.4	UCP216	18.8	UCP315	38
UCP206	2.2	UCP306	3.8	UCP316	41
UCP207	3.2	UCP307	5.7	UCP317	52
UCP208	3.9	UCP308	7.8	UCP318	62
UCP209	5	UCP309	9.4	UCP319	73
UCP210	5.4	UCP310	12.8	UCP320	92
UCP211	7.4	UCP311	16.4	UCP321	106
UCP212	10	UCP312	21	UCP322	133
UCP213	11.8	UCP313	26	UCP324	158

6.2.2. Rolling bearing

(1) An insufficient amount of grease may cause poor lubrication. On the contrary, excessive grease may cause the grease to be stirred and generate heat. After a long time of use, grease deteriorates partially, resulting in lower lubrication properties. Refill the proper amount of grease at the proper intervals.

(2) The following tables show the intervals and quantities of grease to be refilled. Be careful not to overfill. Use COSMO GREASE DYNAMAX EP No.2. or the equivalent of another brand. Do not mix or apply any other type of grease.

(3) While the fan is running, apply grease through the grease nipple using the grease pump.
Old grease collects in the bearing housing.
Drain it through the drain port at the bottom.

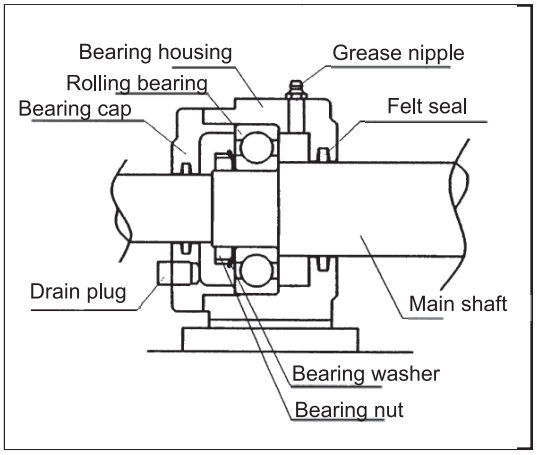
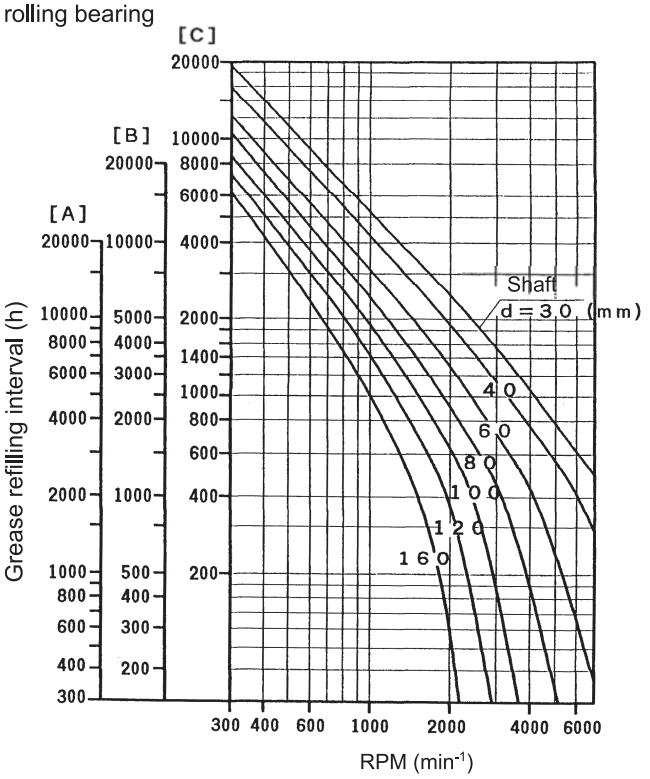


Figure 15 - Rolling bearing configuration

Grease refilling quantity and refilling interval of rolling bearing

Shaft diameter (mm)	Refilling quantity (g)
35	20
40	20
45	20
50	30
55	30
60	30
65	30
70	50
80	50
90	60
100	80
120	100
140	190
150	220

[A]: Deep groove ball bearing
[B]: Cylindrical roller bearing
[C]: Self-aligning roller bearing



6.2.3. Oil bath type bearing

(1) Since the oil is contaminated rapidly during the first six months from the start of operation, replace the entire volume of the oil.
(2) Change the oil after the first 300 hours operation, and every 2000 hours thereafter.
(3) Cosmo ALLpus 32 of Cosmo Oil is used. Select the equivalent oil if you use oils from other brands.
(4) Be careful that dust or foreign matters should not mix with oil when you change the oil.
(5) The volume of oil is as shown in the table. Be careful not to overfill the oil bath.

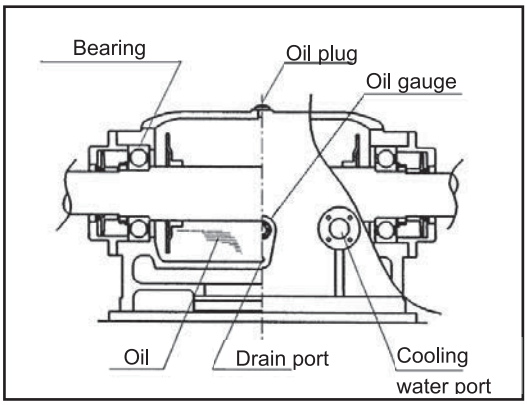


Figure 16 - Amount of oil for the oil bath type bearing

Shaft diameter (mm)	Amount of oil (ℓ)	Shaft diameter (mm)	Amount of oil (ℓ)
40	1.5	65	2.3
50	2.3	80	3.3
55	1.7		

6.2.4. Refill of grease in spring coupling

(1) The spring and the gear coupling are combined in the grease filled in the clearance between the tooth flanks. A large centrifugal force acts on the grease inside the coupling and causes the grease to decompose and deteriorate.
Refill and change the grease periodically.
(2) Use the grease COSMO GREASE DYNAMAX EP No.2 of Cosmo Oil or equivalent.
(3) Refill or change the grease once a year as a general guide.

6.2.5. Consumables

Caution

Part replacement and repairs should only be performed by specialist companies or service centers designated by the manufacturer.
Improper procedures may lead to malfunctions or accidents.

Refer to the table below for intervals to replace consumables.

Consumable	Condition of replacement (as a guide)	Cycle to replace (as a guide)
Bearing	Abnormal noise	Once every 2 to 3 years
Gland packing	Deterioration or wear	Once a year
Coupling rubber	Deterioration or wear	Once a year
V-belt	Deterioration or wear	Once every 1 to 2 years

There are slight differences in length even if V-belts are the same size.
Use a set of V-belt for a single unit of the fan.
Do not use a combination of any parts of new and old belts.
Please use the same consumable parts as shipped for replacement.
If you would like to consider changing the type, please contact us.

7. Troubleshooting

7.1 Troubleshooting

Even if the symptoms of failures of the fan are the same, the causes and countermeasures may be different. There may be two or more causes.
If the cause and countermeasures cannot be determined using the following table, stop the operation immediately and contact a specialist company or a service center specified by the manufacturer.

Failure	Causes	Countermeasures	Reference item
The bearing temperature is high.	Excessive or insufficient grease (oil)	Adjust it to the proper amount.	6.2.2
	Poor connection between the inner ring and shaft of the bearing	Replace the shaft. Replace the motor.	
	Poor connection between the outer ring and the case of the bearing	Replace the bearing case. Replace the motor.	
	Deterioration of grease, or entry of moisture	Change the grease. Replace the bearing.	6.2.2
	Poor heat radiation from the air-cooling parts	Inspect the air-cooling parts. Check ambient temperature and the conditions of heat radiation	
	Poor cooling water conditions, temperature rise	Inspect the piping of cooling water. Check the water temperature.	4.1.2
	Excessive tension of the V-belt	Readjust the V-belt tension.	3.6.1
	Poor alignment of the direct coupling	Correct the alignment of shaft coupling	3.6.2
Strong vibration	Corrosion or wear in or foreign matter on the impeller	Remove the foreign matter adhered to the impeller, and correct the balance of the impeller.	
	Poor connection between the boss and shaft of the impeller	Replace the impeller or shaft of the motor.	
	Unbalance of the V-belt pulley	Replace the V-belt pulley, or correct the balance of the pulley.	
	Bend of the shaft	Replace the shaft. Replace the motor.	
	Poor alignment of the direct coupling	Poor alignment of direct coupling	3.6.2
	Contact between the rotor and casing	Reassemble the casing.	
	Uneven contact of the gland packing	Correct the gland packing	
	Resonant vibration by improper foundation	Reinforce the foundations.	
	Insufficient tightening of the mounting bolt	Retighten the bolt and nut.	
	Damage to the bearing	Replace the bearing.	
Abnormal noise	Damage to the bearing	Replace the bearing.	
	Foreign matter intake	Inspect the inside of the casing.	
	Contact between the rotor and casing	Avoid the contact between the rotor, casing, and air intake.	3.5.1
	Slipping of the V-belt, or contact with the belt guard	Readjust the V-belt tension, or correct the position of the guard.	3.6.1
Low performance	Decrease in rotational speed or frequency	Regulate the power supply.	
	Reverse rotation	Swap the wires of the motor.	3.8
	Corrosion or wear in or foreign matter on the impeller	Clean, repair, or replace the impeller.	
	Clogging of the suction filter	Clean the suction filter.	8.3
	Failure in opening/closing of the damper	Repair the damper.	
	Dust deposited inside the casing and duct	Clean the casing and duct.	
	Excessive resistance	Consider installing a booster fan, or replace the V-belt pulley.	
	Errors in calculating the specific weight of gas	Measure the specific weight, or perform a gas analysis.	
Motor overload	Insufficient resistance	Adjust with damper	8.1
	Excessive rotation (Belt drive type)	Replace the V-belt pulley.	
	Errors in calculating the specific weight of gas	Reduce the rotational speed.	

8. Special accessories

8.1 Dampers

(1) Referring to the dimensional outline drawing that is submitted separately, install the damper in place. At that time, pay attention to the rotation direction of the fan's impeller (see Figure 17).

(1) Open and close the vane to check that it does not contact the casing or ducts.

(2) Apply lube grease on the sliding parts of the vane control damper periodically (once approximately three months).

(3) If the damper is of an electric or air cylinder type, carefully read the instruction manual of each equipment before use.

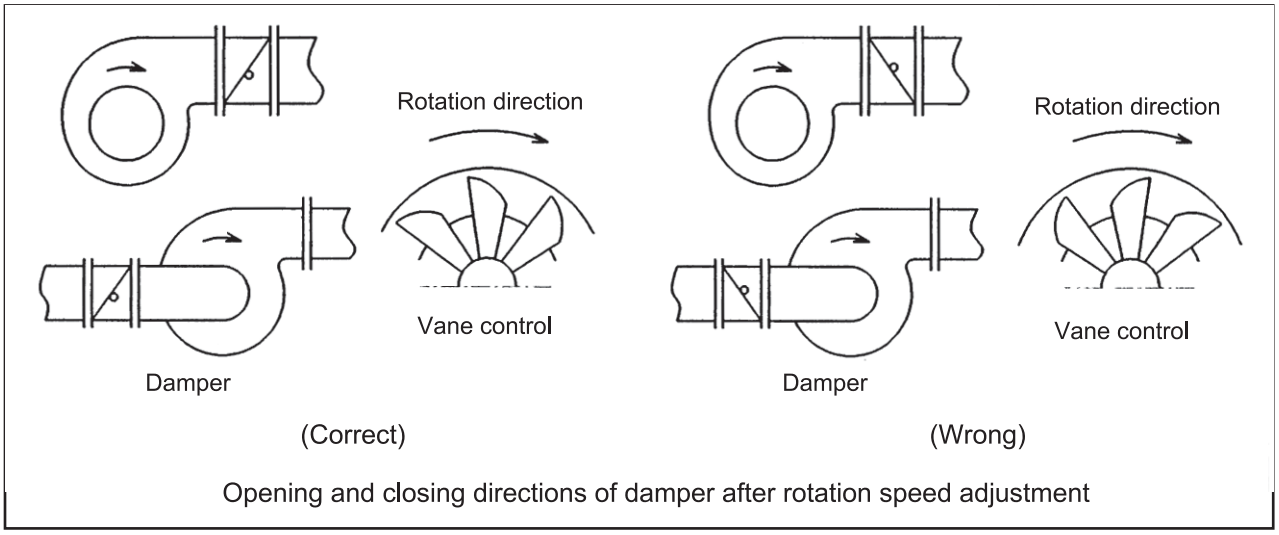


Figure 17 – Damper mounting method

8.2 Expansion joints

Take the distance between the sides as shown on the external dimensions drawing, and take care not to pull or compress the joints excessively. Do not use the expansion joints to correct the alignment of the fan or duct.

8.3 Filter

Plan the installation of the fan in consideration of installing short ducts in order to facilitate disassembly of the fan.
Install filters after thoroughly cleaning the inside of the fan and ducts.
Inspect the filter earlier once the operation starts since it tends to clog easily.
Periodically disassemble the filter element and wash it.

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