

TITLE OF THE INVENTION
AN OUTDOOR UNIT FOR AIR-CONDITIONING APPARATUS

FIELD OF THE INVENTION

5 The present invention relates to an outdoor unit for an air-conditioning apparatus.

BACKGROUND OF THE INVENTION

It is known that an outdoor unit for an air-conditioning apparatus comprises a reactor and a reactor housing inside an inverter box. Said inverter box can contain only one reactor due to heat
10 and ventilation-related problems. Therefore, another reactor must be installed inside the chamber, resulting in a large outdoor unit. The inverter box is installed in the outdoor unit by means of attachment to a chamber partition. Hence, the reactor housing's weight transmits solely to the partition. Vibration from a fan and a fan motor inside the outdoor unit causes the reactor housing to vibrate. Thus, when the weight is overwhelmed, the partition frequently breaks during operation.

15 A conventional outdoor unit usually consists of several steps when performing maintenance services. The steps consist of removing the inverter box from the partition in order to access the reactor. As the inverter box is heavy and large, it is not convenient for operators to provide services, when maintenance services are required within small or limited space areas.

20 Therefore, the development of an outdoor unit for an air-conditioning apparatus that reduces vibration of the reactor housing and improves accessibility of the internal components to provide services in a small or limited space area, is required.

SUMMARY OF THE INVENTION

25 The objective of the present invention is to provide an outdoor unit for an air-conditioning apparatus capable of comprising at least one reactor in a reactor housing, with said reactor housing installed in an outdoor unit using at least two connecting points so as to reduce the movement of said reactor housing, thereby reducing the load imposed on supporting components.

30 In order to achieve the above objective, the embodiment provides an outdoor unit for an air-conditioning apparatus, comprising at least one reactor configured to stabilize electric current in the outdoor unit; and a reactor housing configured to contain at least one reactor to be installed in

the outdoor unit using at least two connecting points, wherein the reactor housing comprises at least one extension for connecting the reactor housing with a motor main frame; and at least one engaging member configured to connect the reactor housing with a chamber partition, so as to reduce the vibration transmitting from a fan and a fan motor to the reactor housing, thereby reduce the movement of said reactor housing.

According to the embodiment of the present invention, since the movement of said reactor housing will be reduced, the load of the reactor and the reactor housing imposed on the chamber partition and the motor main frame will be reduced. Therefore, it is possible that the service life of the chamber partition and the motor main frame, as well as other connected components, can be prolonged.

Moreover, the location of said reactor housing allows accessibility to the internal components when services within the small or limited space area are required.

In the outdoor unit of the embodiment of the present invention, the reactor housing further comprises a first cover configured to attach to the reactor housing to the motor main frame using at least one extension, a second cover configured to attach the reactor housing to the chamber partition using at least one engaging member, and a reactor base configured to connect to the second cover, and configured to receive the weight from at least one reactor, wherein the first cover and the second cover surround at least one reactor, such that a gap is created between at least one reactor and the first cover and the second cover.

According to the embodiment of the present invention, since a gap is present between the reactor and the first cover and the second cover, the transmission of the vibration created from the reactor to the first cover and the second cover will be reduced. As such, the noise during the operation of the outdoor unit can be reduced.

Additionally, since the reactor housing is formed as an enclosure, it is possible to reduce the noises created from the reactor during operation.

In the outdoor unit of the embodiment of the present invention, the first cover comprises a plurality of holes configured to form an air passage for ventilation so as to improve ventilation in the reactor housing.

According to the embodiment of the present invention, since a plurality of holes is provided on the reactor housing, it is possible to reduce the risk of overheating in a reactor housing that contains at least one reactor.

5 In the outdoor unit of the embodiment of the present invention, each hole is configured to have a width equal to or less than 2.2 mm.

According to the embodiment of the present invention, since the width of the each hole does not exceed 2.2 mm, it is possible to reduce the possibility that undesirable particles, droplets, or small animals or insects will enter the reactor housing through the holes.

Preferably, the reactor base will be formed in a C-shape.

10 According to the embodiment of the present invention, it is possible that formation in a C-shape will increase the strength of the reactor base and reduce the chance that the reactor base will distort due to vibration during operation.

Moreover, the C-shape of the reactor base allows at least two connection points between the reactor and the reactor base, thereby increasing the rigidity of the connection.

15 In the outdoor unit of the embodiment of the present invention, as the reactor housing is installed in the outdoor unit using two connecting points, the reactor base further comprises a hook and a protrusion at the end of the reactor base opposite to the second cover, in order to reduce the space between the reactor housing and the chamber partition, and also to bear the weight of the reactor housing.

20 According to the embodiment of the present invention, since the hook is provided on the reactor base, it is possible that the reactor housing can be securely engaged with the chamber partition, thereby allowing the chamber partition to partially support the weight of the reactor.

Furthermore, since the protrusion is provided at the end of the reactor base, it is possible that the reactor housing can be retained in the intended position, substantially adjoining the chamber partition while allowing the chamber partition to partially support the weight of the reactor.

25 In the outdoor unit of the embodiment of the present invention, the reactor base further comprises a plurality of channels configured to form an air passage for ventilation so as to improve ventilation in the reactor.

According to the embodiment of the present invention, since the channels are provided on the reactor base, it is possible to reduce the risk of overheating of the rear side of the reactor and the reactor base that is connected to the reactor.

In the outdoor unit of the embodiment of the present invention, the thickness of the reactor
5 base is in a range of 0.8 – 1.2 mm.

According to the embodiment of the present invention, said thickness will allow the reactor base to support the weight of the reactor.

In the outdoor unit of the embodiment of the present invention, the gap is at least 5 mm.

According to the embodiment of the present invention, since the gap has a minimal length,
10 it is possible to reduce the contact between the reactor and the first cover and the second cover, thereby reducing any friction that may occur from the vibration of the reactor.

BRIEF DESCRIPTION OF THE DRAWINGS

15 The principle of the present invention and its advantages will become apparent in the following description, taking into consideration the accompanying drawings in which:

FIG. 1 shows a cross-sectional view of an outdoor unit 1 for an air-conditioning apparatus in accordance with a preferred embodiment.

FIG. 2 shows an enlarged rear perspective view of a reactor housing 20 in the outdoor unit
20 1, as illustrated in FIG 1.

FIG. 3A shows a perspective view of the reactor housing 20 in accordance with a preferred embodiment.

FIG. 3B shows a front view of the reactor housing 20 in accordance with a preferred embodiment.

25 FIG. 4 shows a perspective view of a reactor base 28 in accordance with a preferred embodiment.

FIG. 5 shows an exploded view of the reactor housing 20 in accordance with a preferred embodiment.

FIG. 6A shows a side view of the outdoor unit 1 for an air-conditioning apparatus.

30 FIG. 6B shows a perspective view of the outdoor unit 1 for an air-conditioning apparatus.

DETAILED DESCRIPTION OF THE EMBODIMENTS OF THE INVENTION

It is to be understood that the following detailed description will be directed to embodiments, provided as examples for illustrating the concept of the present invention only. The present invention is in fact not limited to the particular embodiments described, as such may, of course, vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to be limiting, since the scope of this invention will be limited only by the appended claims.

The detailed description of the invention is divided into various sections for the reader's convenience only, and disclosures found in any section may be combined with those in another section.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs.

It must be noted that as used herein and in the appended claims, the singular forms "a", "an", and "the" include plural referents unless the context clearly dictates otherwise.

The term "approximately" when used before a numerical designation, e.g., dimensions, time, amount, and such other, including a range, indicates approximations, which may vary by (+) or (-) 10%, 5% or 1%, or between any sub-range or sub-value thereof.

"Comprising" or "comprises" is intended to mean that the compositions and processes include the recited elements, but does not exclude others. "Consisting essentially of", when used to define compositions and methods, shall mean excluding other elements of any essential significance to the combination for the stated purpose. Thus, a process or product consisting essentially of the elements as defined herein would not exclude other materials or steps that do not materially affect the basic and novel characteristic(s) of the claimed invention. "Consisting of" shall mean excluding more than trace elements of other ingredients and substantial steps. Embodiments defined by each of these transition terms are within the scope of this invention.

FIG. 1 shows a cross-sectional view of an outdoor unit 1 for an air-conditioning apparatus. As illustrated in FIG. 1, the outdoor unit 1 for an air-conditioning apparatus, comprises: at least one reactor 10 configured to stabilize electric current in the outdoor unit 1; a reactor housing 20 configured to contain at least one reactor 10 and to be installed in the outdoor unit 1 using at least

two connecting points; a motor main frame 30; a chamber partition 40; a fan 50; and a fan motor 60.

As illustrated in FIG. 1, the reactor housing 20 comprises at least one extension 22 for connecting the reactor housing 20 with the motor main frame 30; and at least one engaging member 24 configured to connect the reactor housing 20 with the chamber partition 40 so as to form at least two connecting points. Since the fan 50 and the fan motor 50 are configured to be mounted to the motor main frame 30, vibration from the fan 50 and the fan motor 60 during the operation is transmitted to other devices installed nearby, such as the reactor housing 20, causing the movement of the devices. Said vibration can also be transferred to the motor main frame 30 and further to a chamber 45, causing a harmonic sound wave, which is not desirable for the outdoor unit 1. Hence, using at least two connecting points reduces the vibration transmitted from a fan 50 and a fan motor 60 to the reactor housing 20 and to the motor main frame 30, thereby reducing the movement of said reactor housing 20 and also reducing the harmonic sound wave. Preferably, the two connecting points are at the motor main frame 30 and at the chamber partition 40.

FIG. 2 shows an enlarged view of the reactor housing 20 in the outdoor unit 1, as illustrated in FIG. 1. As illustrated in FIG. 2, at least one extension 22 is configured to have at least one first fastening means 222 for connecting at least one extension 22 with the motor main frame 30. At least one engaging member 24 is configured to have at least one second fastening means 242 for connecting at least one engaging member 24 with the chamber partition 40. Preferably, the engaging member 24 is formed as a metal sheet.

In the preferred embodiment of the present invention, the two connecting points are at the motor main frame 30 and at the chamber partition 40 so as to reduce the movement of the reactor housing 20, either in a vertical axis or in a horizontal axis. The reactor housing 20 comprises one extension 22 and one engaging member 24. The extension 22 is a sheet extending from a wall closer to the motor main frame 30 of the reactor housing 20. Said extension 22 has two first fastening means 222 for connecting the reactor housing 20 with the motor main frame 30. These two holes 222 also reduce the occurrence of scratching between screws and the holes 222 after numerous maintenance services at the motor main frame 30. The engaging member 24 is a sheet extending from a wall of the reactor housing 20 closer, having one second fastening means 242 for connecting the reactor housing 20 with the chamber partition 40.

According to FIG. 3A, the reactor housing 20 further comprises: a first cover 26 configured to attach the reactor housing 20 to the motor main frame (not shown) using at least one extension 22, a second cover 27 configured to attach the reactor housing 20 to the chamber partition (not shown) using at least one engaging member 24, and a reactor base 28 configured to connect to the second cover 27, and configured to receive the weight of at least one reactor 10.

The first cover 26 is configured to connect with the second cover 27, and is also configured to connect with other devices in the outdoor unit 1, preferably the motor main frame 30, using at least one extension 22. The first cover 26 consists of at least two walls, preferably three walls. The first cover 26 comprises a plurality of holes 262 configured to form an air passage for ventilation so as to improve ventilation in the reactor housing 20. The holes 262 are designed to adjust temperature within the reactor housing 20 and also to enhance the heat exchange between an inlet air suctioning from the fan 50, and the heat generated in the reactor housing 20. According to the preferred embodiment of the present invention, a width of each holes 262 is configured to be equal to or less than 3 mm in order to prohibit undesirable particles, droplets of water, or animals or insects to enter the reactor housing 20. Preferably, the width of each holes 262 is approximately 2.2 mm.

In the preferred embodiment of the present invention, the first cover 26 comprises one extension 22 for connecting to the motor main frame 30, and approximately 14 holes of holes 262, preferably, 12 of which are provided on one side, and the others are provided on the other side of the first cover 26. Each of holes 262 has a length of approximately 40 mm and a width of approximately 2.2 mm.

The second cover 27 is configured to connect with the reactor base 28, and is also configured to connect with other devices in the outdoor unit 1, preferably the chamber partition 40 using at least one engaging member 24. The second cover 27 consists of two walls and comprises at least one leg 272 configured to support the weight of the reactor housing 20. At least one leg 272 is formed as a metal sheet comprising a connecting end 2722, adjoining the second cover 27, and a free end 2724 forming a curved shape for insertion into a part of the chamber partition 40. Preferably, the free end 2724 is formed in a curved shape with a curvature radius of 20 degrees.

In the preferred embodiment of the present invention, the second cover 27 comprises one engaging member 24 for connecting to the chamber partition 40, and two legs 272 for supporting the weight of the reactor housing 20.

The reactor base 28 is configured to connect to the second cover 27, and configured to receive a weight from at least one reactor 10. At least one reactor 10 is configured to stabilize the electric current in the outdoor unit 1, such as a compressor 70. During the operation of the outdoor unit 1, a reactor coil inside the reactor 10 creates the induction of an electric current, causing vibration of the reactor coil. At least one reactor 10 is detachable from the reactor base 28 and can be attached to the reactor base 28 by fastening means.

The reactor base 28 is made of a robust material capable of preventing a distortion to occur at the reactor base 28, thereby providing a strong and solid base that reduces the vibration received from the reactor coil.

Hence, the reactor base 28 is formed in a shape that enables an improvement in the strength of the base in order to receive the weight of at least one reactor 10 and also enables it to withstand distortion because of the vibration. Preferably, the reactor base 28 is formed in a C-shape so as to increase the strength of the reactor base 28 and reduce the chance that the reactor base 28 will be distorted due to the vibration of the reactor coil during operation.

Moreover, the C-shape of the reactor base allows at least two connection points between the reactor and the reactor base, thereby increasing the rigidity of the connection.

According to the preferred embodiment of the invention as illustrated in FIG 4, the reactor base 28 is formed in a C-shape and receives the weight from two reactors 10. Said two reactors 10 can be attached to the same reactor base 28 at a main body 288 of the C-shape by using fastening means, preferably by a plurality of screws. The main body 288 is made of steel and has a thickness within approximately the range of 0.8 – 1.2 mm in order to effectively receive the weight of the two reactors 10.

The reactor base 28 further comprises a hook 282 and a protrusion 286 at the end of the reactor base 28 opposite to the second cover 27 for reducing the space between the reactor housing 20 and the chamber partition 40, and also for bearing the weight of the reactor housing 20. The hook 282 and the protrusion 286 are provided at the other end of the reactor base 28.

The hook 282 is configured to bear most of the weight of the reactor housing 20 in a vertical direction. The hook 282 is formed in a metal sheet having a shape fitting with the shape of the chamber partition 40, thereby reducing the space between the reactor housing 20 and the chamber

partition 40. Preferably, the hook 282 is formed in a curved shape with a curvature radius of 10 degrees.

The protrusion 286 is configured to guide the reactor housing 20 to closely fit with the chamber partition 40. The protrusion 286 is formed in a metal sheet having a bended end 2864 for directing the reactor housing 20 to the chamber partition 40. Preferably, the bended end 2864 is formed in a curved shape with a curvature radius of 150 degrees.

According to FIG 4, the reactor base 28 further comprises a plurality of channels 284 configured to form an air passage for ventilation so as to improve ventilation in the reactor 10.

According to the preferred embodiment, as illustrated in FIG 3B, the first cover 26 is connected to the second cover 27 by fastening means. The reactor base 28 is configured to connect to the second cover 27 at one end of the reactor base 28 by fastening means. Preferably, the reactor base 28 is configured to connect to the second cover 27 at one end of the reactor base 28 by using screws. The reactor base 28 connects to the second cover 27 at the smaller walls of the two in a manner whereby the reactor base 28 is off-center.

The first cover 26 and the second cover 27 of the reactor housing 20 surrounds at least one reactor 10 such that a gap 29 is created between at least one reactor 10, and the first cover 26 and the second cover 27. The first cover 26 and the second cover 27 of the reactor housing 20 are configured to envelop the reactor base 28 containing said at least one reactor 10 in a box shape in order to reduce the noise generated by the reactor. The gap 29 prohibits friction between at least one reactor 10 and the first cover 26 and the second cover 27 of the reactor housing 20. Preferably, the created gap 29 is at least 5 mm.

According to FIG. 2, FIG. 3A and FIG. 5, at least one reactor 10 is detachable from the reactor base 28 for maintenance and service. The steps of detaching at least one reactor 10 comprises the following steps:

Step 1: removing the reactor housing 20 from the two connecting points by unfastening the first fastening means 222 and the second fastening means 242.

In the preferred embodiment of the present invention, the reactor housing 20 is removed from the motor main frame 30 by means of unfastening the first fastening means 222 connecting the extension 22 of the reactor housing 20 with the motor main frame 30, so as to enable the vertical movement of the reactor housing 20, and the reactor housing 20 is removed from the chamber

partition 40 by means of unfastening the second fastening means 242 connecting the engaging member 24 connecting the reactor housing 20 with the chamber partition 40 so as to enable the horizontal movement of the reactor housing 20.

Step 2: removing the first cover 26 by unfastening the fastening means between the first
5 cover 26 and the second cover 27.

Step 3: removing the second cover 27 by unfastening the fastening means between the second cover 27 and the reactor base 28.

Step 4: removing at least one reactor 10 from the reactor base 28 by unfastening the fastening means.

10 In the preferred embodiment of the present invention, each of the two reactors 10 is detached from the reactor base 28 by unfastening the fastening means connecting each reactors 10 with each side of the main body 288 of the C-shape in order to remove the reactors 10 for maintenance and services.

In order for the reactor housing 20 to contain at least one reactor 10 without overheating
15 due to heat stored inside the housing 20 and causing damage to the outdoor unit 1 and the surroundings, the reactor housing 20 is installed at the location where there is sufficient ventilation in the outdoor unit 1.

As illustrated in FIG 2, FIG 4, FIG 6A and 6B, ambient air enters the outdoor unit 1 via an air passage provided at the back of the outdoor unit 1 by means of suction from the fan 60. The inlet
20 ambient air splits to form two air passages after being suctioned. The first portion of the inlet air flows through a first air passage, passing a heat sink behind a terminal 80 disposed inside the outdoor unit 1, prior to flowing through the plurality of holes 262 so as to enter the reactor housing 20 and to receive the heat from the reactor housing 20. Said plurality of holes 262 enable the transfer of the heat generated inside the reactor housing 20 to be released from the reactor housing 20. The second
25 portion of the inlet air flows through a second air passage, passing the chamber 45 and a plurality of slit holes of the chamber partition 40, prior to entering the reactor housing 20 and receiving the heat from the reactor housing 20. The fan 60 is configured to ventilate the heated air out from the outdoor unit 1.

Furthermore, the channel 284 at the reactor base 28 enhances the ventilation of the heat by providing another air passage for forcing the inlet air to flow through the back of at least one reactor 10.

Accordingly, the overheating problem with regard to heat stored inside the housing 20 and causing damage to the outdoor unit 1 can be alleviated, thus allowing the outdoor unit 1 to be operated smoothly.

Although specific embodiments of the invention have been disclosed and described, as well as illustrated in the accompanying drawings, these are simply for the purpose of a better understanding of the principles of the present invention and are not meant to impose a limitation on the scope and spirit of the teaching of the present invention. Adaption and modification to various structures, such as design or material of the invention, are possible and apparent to a skilled person without departing from the scope of the present invention, which is to be determined by the claims.

List of References:

15	1	outdoor unit
	10	reactor
	20	reactor housing
	22	extension
	222	first fastening means
20	24	one engaging member
	242	second fastening means
	26	first cover
	262	hole
	27	second cover
25	272	leg
	2722	connecting end
	2724	free end
	28	reactor base
	282	hook
30	284	channel

	286	protrusion
	2864	bended end
	288	main body
	29	gap
5	30	motor main frame
	40	chamber partition
	45	chamber
	50	fan
	60	fan motor
10	70	compressor
	80	terminal

CLAIMS

1. An outdoor unit (1) for an air-conditioning apparatus, comprising:
 - at least one reactor (10) configured to stabilize electric current in the outdoor unit (1); and
 - a reactor housing (20) configured to contain said reactor (10) and to be installed in the
 - 5 outdoor unit (1) using at least two connecting points,
 - wherein the reactor housing (20) comprises at least one extension (22) for connecting the reactor housing (20) with a motor main frame (30); and at least one engaging member (24) configured to connect the reactor housing (20) with a chamber partition (40) so as to reduce vibration transmitting from a fan (50) and a fan motor (60) to the reactor housing (20), thereby
 - 10 reducing the movement of said reactor housing (20).
2. The outdoor unit (1) according to claim 1, wherein the reactor housing (20) further comprises:
 - a first cover (26) configured to attached the reactor housing (20) to the motor main frame
 - (30) using said at least one extension (22);
 - 15 a second cover (27) configured to attach the reactor housing (20) to the chamber partition (40) using said engaging member (24); and a reactor base (28) configured to connect to the second cover (27), and configured to receive the weight from said reactor (10), wherein the first cover (26) and the second cover (27) surround said reactor (10), such that a gap (29) is created between said reactor (10) and the first cover (26) and the second cover (27).
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3. The outdoor unit (1) according to claim 2, wherein the first cover (26) comprises a plurality of holes (262) configured to form an air passage for ventilation so as to improve ventilation in the reactor housing (20).
4. The outdoor unit (1) according to claim 3, wherein each hole (262) is configured to have a width
- 25 equal to or less than 2.2 mm.
5. The outdoor unit (1) according to claim 2, wherein the reactor base (28) is formed in a C-shape.
6. The outdoor unit (1) according to claims 2 or 5, wherein the reactor base (28) comprises a hook (282) and a protrusion (286) at the end of the reactor base (28) opposite to the second cover (27)

for reducing a space between the reactor housing (20) and the chamber partition (40), and also for bearing the weight of the reactor housing (20).

7. The outdoor unit (1), according to claims 2 or 5, wherein the reactor base (28) further comprises a plurality of channels (284) configured to form an air passage for ventilation so as to improve ventilation in the reactor (10).
8. The outdoor unit (1), according to claims 2 or 5, wherein a thickness of the reactor base (28) is within a range of 0.8 – 1.2 mm.
9. The outdoor unit (1) according to claim 2, wherein the gap (29) is at least 5 mm.