COMPRESSOR MOUNTING BASE PLATE

FIELD

The present invention relates to a compressor mounting base plate for an appliance; and a process for manufacturing the compressor mounting base plate. The present invention also relates to an appliance such as a refrigerator installed with the above compressor mounting base plate for a compressor to be mounted thereon.

BACKGROUND

Original equipment manufacturers (OEMs) that manufacture refrigerators are aspiring to shift from the OEMs' current convention design practice of steel stamped refrigerator parts to new technologies in designing and manufacturing of such refrigerator parts. The current trend in the home appliance industry is moving toward a wall-mounted refrigerator which will prompt OEMs to make such products lighter. For example, OEMs are looking to replace the current steel compressor mounting plate (which is 1-2 kg in weight) of a current refrigerator with a light weight and a non-corrosive composite material compressor mounting base plate.

Generally, the lower portion or bottom structure of an appliance such as a refrigerator contains a machine compartment of the refrigerator, a compressor, and a compressor mounting base plate for attaching the compressor to the base plate. A compressor mounting base plate is positioned under the rear part of the refrigerator bottom so as to define a machine compartment and the compressor mounting base plate supports a compressor mounted on the base plate located in the machine compartment.

Figures 1 and 2 show a conventional design of a refrigerator, generally indicated by numeral 10, illustrating some of the conventional parts of a refrigerator including a conventional steel compressor mounting base plate 11 affixed to the bottom portion of the refrigerator cabin 12 at a lower portion of a refrigerator cabin; and a conventional compressor 13 affixed to the top surface of the compressor mounting base plate 11. The compressor 13 is attached to the top surface of the compressor mounting base plate 11 via threaded bolts 14 and threaded nuts 15; and compressor support member brackets 16 attached to the compressor 13. Disposed in-between the brackets 16 and the surface of the compressor mounting base plate 11 are vibration damping members 17 for attenuating the vibrations of the compressor when the compressor is in operation. In addition, wheels 18 are attached to the compressor mounting base plate 11 to provide movement of the refrigerator when the compressor mounting base plate 11 is affixed to the refrigerator cabin 12.

Figures 3-5 illustrate another example of a conventional steel compressor mounting base plate in the form of a rectangular-shaped tray member generally indicated by numeral 20 which can be affixed to the bottom portion of a refrigerator unit of the prior art (not shown) and which is also adapted for receiving and affixing a conventional compressor (not shown) thereto.

A typical compressor mounting plate of the prior art as shown in Figures 3-5 is made from 1 millimeter (mm) thick steel sheets. The compressor mounting plate is usually

manufactured using a sheet metal stamping process to form a compressor mounting base plate 21 having a top surface 22 and a bottom surface 23. Integral with the base plate 21 are longitudinal sidewalls 24 and transverse sidewalls 25 forming a tray member 20. A secondary operation is typically used to form flange tabs 26, flange holes 27, orifices 28, and orifices 29 in the sheet (see Figures 3 and 4). Typically, the finished steel compressor mounting plate part is about 1.2 kilograms (kg) in weight.

The compressor mounting base plate 21 contains a plurality of orifices, typically four orifices 29, for receiving a threaded bolt 31 and a threaded nut 32 (for purposes of illustration, one orifice 29 is shown in Figures 3 and 4 without nuts and bolts). The threaded bolts 31 and nuts 32 are used to affix the compressor to the compressor mounting base plate 21. A rubber damper member 33, shown in Figures 3-5, is inserted between the bolt and nut for providing damping during operation of the compressor. The compressor is attached to the top surface 22 of the base plate to attach to the compressor mounting base plate via a bracket member (similar to bracket 16 of Figure 1 and 2). Wheels 34 rotatably affixed to the compressor mounting base plate 21 are used to install the compressor mounting base plate into the refrigerator unit.

When the steel compressor mounting plate of the prior art is subjected to a corrosive environment, over time, the conventional steel compressor mounting plate corrodes and loses its strength. Also, the structural damping coefficient for steel is approximately 2 percent (%) which causes vibrations to transfer to the refrigerator cabin through the compressor mounting plate even though there are typically four rubber dampers 33 fixed with the bolts 31 and nuts 32 on the steel sheet (see Figures 3-5) below the location of where the compressor support member brackets will be positioned (see brackets 16 of Figure 1 and 2).

Thus, OEMs in the home appliance industry are continually seeking appliance equipment and parts such as a compressor mounting base plate product for a refrigerator unit that would provide an improvement to the overall manufacturing and cost of an appliance such as a refrigerator unit.

SUMMARY

~~The~~Embodiments of the present invention includes a compressor mounting base plate design for an appliance device which uses a compressor, a motor, or an equivalent vibrating (reciprocating/rotating) apparatus such as a washing machine, a dishwasher, an air-conditioning unit, or a refrigerator unit. The compressor mounting plate exhibits beneficial characteristics which can also be critical customer requirements. For example, the compressor mounting base plate as per embodiments of the present invention can be light weight such that the compressor mounting base plate is from about 20 % to 30 % lighter than a steel plate. The compressor mounting base plate as per embodiments of the present invention also can be advantageously manufactured from a non-metal, non-corrosive composite material such as for example a polyurethane polymer.

~~According to a first aspect of the present invention, there is provided a compressor mounting base plate structure comprising: a base plate segment having a top surface and a bottom surface, said base plate segment further comprising four vertical sidewalls disposed perpendicular to the horizontal plane of the base plate and integral with the base plate segment, one vertical sidewall disposed on each of the four sides of the base plate segment and along the perimeter of the top surface of the base plate segment forming a base~~

~~plate tray member, wherein the base plate segment is adapted for receiving a compressor on the top surface of the base plate segment within the area of the base plate segment surrounded by the four vertical sidewalls; a means for receiving and removably affixing a compressor to the top surface of the base plate segment; a reinforcement section integral with said base plate segment, wherein said reinforcement section includes at least two elongated transverse reinforcement segments integral with the base plate segment, one transverse reinforcement segment adjacent the transverse sides of the base plate segment; and a repositioning section integral with the reinforcement section, wherein said repositioning section includes at least two elongated transverse repositioning segments integral with the reinforcement section, one transverse reinforcement segment adjacent the transverse sides of the reinforcement section.~~

According to a first aspect of the present invention, there is provided an elongated non-metal, non corrosive compressor mounting base plate structure comprising an integral combination of: (I) a middle or central base plate segment comprising a planar base plate segment member having a top surface and a bottom surface, and further comprising four vertical sidewall members integral with the planar base plate segment member on the perimeter of the top surface of the planar base plate segment member, forming a base plate tray member; (II) one or more orifices disposed through the body of the planar base plate segment member, and is adapted for receiving a means for receiving and removably affixing a compressor to the top surface of the planar base plate segment member, disposed in the middle or central portion of the planar base plate segment member; and (III) a reinforcement means integrally connected to and transverse to the longitudinal horizontal plane of said base plate segment; wherein said reinforcement means includes at least two elongated transverse reinforcement segments integrally connected to the base plate segment, with one transverse reinforcement segment at each of the transverse sides of the base plate segment; wherein each of the two elongated transverse reinforcement segments comprises a U-shaped channel when viewed in cross-section, the U-shaped channel includes sidewalls at both ends of the U-shaped channel forming an elongated U-shaped trough member; said reinforcement means being adapted for providing the compressor mounting base plate structure with sufficient strength and rigidity such that the compressor mounting base plate structure can withstand deformation a load from the weight of the compressor; and wherein the compressor mounting base plate structure comprises a non-metal, non corrosive structure.

According to a second aspect of the present invention, there is provided a process for manufacturing a compressor mounting base plate structure composite comprising subjecting a composite material to an open mold or a closed mold Structural Reaction Injection Molding (S-RIM) process to form a one piece compressor mounting the above base plate structure.

According to a third aspect of the present invention, there is provided an appliance device which uses a compressor, a motor, or an equivalent vibrating (reciprocating/rotating) apparatus comprising the above compressor mounting base plate structure.

According to a ~~third~~ fourth aspect of the present invention, there is provided a refrigerator, comprising: a refrigerator main body having a cooling chamber for storing foods and a machine room; a compressor mounting the above base plate structure installed in the machine room located at a lower portion of the refrigerator main body; said compressor

mounting base plate structure adapted for receiving and supporting a compressor; and a compressor mounted on the mounting base plate structure.

In another embodiment, the compressor mounting base plate of the present invention may optionally include a means for receiving and retaining liquid condensation that may occur during operation of the compressor. For example, such means can include a condensation tray member; and the condensation tray member can either be integral with the compressor mounting base plate segment or the condensation tray member can be a separate tray member removably attached to the top surface of the base plate segment. The condensation tray member can also be referred to as a drip tray. When the drip tray is employed in the present invention, for example, the drip tray can be located under the machine compartment of a refrigerator and designed for receiving and retaining water that might drip off an evaporator in the refrigerator.

Still another embodiment of the present invention includes a process for manufacturing the compressor mounting base plate. In one preferred embodiment for example, the process for manufacturing the compressor mounting base plate may include a Structural Reaction Injection Molding (S-RIM) process.

The composite-based compressor mounting base plate as per embodiments of the present invention has several advantages over a conventional steel-based compressor mounting base plate. For example, the composite-based compressor mounting base plate product of the present invention: (1) is light weight and up to 30 % lighter in weight compared to a steel compressor mounting base plate; (2) is strong as a steel compressor mounting base plate; (3) exhibits no corrosion because the composite-based compressor mounting base plate of the present invention is made of a non-corrosive material such as a polyurethane polymer; (4) exhibits improved dynamic response under compressor loading conditions which is beneficial to restrict mechanical vibrations of the compressor during operation in an appliance device such as a refrigerator; and (5) is easily integrated into conventional parts of various appliance devices such as a conventional refrigerator.

In addition, one of the advantages of using the process as per embodiments of the present invention to manufacture a composite-based compressor mounting base plate over a steel-based compressor mounting base plate is that the process allows a manufacturer to make a product that can be made with low tooling cost and low manufacturing process cost in an attempt to reduce part cost.

BRIEF DESCRIPTION OF THE DRAWINGS

For the purpose of illustrating the present invention, the drawings show a form of the present invention which is presently preferred. However, it should be

CLAIMS:

1. ~~A~~ An elongated non-metal, non corrosive compressor mounting base plate structure comprising an integral combination of:

(I) a middle or central base plate segment comprising a planar base plate segment member having a top surface and a bottom surface, and ~~said base plate segment~~ further comprising four vertical ~~sidewalls~~ sidewall members integral with the planar base plate segment member on the perimeter of the top surface of the planar base plate segment member, ~~disposed perpendicular to the horizontal plane of the base plate and integral with the base plate segment, one vertical sidewall disposed on each of the four sides of the base plate segment and along the perimeter of the top surface of the base plate segment~~ forming a base plate tray member~~, wherein the base plate segment is adapted for receiving a compressor on the top surface of the base plate segment within the area of the base plate segment surrounded by the four vertical sidewalls~~;

(II) one or more orifices disposed through the body of the planar base plate segment member, and is adapted for receiving a means for receiving and removably affixing a compressor to the top surface of the planar base plate segment~~; a reinforcement section integral with said base plate segment, wherein said reinforcement section includes at least two elongated transverse reinforcement segments integral with the base plate segment, one transverse reinforcement segment adjacent the transverse sides of the base plate segment~~ member, disposed in the middle or central portion of the planar base plate segment member; and

~~a repositioning section integral with the reinforcement section, wherein said repositioning section includes at least two elongated transverse repositioning segments integral with the reinforcement section, one transverse reinforcement segment adjacent the transverse sides of the reinforcement section~~

(III) a reinforcement means integrally connected to and transverse to the longitudinal horizontal plane of said base plate segment; wherein said reinforcement means includes at least two elongated transverse reinforcement segments integrally connected to the base plate segment, with one transverse reinforcement segment at each of the transverse sides of the base plate segment; wherein each of the two elongated transverse reinforcement segments comprises a U-shaped channel when viewed in cross-section, the U-shaped channel includes sidewalls at both ends of the U-shaped channel forming an elongated U-shaped trough member; said reinforcement means being adapted for providing the compressor mounting base plate structure with sufficient strength and rigidity such that the

compressor mounting base plate structure can withstand deformation a load from the weight of the compressor; and

wherein the compressor mounting base plate structure comprises a non-metal, non corrosive structure.

2. The compressor mounting base plate structure of claim 1, further comprising IV at least one load bearing/load distributing structure adapted for providing strength, reinforcement and integrity to the mounting base plate structure integral with the base plate.

3. The compressor mounting base plate structure of claim 2, wherein the at least one load bearing/load distributing structure is a raised surface area in at least a portion of the base plate segment adapted for receiving a compressor.

~~4. The compressor mounting base plate structure of claim 1, comprising a means for receiving and retaining liquid condensation that may optionally occur during operation of the compressor.~~

~~5. The compressor mounting base plate structure of claim 4, wherein the means for receiving and retaining liquid condensation comprises a condensation tray member integral with the base plate tray member; wherein the condensation tray member comprises four vertical sidewalls, each vertical sidewall disposed perpendicular to the horizontal plane of the base plate and integral with the base plate segment on at least a portion of the top surface of the base plate segment, each vertical sidewall integral with each other and disposed such that four vertical sides of a rectangular shape condensation tray member is form on at least a portion of the top surface of the base plate segment; wherein the condensation tray member is adapted for receiving and retaining liquid condensation that may optionally occur during operation of the compressor.~~

~~6. The compressor mounting base plate structure of claim 5, wherein the condensation tray member comprises a separate tray member removably attached to the top surface of the base plate segment.~~

~~7. The compressor mounting base plate structure of claim 1, wherein the reinforcement section comprises at least a first reinforcing structure member integral with the base plate at~~

~~a proximal end of the base plate; and at least a second reinforcing structure member integral with the base plate at a distal end of the base plate.~~

~~8. The compressor mounting base plate structure of claim 7, wherein the at least first reinforcing structure member comprises a first U-shaped channel and disposed at one transverse end of and integral with the base plate, wherein the first U-shaped channel includes sidewalls at both ends of the U-shaped channel forming a first elongated U-shaped trough member; and wherein the second reinforcing structure member comprises a second U-shaped channel and disposed at the other transverse end of and integral with the base plate, wherein the second U-shaped channel includes sidewalls at both ends of the U-shaped channel forming a second elongated U-shaped trough member.~~

~~9. The compressor mounting base plate structure of claim 7, wherein the at least first and second reinforcing structure members comprise a V-shaped channel .~~

~~10. The compressor mounting base plate structure of claim 1 wherein said repositioning section is adapted for moving the base plate to and from a lower portion of a refrigerator unit during installation of the base plate to the refrigerator unit; and adapted for moving the refrigerator unit from location to another location once the base plate structure is affixed to the lower portion of the refrigerator unit.~~

~~11. The compressor mounting base plate structure of claim 10, wherein the repositioning section comprises a first inverted U-shaped channel disposed in-between the base plate and the first reinforcing structure member and integral with the base plate and the first reinforcing structure member; and a second inverted U-shaped channel disposed in-between the base plate and the first reinforcing structure member and integral with the base plate and the second reinforcing structure member.~~

~~12. The compressor mounting base plate structure of claim 11, wherein the repositioning section includes at least first wheel member removably attached to the first inverted U-shaped channel and at least a second wheel member removably attached to the second inverted U-shaped channel.~~

~~13. The compressor mounting base plate structure of claim 12, wherein the at least first and second wheel members are removably mounted to the base plate via an L-shaped insert member over-molded into the compressor mounting base plate at the first and second inverted U-shaped channels, respectively.~~

~~14. The compressor mounting base plate structure of claim 8, comprising a lip edge on the outside rim perimeter of the first elongated U-shaped channel trough member; and including a lip edge on the outside rim perimeter of the second elongated U-shaped channel trough member.~~

~~15. The compressor mounting base plate structure of claim 14, wherein the lip edges of the first and second elongated U-shaped channel trough members include a means for attaching the compressor mounting base plate structure to a lower portion of a refrigerator unit.~~

~~16~~4. The compressor mounting base plate structure of claim ~~7~~1, wherein the at least first reinforcing structure member comprises a first solid elongated bar or rib member disposed at one transverse end of and integral with the base plate; and wherein the second reinforcing structure member comprises a second solid bar or rib disposed at the other transverse end of and integral with the base plate.

~~17~~5. The compressor mounting base plate structure of claim ~~8~~4, wherein the first elongated U-shaped channel trough member, the second elongated U-shaped channel trough member, or both comprise a solid elongated U-shaped bar or rib integral with the base plate.

~~18. The compressor mounting base plate structure of claim 1, wherein the base plate is rectangular in shape.~~

~~19. The compressor mounting base plate structure of claim 1 made of a composite material comprising a thermosetting resin and fibers.~~

~~20. The compressor mounting base plate structure of claim 19, wherein the fibers comprise continuous fibers, knitted mat fibers, chopped fibers, random fibers, or mixtures thereof.~~

~~21. The compressor mounting base plate structure of claim 19, wherein the fibers comprise glass fibers, carbon fibers, natural fibers, or mixtures thereof.~~

~~22. The compressor mounting base plate structure of claim 19, wherein the fibers are present in the thermosetting resin from about 10 percent by volume to about 70 percent by volume.~~

~~23. The compressor mounting base plate structure of claim 19, wherein the thermosetting resin comprises a polyurethane resin.~~

~~24~~6. A process for manufacturing a compressor mounting base plate structure composite comprising subjecting a composite material to an open mold or a closed mold Structural Reaction Injection Molding (S-RIM) process to form a one piece compressor mounting base plate structure of claim 1.

~~25~~7. An appliance device which uses a compressor, a motor, or an equivalent vibrating (reciprocating/rotating) apparatus comprising the compressor mounting base plate structure of claim 1.

~~26. The appliance device of claim 25 selected from the group consisting of a washing machine, a dishwasher, an air-conditioning unit, or a refrigeration unit.~~

~~27~~8. A refrigerator, comprising:

(a) a refrigerator main body having a cooling chamber for storing foods and a machine room;

(b) a compressor mounting base plate structure of claim 1 installed in the machine room located at a lower portion of the refrigerator main body; said compressor mounting base plate structure adapted for receiving and supporting a compressor; and

(c) a compressor mounted on the mounting base plate structure.