Pentapost type air handling unit casing comprising panels arranged side by side and perpendicularly, and side profiles embodied between the perpendicular panels and middle profiles embodied between side by side panels whereby side profiles (2) comprises at least two joined partitions having a predetermined height and width difference with respect to cross-sections thereof and the middle profiles (3) having the same thickness with the side panels are provided with steps on two opposite directions around circumference of the middle profiles (3) and self-drilling screws located inside of plastic bushings (10) for connection of the panels and side, middle profiles and gasket (19) means for air leakage between casing and surroundings thereof.
PENTAPOST AIR HANDLING UNIT CASING

TECHNICAL FIELD

[0001] This invention relates to an Air Handling Unit (AHU) Casing housing various components for changing the air thermal conditions therein. More particularly the present invention relates to casing elements and structure providing smooth and flat interior surfaces, eliminating the utilization of nuts inside the unit and thus serving an embodiment for easy casing assembly and maintenance and providing a decrease of heat transfer between inside and outside of the air handling unit.

BACKGROUND ART

[0002] Air handling units are widely used in both comfort and industrial process air conditioning systems for the purposes of changing the thermal conditions of air and removing the undesired particles and odors from the air. Various components such as cooling and heating coils, filters, blowers, humidifiers etc. are installed inside the air handling unit casing to change the thermal conditions of air and in order to circulate the air through the air handling unit casing.

[0003] The function of the air handling unit casing is to physically separate the conditioned and circulated air inside the unit from the environment air outside and additionally to provide a protective cover for the inner components.

[0004] Generally, air handling unit casings can be classified into two groups which are called as frameless and pentapost casings. In a frameless air handling unit casing, panels can be directly connected to each others, however in a pentapost casing frames provide panel connection.

[0005] Main elements of a pentapost AHU casing are side profiles, middle profiles, corner pieces, panels and doors. A framework is constructed from the side profiles and corner pieces. Joining of the side profiles to each other is performed by corner pieces. Middle profiles and panels are connected to the side profiles in order to produce an enclosure. The perpendicular connection of the panels is performed by side profiles however the side by side panel connection is achieved by using middle profiles.

[0006] The panels are produced from two separate sheet plates and an insulation material in between. Since the air handling units come with different sizes depending on the required performance and air conditioning capacity, a different number and combination of modular standard panels are used to build each particular size of the casing.

[0007] The doors provide access to the inside of the casing for maintaining and repairing the components or for making amendments or adjustments on the system in case of necessity. The door is also made up of two separate sheet metal plates called inner and outer skins and a filling insulation material in between. The door is furnished with hinges along one side through which it is fixed to the profiles and with door handles on the side across, for locking the door.

[0008] With the present state of the art the construction outlines of air handling unit casings as described above, the following problems are generally faced in practice:

[0009] Generally side profiles hold edges on which panels are joined. These edges reduce the beneficial height of the unit. The height of the elements must be reduced in order to be inserted to or withdrawn from the unit. This causes decrease of the unit elements face area and consequently decrease of their performance.

[0010] When two sub-unit of an air handling unit are joined to each other in order to produce a longer unit, the profile edges on sub-units connection parts obstruct the air flow near the interior surface which collects dust and particles and also produce difficulties for washing and cleaning of the inside of the unit.

[0011] Dust and particles are also collected inside the unit due to different thickness of middle profiles with panels and also due to unsmooth interior surface of the middle profiles. The collection of dust and particles inside the unit degrades hygene of the unit.

[0012] Panels are connected to profiles by means of bolts and nuts. The existence of nuts inside the unit makes difficulties for setting of the AHU elements since elements can not be placed on nuts and they should be shifted to the positions where nuts do not exist so increasing the air handling unit length.

[0013] The joining of the panels to the side or middle profile by bolts and nuts also makes difficulties during the casing assembly since it requires two persons, one to hold the nut inside while the other one should turn the bolt outside the unit.

[0014] Condensation on the casing surface is another problem which is frequently faced especially in the regions with high relative humidity. Condensation on the casing causes the rusting and corrosion of the skin. Although insulation in the panels decreases heat transfer between inside and outside of the unit, condensation generally occurs on the surface of middle profile since it is not filled with insulation.

[0015] In recent years, works and developments on air handling unit casings have been performed to eliminate problems described above, however, a modular construction in which welding is not employed has not been presented to remove or reduce the effect of the all described problems.

DESCRIPTION OF THE INVENTION

[0016] The main elements of the casing of the present invention are corner pieces, side profiles, middle profiles, panels and doors, however, the present casing eliminates some problems mentioned above and decreases the effect of the other ones.

[0017] Object of the present invention is to remove the side profile edges and obtain an air handling unit in which the interior height becomes equal to the serviceable height. Therefore, eliminating the necessity of reduction of the unit elements height.

[0018] Another object of the present invention is to provide a casing having smooth and flat interior surfaces and so eliminating profile edges, nuts inside the unit and channels or projections even in the case of the connection of two sub-unit sections.

[0019] Another object of the present invention is to decrease the condensation possibility on middle profile.
The casing of the air handling unit whose features are described above is mainly composed of panels, side profiles, middle profiles, corner pieces and doors.

Panels are made of an inner skin, an outer skin and an insulation material in between. Panels can be fastened to each others parallelly or perpendicularly by use of middle or side profiles respectively. Sufficient number of plastic bushings, in which the screws are located, are provided around the circumference of the panels.

The side profiles provide the perpendicular connection of two panels. They do not hold any edges. The panels and side profiles are joined to each others by means of self-drilling screws, instead of the bolts and nuts. The screws are placed inside the plastic bushings and forced to drill the profiles in order to join panel to the side or middle profiles. The nuts are not used since the feature of the employed screw is to open grooves in sheet while it drills.

The middle profile provides 180 degree panel connections. It can be produced by formation of appropriate steel sheet strip or by employing two skins like the structure of panels. The middle profile and panels are fastened to each others by the same method described for side profile and panel connection. The thickness of the middle profile is the same with panels and it has flat and smooth interior surface. The inside of the middle profile is filled with insulation material which increases the profile thermal resistance and reduces the condensation possibility on the middle profile surfaces.

Both in perpendicular and parallel panel connection, a specially embodied rubber gasket is used to decrease air leakage due to pressure difference between inside and outside of the casing. Two different lips on two different directions on the gasket increase the air leakage resistance both in the case of positive or negative pressure difference that may occur between the unit and surroundings.

The corner pieces are employed to join side profiles on the corners of the unit. They have three legs whose outer shapes and dimensions are designed such that allow them to be inserted into the side profiles.

The structure of the door is the same with panels, however the joining of the door with middle or side profile is performed by means of hinges and door handles. The door is fitted with hinges along one side for being mounted on middle or side profile. A door handle and a door lock on the reverse side help to open or close thereof. The same rubber gasket is placed on middle or side profile for air tightness when the door is closed.

DESCRIPTION OF DRAWINGS

FIG. 1 shows a perspective view of the air handling unit casing.
FIG. 2 shows the details of the designed panel.
FIG. 3 shows the detail of the designed side profile.
FIG. 4 shows the detail of the alternative sample of the side profile.
FIG. 5 shows the detail of the designed middle profile.
FIG. 6 shows the detail of the alternative sample of middle profile.
FIG. 7 shows the detail of the designed corner piece.
FIG. 8 shows the detail of side profile, middle profile, panel and door connection.
FIG. 9 shows the detail of the designed gasket.
FIG. 10 shows the detail of the designed plastic bushing.

REFERENCE NUMBERS OF ELEMENTS IN THE FIGURES

<table>
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<th>Element</th>
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<td>Side profile</td>
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<tr>
<td>3</td>
<td>Middle profile</td>
</tr>
<tr>
<td>4</td>
<td>Corner piece</td>
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<td>Door</td>
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<tr>
<td>12</td>
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<tr>
<td>21</td>
<td>Plastic bushing lid</td>
</tr>
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</table>

DETAILED DESCRIPTION OF THE INVENTION

The elements of the air handling unit casing are shown in FIG. 1. The main elements are panels (1) which can be joined side by side or perpendicularly, side profile (2) which provides perpendicular panel connection, middle profile (3) which is employed to join panels side by side, corner pieces (4) which facilitate joining of the side profiles (2) on the corner of the unit and door (5) which is used to access to the air handling unit elements e.g. in order to repair thereof.

FIG. 2 shows the detail of the designed panel (1) according to the present invention. The panel (1) is formed by an inner skin (6), outer skin (7) and insulation material (8) in between. The insulation material may be formed from two separate insulation sheets or the space between inner skin (6) and outer skin (7) may be filled with insulation material. A step is provided around the circumference of the interior side of the panel (1) by reduction of the panel thickness. Predetermined number of plastic bushings (10), in which the screws are located, are mounted in the thin part (1) around the panel (1) circumference.
The side profiles (2) are employed for the perpendicular panel (1) connections. It has not been furnished with edges. It can be embodied by forming of a steel sheet strip. The fastening of the sides of the strip may be performed by welding or sewing as shown in FIGS. 3 and 4 respectively. The joining position of the edges of the steel sheet strip depends on the producer. The side profile (2) is embodied by two different partitions located diagonally with respect to each other. The width and height of the side profile (2) is same with panel (1) and middle profile (3), however, steps on two sides of the profile are provided to mount panel (1) or middle profile (3).

FIG. 5 shows the detail of the middle profile (3). It is produced from an inner profile skin (11) and outer profile skin (12) and insulation material (8) in between, like the structure of panel (1), however alternative manufacturing methods are also possible. As an example, it can also be embodied by forming of a steel sheet strip. The top and bottom sides of the profile can be covered by lids (14) as it is shown in FIG. 6. The middle profile (3) thickness is the same with the panels (1). Steps on two opposite directions around the circumference of the panel are provided. Lengthwise steps on which panels are fastened are formed on the exterior side of the middle profile (3), however widthwise steps which provide side profile connection are made on interior middle profile side. The steps are embodied by reducing profile thickness. The middle profile (3) is filled with insulation material (8). Plastic bushings (10) are mounted on the top and bottom parts (3) in order to join middle profiles (3) to the side profiles (2).

FIG. 7 shows the details of a corner piece (4). It has three legs that exterior surface shapes are same with the interior shape of the side profile (2). The legs are inserted into the side profile (2) and perform joining of three side profiles (2) on the corner of the unit. It may be produced from plastic or other convenient materials.

The detailed view of the air handling unit door can be seen from FIG. 8. The structure of the door (5) is similar to the panel (1). The door (5) is also formed from an inner skin (15), an outer skin (16) and an insulation (8) in between, however does not contain any plastic bushing. Hinges (18) are employed to connect the door (5) to middle or side profile (3). The door handle (17) is assembled on the door to open or close it.

The door handle (17) is assembled on the door to open or close it. Hinges (18) are employed to connect the door (5) to the unit.

FIG. 9 shows the designed gasket (19) which is employed to prevent air leakage between inside and outside of the unit. It holds two lips on two different directions in order to be effective on positive and negative pressure differences between inside and outside. It is located on the contact surfaces between the side profiles, middle profiles and panels as it can be seen from FIG. 8.

The plastic bushing (10) in the scope of the present invention is shown in FIG. 10. It is furnished with two elastic nails (11) which can move in the direction of the bushing radius. The plastic bushing is inserted to the bushing hole which is made before in the panels. The nails (10) are firstly pressed towards the center during the insertion and then expanded when they are fitted and fixed in the outer panel skin (7). The plastic bushing (10) provides a strong connection between screw and panel and also decreases the length of the screw since the screw head is inserted up to the end of bushing (10) as it is shown in FIG. 8. The top surface of the bushing (10) which appears on the exterior panel surface is covered by a lid (21) to protect screw from corrosion and provide aesthetic external view.

The unit can be easily embodied by employing structural elements described above. Firstly the frame of the unit is made by using the side profiles (2) and corner pieces (4). Each leg of the corner piece (4) is inserted to a side profiles (2). This provides the joining of the three side profiles (2) on the corners of the unit. A frame can be constructed by the eight corner pieces (4) and twelve side profiles (2).

After the construction of the frame, the joining of the panel (1) and middle profiles (3) with the side profiles (2) are performed in order to obtain an enclosure. The connection of the side profile (2) with panel (1) and middle profile (3) can easily be imagined from FIG. 8. As it can be seen from this figure, the perpendicular connection of the panels (1) is performed by side profile (2). The step part of the panel (1) is located on the side profile (2). A self-drilled screw (9) is inserted through the plastic bushing of the panel (1). It is forced to drill the side profile (2) until the head of screw touches the end of plastic bushing and a strong junction is achieved. The screw open grooves in profiles (2) when drilling. It’s tip remains inside of the profile (2). The employing of this type screw eliminates the use of nuts in construction.

The side by side panel (1) joining is performed by middle profile (2). This connection can also be seen from FIG. 8. The step of the panel (1) is placed on the step of the middle profile (2). The method described for side profile (2) and panel (1) joining is also employed to fasten panel (1) to the middle profile (3). The screw (9) is inserted through the plastic bushing (10) of the panel (1), then it is forced to drill middle profile (3) to join panel (1) with middle profile (3).

The gasket (19) in the scope of the present invention is located between the panels (1), middle profile (3) and side profiles (2) to prevent air leakage between inside and outside of unit. The location of the used gasket (19) can be seen from FIG. 10. The flat surface of the gasket (19) is located on steps of the middle (3) or side profiles (2) and the gasket lips (19) are pressed by panels (1).

1. Pentapost type air handling unit casing comprising panels arranged side by side and perpendicularly, and side profiles embodied between the perpendicular panels and middle profiles embodied between side by side panels characterized in that said side profiles (2) comprises at least two joined preferably diagonal partitions having a predetermined height and width and said middle profiles (3) having the same thickness with the side panels are provided with steps on two opposite directions around circumference of the said middle profiles (3).

2. Pentapost type air handling unit casing according to claim 1, characterized in that said steps of middle profile (3) comprise lengthwise steps on which panels are fastened are formed on the exterior side of the middle profile (3) and widthwise steps providing side profile (2) connection are formed on interior middle profile side.
3. Pentapost type air handling unit casing according to claim 1, characterized in that said two partitions of the side profiles (2) are preferably embodied diagonally with respect to each other.

4. Pentapost type air handling unit casing according to claim 1, characterized in that at the corners of the said casing, corner pieces (4) are located for connecting said side profiles (2).

5. Pentapost type air handling unit casing according to claim 4, characterized in that said corner pieces (4) have preferably three legs for housing associated side profile therein.

6. Pentapost type air handling unit casing according to claim 1, characterized in that self-drilling screws (9) are embodied for providing connection between the side profiles (2) to panels, and middle profiles (3) to panels.

7. Pentapost type air handling unit casing according to claim 1 and 6, characterized in that said self-drilling screws (9) are located inside plastic bushings (10) having a cylindrical embodiment and providing connection between the panels and side, middle profiles.

8. Pentapost type air handling unit casing according to claim 7, characterized in that said bushing (10) is furnished with two elastic nails (11) movable in the direction of the bushing radius.

9. Pentapost type air handling unit casing according to claim 7, characterized in that top surface of the bushing (10) appearing on exterior panel surface is covered by a lid (21) for protecting screw from corrosion and provide aesthetic view.

10. Pentapost type air handling unit casing according to claim 1, characterized in that said side profile (2) is preferably a steel strip while the middle profile is preferably two steel skins, an insulation material therebetween or steel strip having bottom and top lids.

11. Pentapost type air handling unit casing according to claim 1 and 10, characterized in that said side profiles (2) are sewn or preferably welded from lengthwise edges to each other.

12. Pentapost type air handling unit casing according to claim 1, characterized in that rubber gaskets (19) having two different lips thereof for increasing air leakage resistance in case of positive and negative pressure difference between the casing and surrounding are located between the panels and side (2), middle profiles (3).

* * * * *