The invention provides a dry joint wall panel attachment system, applying the rainscreen principle. Interlocking components are used to attach aluminum wall panels to an exterior wall.
DRY JOINT ALUMINUM WALL PANEL ATTACHMENT SYSTEM

FIELD OF THE INVENTION

[0001] The invention relates to wall panel systems, and more particularly to methods of attaching wall panels to exterior surfaces.

BACKGROUND OF THE INVENTION

[0002] There are numerous problems with known aluminum wall panel attachment systems. Conventionally, such systems relied upon adhesive or caulk to "seal" the aluminum panel from the elements. However, under heat and cold and moisture, the adhesive or caulk breaks down compromising the stability of the system and giving an undesirable appearance. Even when such a seal is functional, there a tendency for undesirable effects on the aluminum panels as the interior environment can trap heat which affects the panels, creating "oil-canning" or popping in response to the pressure differential. In spite of such seals, such systems can also trap moisture in the wall cavity, which results in oxidation of parts and staining or deterioration of exterior wall surfaces.

[0003] More recently systems have been developed according to the " rainscreen principle " in which the wall cavity is vented, resulting in a temperature and pressure equalized system with adequate moisture drainage. However, such systems can be difficult to install, relying on many components to be milled or adapted on-site, and requiring excessive labor cost and specialty materials. No suitable system has been developed which applies the rainscreen principle, while providing cost-effective simple installation.

SUMMARY OF THE INVENTION

[0004] A dry joint aluminum wall panel attachment system is provided. The system comprises

[0005] a bracket assembly fastened to the exterior wall;

[0006] an attachment clip fastened to the bracket assembly by a fastener, the attachment clip having a central fastening surface fastened to the bracket assembly and at least one wing member extending outwardly from the central fastening surface;

[0007] a wall panel having an exterior flat surface and at least two side surfaces bent generally perpendicularly to the exterior flat surface and defining a hollow interior portion;

[0008] a panel perimeter strip fastened to one side surface of the wall panel, the perimeter strip comprising:

[0009] a generally C shaped body member sitting inside a corner of the wall panel and extending along an inside portion of the side surface, and

[0010] a receiving member integrally attached to the body member that extends beyond the side surface of the wall panel and provides a slot adapted to engage and interlock the wing member of the attachment clip, thus connecting the wall panel to the attachment clip and thereby to the wall;

[0011] an infill strip dimensioned to fit in the slot of the panel perimeter strip proximate to the attachment clip so as to cover the fastener;

[0012] wherein the system is held together non-adhesively and wherein the wall panels are ventilated to permit ingress and egress of air and moisture to provide a pressure-balanced and moisture-drained interior environment.

[0013] Preferably, the attachment clip (here aluminum) comprises two wing members, each adapted to engage a panel perimeter strip of an adjacent wall panel.

[0014] Preferably, the bracket assembly (here steel) comprises two back-to-back L angle brackets fastened to each other to form a generally Z shaped assembly, a first end of which is for attachment to the wall and a second end of which is for fastening to the attachment clip (such as a threaded fastener).

[0015] The wall panels comprise an aluminum composite material, which is preferably routed and bent to form the exterior and side surfaces. The panel perimeter strip (here aluminum) may be pre-assembled to the wall panel before installation to the wall. Preferably the panel perimeter strip is fastened to the wall panel by rivet. This rivet may contribute to the ventilation of the panel system.

[0016] The infill strip (here aluminum composite) may be engaged with the slot of the panel perimeter strip prior to installing an adjacent wall panel. Alternatively, the infill strip may be introduced to the slots of two adjacent panel perimeter strips after two adjacent wall panels have been installed.

[0017] Preferably, the system further comprises an isolation tape which is applied between the attachment clip and the bracket assembly.

[0018] The system may further comprise a panel stiffener component placed inside the hollow interior portion of the wall panel to reinforce the exterior surface of the panel and prevent deforming or popping of the wall panel.

BRIEF DESCRIPTION OF THE FIGURES

[0019] So that the manner in which the above recited features of the present invention can be better understood, certain drawings are appended hereto. It is to be noted, however, that the appended drawings illustrate only selected embodiments of the inventions and are therefore not to be considered limiting of scope, for the inventions may admit to other equally effective embodiments and applications.

[0020] FIG. 1 shows a simplified cut-through view of the dry joint aluminum wall panel attachment system, according to the preferred embodiment.

[0021] FIG. 2 shows a panel perimeter strip used in the attachment system.

[0022] FIG. 3 shows an attachment clip used in the attachment system.

[0023] FIG. 4 shows a cut-through view of a panel stiffener optionally used in the attachment system.

[0024] FIG. 5 shows a cut-through view of the aluminum composite material (ACM) used in the panels.

[0025] FIGS. 6, 7, 8 show progressive steps in the formation of an ACM panel for use in the present system.

[0026] FIG. 9 shows a cut-through view of an infill strip used in the attachment system.
FIG. 10 shows a detailed view of the preferred placement of the infill strip in the attachment system.

FIG. 11 shows a simplified elevational view of the sub-framing used before mounting the ACM panels in the present system.

FIG. 12 shows a detailed view of the complete attachment system with sub-framing.

FIGS. 13, 14, 15 show progressive steps in the installation of panels in the present system (first method).

FIG. 16 shows a view of the installation of lengths of infill strip in the present system (second method).

FIG. 17 shows a view of a finished wall paneled exterior.

FIG. 18 shows a cut-through view of an alternative panel perimeter strip.

FIGS. 19-20 show cut-through views of two versions of an alternative panel stiffener.

DETACHED DESCRIPTION

The present panel attachment system 10 uses an extruded aluminum attachment system for fastening fabricated panels to all building surfaces. The system’s strength is further enhanced by the use of an extruded perimeter frame design.

The system 10 is designed to the standard of the rainscreen principle. Simply, it is designed so that the wall cavity is vented, resulting in a pressure equalized system as seen in FIG. 1. Controlled moisture drainage within the system, coupled with this equalized pressure, contributes to effective, maintenance free construction.

The extrusion process begins with an aluminum billet, the material from which the profiles are extruded. The billet must be softened by heat prior to extrusion process. The heated billet is placed into the extrusion press, a powerful hydraulic device wherein a ram pushes a dummy block that forces the softened metal through a precision opening, known as a die, to produce the required shapes. The extruded shape may have a mill or anodized finish.

The system includes a panel perimeter strip 14 (FIG. 2), which is attached to the ACM panel 32 using counter sunk rivets 36. The panel perimeter strip is designed to fit together with the attachment clip 16 (FIG. 3). The custom designed extrusion allows for maximum attachment area without foregoing structural integrity.

The attachment clip 16 (FIG. 3) is used on site to attach the panel perimeter strip 14 to the building as illustrated in FIG. 12. The clip 16 is designed so as to interlock with the panel perimeter strip 14 while holding the infill strip 38 (FIG. 10) securely in place.

The system optionally includes a panel stiffener 18 component (FIG. 4), which may be used on large sized panels. The stiffener 18 is used to prevent the popping or “oil canning” of the panel. As the panel heats up, the panel expands and makes a popping sound. The stiffener 18 reinforces the panel to reduce this effect.

The panel stiffener 18 may alternatively be used for greater stability (see FIGS. 19, 20). Where panel stiffeners are used, the panel perimeter strip may be adapted to better locate and secure the stiffener component. A panel perimeter strip 14A having profile as shown in FIG. 18 may be advantageous for this purpose. The extended interior lip of the panel perimeter strip operates to secure the panel stiffener component.

Panel stiffeners may be provided in different sizes depending on the wind pressures to which the panel will be exposed. A larger width panel stiffener 18B may be advantageous where there are greater wind loads on the panel system or if less deflection on the panel is desired. It will be appreciated that the construction of the panels also provides a basic level of rigidity and stiffeners are not necessarily required.

As shown in FIG. 5, the aluminum composite material 20 (ACM) consists of a core of low density polyethylene 24 sandwiched between two sheets of aluminum 22 (each approximately 0.5 mm thick). The finish face of the aluminum is coated with a polyvinylidene fluoride coating. The inner aluminum layer is typically coated with chrome or polyester coatings. The standard thickness of the panel is ½” (4 mm) but thickness may range from ⅛” (3 mm) to ¼” (6 mm), depending on customer preference or structural requirements.

A finished ACM panel 32 may be fabricated from a flat sheet of ACM 26 using different types of router and cutting bits 28 (FIG. 6). After the sheet of ACM has been cut and routed, it is then bent along the router lines to form the finished panel 32 (FIG. 7). The newly shaped panel 32 is then assembled with the panel perimeter strip 14 using a panel rivet 36 to complete the finished panel (FIG. 8). A standard panel rivet for this application is ⅛” diameter.

There are various methods to accomplish the routing and cutting process:

Method 1

Handheld router (not shown): A handheld router is used more often when reworking a panel to a different size. This method requires the simplest tool set up, but is the most labour-intensive method of fabrication due to the lengthy time for setup and layout of each different panel.

Method 2

Vertical table saw (not shown): A vertical table saw can also be used, both to cut and rout the panels. Custom “V” routing blades can be purchased to rout the panels. Panel design is limited using the vertical table saw in itself. Using it in combination with the hand held router has its advantages, but it is still a costly way to manufacture panels.

Method 3

CNC-Machine (not shown): The computer numerically controlled (CNC) machine is a complete and concise way to manufacture panels. Once the panel has been designed by a CAD operator it is then sent directly to the machine. This machine has been found to be very useful and economical for manufacturing panels. This is the applicants’ preferred method for cutting and routing panels.

The infill strip (FIG. 9) is typically cut to a width of approximately 1⅛” (32 mm) for a ⅛” (13 mm) joint. The infill strip replaces the conventional caulk joint, giving the
panel system a clean, maintenance free appearance. The infill strip also is used to hide the fasteners 36 for the attachment clip (FIG. 10).

[0053] As shown in FIG. 11, to install the panel system, sub framing is first constructed using two back-to-back galvanized steel “L” angles 40 (FIG. 12); the two “L” angles allow the installer to level the substrate in all 3 axes before installation of panels. The sub framing is typically installed horizontally at each horizontal joint as shown in FIG. 11. The method of installation of the framing at its correct installation measurements starts at the bottom of the substrate wall and moves up, making sure that each row is level to the previous row installed.

[0054] A layer of isolation tape 42 may be applied to the back of aluminum attachment clips 16 (FIG. 3) to prevent direct contact between the galvanized steel sub framing and the aluminum attachment clip and thus prevent galvanic action (electrolytic decay of the aluminum) over time. Preferably, stainless steel self-drilling screws are used to fasten aluminum attachment clips to steel sub framing 40. After determining a logical order of installation, each panel is to be plumbed and leveled to ensure a tight and concise fit form panel to panel.

[0055] Infill strip is preferably shipped in long lengths and are to be cut to fit on site. The strips may have a protective plastic coating, which is then removed from the face of the infill strips before installing them. These infill strips can be installed one or two ways:

[0056] First, as shown in FIGS. 13-15, the infill strips may be slipped in before the adjacent panel is installed when the edge of the joint is not accessible, or when the infill strip has a curve or bend in it. The infill strip 38 is fitted into the space between the panel 32 return and the attachment clips 14 as illustrated in FIG. 13 and FIG. 14. Then an adjacent panel 32 is installed so that the infill strip 38 and attachment clip 16 engage into the slots in the panel edge at the perimeter strip 14’ (FIG. 15).

[0057] As an alternative method of installation, the installer can slide the infill strip 38 in from the end (FIG. 16), which allows for a simplified installation of the panels. The infill strips are not installed until an area is complete. This means that panels can be adjusted for straightness and position even after adjacent panels have been installed. The difficulty with this method is that the end of the joint will not always be accessible (i.e. wall or window frame) and the infill strip 38 may have a tendency to catch on the attachment clips as it is being slid into the joint. To aid in the sliding of the strip, a tool may be used to pull the leading edge over the clips (not shown).

[0058] The finish faces of the panels may have a protective film 50 to protect against minor abrasions that may occur during handling and installation. The protective film may be peeled back from the returns of the panels before installing. To keep the panels clean and free of construction debris, generally the protective plastic film 50 is only removed from the faces of the panels once the landscaping has been completed, as seen in FIG. 17.

[0059] The foregoing description illustrates only certain preferred embodiments of the invention. The invention is not limited to the foregoing examples. That is, persons skilled in the art will appreciate and understand that modifications and variations are, or will be, possible to utilize and carry out the teachings of the invention described herein. Accordingly, all suitable modifications, variations and equivalents may be resorted to, and such modifications, variations and equivalents are intended to fall within the scope of the invention as described and within the scope of the claims.

The claims are:

1. A dry joint aluminum wall panel attachment system for attaching a wall panel to an exterior building wall, the system comprising:

   a bracket assembly fastened to the exterior wall;
   an attachment clip fastened to the bracket assembly by a fastener, the attachment clip having a central fastening surface fastened to the bracket assembly and at least one wing member extending outwardly from the central fastening surface;
   a wall panel having an exterior flat surface and at least two sides surfaces bent generally perpendicularly to the exterior flat surface and defining a hollow interior portion;
   a panel perimeter strip fastened to one side surface of the wall panel, the perimeter strip comprising:
   a generally C shaped body member sitting inside a corner of the wall panel and extending along an inside portion of the side surface, and
   a receiving member integrally attached to the body member that extends beyond the side surface of the wall panel and provides a slot adapted to engage and interlock the wing member of the attachment clip, thus connecting the wall panel to the attachment clip and thereby to the wall;
   an infill strip dimensioned to fit in the slot of the panel perimeter strip proximate to the attachment clip so as to cover the fastener;

   wherein the system is held together non-adhesively and wherein the wall panels are ventilated to permit ingress and egress of air and moisture to provide a pressure-balanced and moisture-drained interior environment.

2. The attachment system of claim 1, wherein the attachment clip comprises two wing members, each adapted to engage a panel perimeter strip of an adjacent wall panel.

3. The attachment system of claim 1, wherein the bracket assembly comprises two back-to-back L angle brackets fastened to each other to form a generally Z shaped assembly, a first end of which is for attachment to the wall and a second end of which is for fastening to the attachment clip.

4. The attachment system of claim 1, wherein the wall panels comprise an aluminum composite material.

5. The attachment system of claim 1, wherein the wall panels comprise an aluminum composite material which is routed and bent to form the exterior and side surfaces.

6. The attachment system of claim 1, wherein the fastener comprises a threaded fastener.

7. The attachment system of claim 1, wherein the panel perimeter strip is pre-assembled to the wall panel before installation to the wall.

8. The attachment system of claim 1, wherein the panel perimeter strip is fastened to the wall panel by rivet.

9. The attachment system of claim 8, wherein the rivet contributes to the ventilation of the panel system.
10. The attachment system of claim 1, wherein the infill strip is engaged with the slot of the panel perimeter strip prior to installing an adjacent wall panel.

11. The attachment system of claim 1, wherein the infill strip is introduced to the slots of two adjacent panel perimeter strips after two adjacent wall panels have been installed.

12. The attachment system of claim 1, wherein the system further comprises an isolation tape which is applied between the attachment clip and the bracket assembly.

13. The attachment system of claim 1, wherein the attachment clip comprises an aluminum attachment clip.

14. The attachment system of claim 1, wherein the bracket assembly comprises a steel bracket assembly.

15. The attachment system of claim 1, wherein the infill strip comprises a strip of aluminum composite material.

16. The attachment system of claim 1, wherein the panel perimeter strip is made of aluminum.

17. The attachment system of claim 1, wherein the system further comprises a panel stiffener component placed inside the hollow interior portion of the wall panel to reinforce the exterior surface of the panel and prevent deforming or popping of the wall panel.