

FEEDER PILLAR AND METHOD OF FORMING THE SAME

TECHNICAL FIELD

[0001] Various aspects of this disclosure relate to a feeder pillar. Various aspects of this disclosure relate to a method of forming a feeder pillar.

BACKGROUND

[0002] Low-voltage feeder pillars are critical in public electrical distribution networks. They provide the power supply as well as protect the downstream low-voltage distribution network.

[0003] Conventional weatherproof feeder pillars protect against rain but not against adverse weather or environmental events such as flash flooding, typhoons, and monsoon flooding. Flash flooding has repeatedly plagued Singapore (6-10 episodes in various parts of Singapore over the past 8 years). Typhoons and monsoon flooding occur in Hong Kong and Macau on a relatively frequent basis. The submersion of feeder pillars in the event of flooding poses risk of electrocution to the general public.

SUMMARY

[0004] Various embodiments may relate to a feeder pillar. The feeder pillar may include a fuse switch compartment. The feeder pillar may also include a cable termination compartment. The fuse switch compartment may include a housing, and a panel board within the housing. The cable termination compartment may include or be configured to receive one or more incoming cables configured to electrically connect an external power source to the panel board. The cable termination compartment may also include or be configured to receive one or more outgoing cables configured to electrically connect the panel board to one or more electrical devices. The housing may include an interface assembly. The interface assembly may include a molded structure including a plurality of through-holes extending from a first surface of the molded structure to a second surface of the molded structure opposite the first surface. The interface assembly may further include a plurality of electrical pins in electrical connection with the panel board; the plurality of electrical pins protruding from the plurality of through-holes into the cable

termination compartment. A first group of electrical pins may be or configured to be in contact with the one or more incoming cables and configured to electrically connect the external power supply to the panel board via the one or more incoming cables. A second group of electrical pins may be or configured to be in contact with the one or more outgoing cables and configured to electrically connect the panel board to the one or more electrical devices via the one or more outgoing cables.

[0005] Various embodiments may relate to a method of forming a feeder pillar. The method may include forming or assembling a fuse switch compartment. The fuse switch compartment may include a housing, and a panel board within the housing. The method may also include forming or assembling a cable termination compartment. The cable termination compartment may include or be configured to receive one or more incoming cables configured to electrically connect an external power source to the panel board. The cable termination compartment may further include or be configured to receive one or more outgoing cables configured to electrically connect the panel board to one or more electrical devices. The housing may include an interface assembly. The interface assembly may include a molded structure including a plurality of through-holes extending from a first surface of the molded structure to a second surface of the molded structure opposite the first surface. The interface assembly may further include a plurality of electrical pins in electrical connection with the panel board. The plurality of electrical pins may protrude from the plurality of through-holes into the cable termination compartment. A first group of electrical pins may be or configured to be in contact with the one or more incoming cables and configured to electrically connect the external power supply to the panel board via the one or more incoming cables. A second group of electrical pins may be or configured to be in contact with the one or more outgoing cables and configured to electrically connect the panel board to the one or more electrical devices via the one or more outgoing cables.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The invention will be better understood with reference to the detailed description when considered in conjunction with the non-limiting examples and the accompanying drawings, in which:

FIG. 1A is a schematic showing a front view of a feeder pillar according to various embodiments.

FIG. 1B is a schematic showing a side view of the feeder pillar shown in FIG. 1A according to various embodiments.

FIG. 1C is a schematic showing a perspective view of the feeder pillar shown in FIG. 1A according to various embodiments.

FIG. 1D is a schematic showing a perspective view of the fuse switch compartment of the feeder pillar according to various embodiments.

FIG. 1E is a schematic showing another perspective view of the fuse switch compartment of the feeder pillar according to various embodiments, with the partition separating the fuse compartment and the cable termination compartment visible.

FIG. 1F is a schematic showing a planar view of the partition of the feeder pillar according to various embodiments.

FIG. 1G is a schematic showing a cross-sectional front view of the fuse switch compartment of the feeder pillar according to various embodiments.

FIG. 1H is a schematic showing a cross-sectional side view of the fuse switch compartment of the feeder pillar according to various embodiments.

FIG. 1I is a schematic showing a cross-sectional top view of the fuse switch compartment of the feeder pillar according to various embodiments.

FIG. 1J is a schematic showing a cross-sectional view across a width of a heat sink according to various embodiments.

FIG. 1K is a schematic showing a perspective view of a heat sink of the side cover of the fuse switch compartment according to various embodiments.

FIG. 1L is a schematic showing a perspective view of an external heat sink of the top cover of the fuse switch compartment according to various embodiments.

FIG. 1M is a schematic showing a perspective view of an internal heat sink of the top cover of the fuse switch compartment according to various embodiments.

FIG. 1N is a schematic showing a perspective view of the cable termination compartment of the feeder pillar according to various embodiments.

FIG. 1O is a schematic showing another perspective view of the cable termination compartment of the feeder pillar according to various embodiments.

FIG. 1P is a schematic showing a cross-sectional front view of the cable termination compartment of the feeder pillar according to various embodiments.

FIG. 1Q is a schematic showing a cross-sectional side view of the cable termination compartment of the feeder pillar according to various embodiments.

FIG. 1R is a schematic showing a cross-sectional top view of the cable termination compartment of the feeder pillar according to various embodiments.

FIG. 1S is a schematic showing a cross-sectional bottom view of the cable termination compartment of the feeder pillar according to various embodiments.

FIG. 1T is a schematic showing a cross-sectional view of the feeder pillar according to various embodiments.

FIG. 1U is a general illustration of the remote sensing capabilities of the feeder pillar according to various embodiments.

FIG. 2 is a general illustration of a feeder pillar according to various embodiments.

FIG. 3 is a general illustration of a method of forming a feeder pillar according to various embodiments.

FIG. 4 shows information pertaining to Ingress Protection (IP) ratings.

DETAILED DESCRIPTION

[0007] The following detailed description refers to the accompanying drawings that show, by way of illustration, specific details and embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention. Other embodiments may be utilized and structural, and logical changes may be made without departing from the scope of the invention. The various embodiments are not necessarily mutually exclusive, as some embodiments can be combined with one or more other embodiments to form new embodiments.

[0008] Embodiments described in the context of one of the methods or feeder pillars are analogously valid for the other methods or feeder pillars. Similarly, embodiments described in the context of a method are analogously valid for a feeder pillar, and vice versa.

[0009] Features that are described in the context of an embodiment may correspondingly be applicable to the same or similar features in the other embodiments. Features that are described in the context of an embodiment may correspondingly be applicable to the other embodiments, even if not explicitly described in these other embodiments. Furthermore, additions and/or combinations and/or alternatives as described for a feature in the context of an embodiment may correspondingly be applicable to the same or similar feature in the other embodiments.

[0010] The word "over" used with regards to a deposited material formed "over" a side or surface, may be used herein to mean that the deposited material may be formed "directly on", e.g. in direct contact with, the implied side or surface. The word "over" used with regards to a deposited material formed "over" a side or surface, may also be used herein to mean that the deposited material may be formed "indirectly on" the implied side or surface with one or more additional layers being arranged between the implied side or surface and the deposited material. In other words, a first layer "over" a second layer may refer to the first layer directly on the second layer, or that the first layer and the second layer are separated by one or more intervening layers. Further, in the current context, a layer "over" or "on" a side or surface may not necessarily mean that the layer is above a side or surface. A layer "on" a side or surface may mean that the layer is formed in direct contact with the side or surface, and a layer "over" a side or surface may mean that the layer is formed in direct contact with the side or surface or may be separated from the side or surface by one or more intervening layers.

[0011] In the context of various embodiments, the articles "a", "an" and "the" as used with regard to a feature or element include a reference to one or more of the features or elements.

[0012] In the context of various embodiments, the term "about" or "approximately" as applied to a numeric value encompasses the exact value and a reasonable variance.

[0013] As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0014] Various embodiments may mitigate or address the problems as described above. Various embodiments may provide a feeder pillar that achieves an Ingress Protection (IP) rating of 67, in contrast to conventional feeder pillars that achieves an IP rating of 55. Various embodiments may relate to a feeder pillar that is waterproof, in contrast to conventional feeder pillars which are only weather proof.

[0015] In addition, at present, power utility operators are required to manually operate and troubleshoot electrical faults and power outages. Current systems are not equipped to collect data such as current, voltage, temperature, and/or moisture for predictive maintenance and/or optimal load monitoring. This reduces the ability to detect and isolate faults which prolongs response time during power outages.

[0016] Various embodiments may mitigate or address the abovementioned problems. Various embodiments may provide a feeder pillar that is configured for remote sensing. Various embodiments may provide a feeder pillar that include sensors for sensing or detecting current, voltage, temperature, and/or moisture, and conveying the relevant data to a monitoring system for predictive maintenance and/or load monitoring.

[0017] FIG. 1A is a schematic showing a front view of a feeder pillar 100 according to various embodiments. FIG. 1B is a schematic showing a side view of the feeder pillar 100 shown in FIG. 1A according to various embodiments. FIG. 1C is a schematic showing a perspective view of the feeder pillar 100 shown in FIG. 1A according to various embodiments.

[0018] The feeder pillar may include a main enclosure 102, and a cable termination compartment 104. The main enclosure 102 may be a fuse switch compartment (alternatively referred to as a fuse rail compartment), and may be above the cable termination compartment 104. The main enclosure 102 may be defined by side covers 102a, a roof 102b, a door 102c, a back cover 102d, and well as a partition separating the main enclosure 102 and the cable termination compartment 104 (not shown in FIGS. 1A-C). The side covers 102a, roof 102b, door 102c, back cover 102d, and the partition separating the main enclosure 102 and the cable termination compartment 104 (not shown in FIGS. 1A-C) may form a housing and may include a suitable metal such as aluminum or galvanized/electro galvanized steel.

[0019] The cable termination compartment 104 may be defined by side covers 104a, front and back covers 104b, base (not shown in FIGS. 1A-C) as well as the partition separating the main enclosure 102 and the cable termination compartment 104. The side covers 104a, the front and back covers 104b, and the base may include a suitable metal such as aluminum or galvanized/electro galvanized steel. The front and back covers 104b may include a plurality of louver openings 104c for ventilation. In addition, one of the side covers 102a may include a side cable entry opening covered by a metal cover 104d. The metal cover 104d may be detached from

the compartment 104 to expose the side cable entry opening. The side cable entry opening may provide a temporary access means for a cable during maintenance. In various embodiments, the fuse switch compartment 102 may achieve an IP rating of 67, while the cable termination compartment 104 may achieve an IP rating of 32.

[0020] FIG. 1D is a schematic showing a perspective view of the fuse switch compartment 102 of the feeder pillar 100 according to various embodiments. FIG. 1E is a schematic showing another perspective view of the fuse switch compartment 102 of the feeder pillar 100 according to various embodiments, with the partition 106 separating the fuse compartment 102 and the cable termination compartment 104 visible. FIG. 1F is a schematic showing a planar view of the partition 106 of the feeder pillar 100 according to various embodiments.

[0021] The door 102c may be a hinged door, and may be attached to the rest of the compartment 102 via hinges 108. The door 102c may be opened, e.g. during maintenance to access the panel board within the fuse switch compartment 102. The door may be switched between an open position and a closed position by pivoting about hinges 108. The compartment 102 or housing may include a sealing structure for sealing the housing when the door is in the closed position. The sealing structure may be a gasket including a material such as rubber cork or silicone. The rubber cork may be natural rubber or synthetic rubber such as neoprene. When the door 102c is in the closed position, the side walls 102a, the roof 102b, the door 102c, the back cover 102d, and the partition 106 may form a sealed enclosure, and may prevent or drastically reduce the amount of dust and water from getting into the fuse switch compartment 102.

[0022] A first surface or portion of the first surface of the door 102c facing the external environment may include perforations, while an opposing second surface of the door 102c facing the interior of the compartment 102 may be a solid surface, i.e. a surface devoid of any perforation. The perforated first surface of the door 102c may help to dissipate heat, while the solid second surface may seal the compartment 102. The door 102c may include an air pocket or an enclosed space between the first surface and the second surface. In various embodiments, the back cover 102d may include a perforated first surface facing the external environment and a solid second surface facing the interior of the compartment 102, similar to the door 102c. In

various embodiments, the back cover 102d may be sealed or attached such that it cannot be opened.

[0023] The partition 106 may be an interface assembly including a molded structure 106a. The molded structure 106a may include a plurality of through-holes extending from a first surface of the molded structure 106a to a second surface of the molded structure 106a opposite the first surface. The molded structure may include a suitable material such as cured dough molded compound (DMC). The interface assembly may also include a plurality of electrical pins 106b protruding from the plurality of through-holes (not all electrical pins have been labelled for sake of clarity and to avoid clutter). The plurality of electrical pins 106b may include a suitable electrically conductive material such as copper or aluminum. The plurality of electrical pins 106b may be in electrical connection with the panel board within the fuse switch compartment 102.

[0024] The incoming and outgoing cables may be contacted with the plurality of pins 106b outside of compartment 102 and within compartment 104 for electrical connection with an external supply and with downstream devices respectively. The incoming cables may be contacted with a first group of pins 106b to electrically connect an external power source (e.g. electrical substation) to the panel board. The outgoing cables may be contacted with a second group of pins 106b to electrically connect the panel board to one or more downstream electrical devices, e.g. consumer units or street lamps etc. The incoming and outgoing cables may be led into the compartment 104 from the ground via an opening at the base of compartment 104.

[0025] The feeder pillar 100 may achieve an IP rating of 67 due to the sealed enclosure as well as the relocation of the point of cable termination to outside of the fuse switch compartment 102 and within the cable termination compartment 104. By relocating the point of cable termination to outside of compartment 102, the housing of compartment 102 may not require holes for cables to pass through into compartment 102. Under IP 67 rating, the enclosure or fuse switch compartment 102 may be dust tight (no ingress of dust) for a period of two to eight hours, and may provide protection against effects of immersion in water (having a depth between 15 cm and 1 m) for 30 minutes.

[0026] The sealing structure for sealing with door 102c may provide excellent sealing capabilities with low compressive forces and good tensile strength that ensures high repeatability. The point of cable termination being relocated to outside of the compartment 104

may maintain the integrity of the sealed compartment 102 against dust and water. The cable connection to the water proof compartment 102 (via pins 106b) may be controlled stringently during factor assembly, which may maintain integrity of the waterproof and dustproof seal during production and installation. In addition, the point of contact of each of the outgoing cables and incoming cables with a respective pin 106b may be enclosed or covered by an insulating tube for protecting the point of contact against water or dust that gets into the compartment 104.

[0027] FIG. 1G is a schematic showing a cross-sectional front view of the fuse switch compartment 102 of the feeder pillar 100 according to various embodiments. FIG. 1H is a schematic showing a cross-sectional side view of the fuse switch compartment 102 of the feeder pillar 100 according to various embodiments. FIG. 1H corresponds to the view across line B-B shown in FIG. 1G. FIG. 1I is a schematic showing a cross-sectional top view of the fuse switch compartment 102 of the feeder pillar 100 according to various embodiments. FIG. 1I corresponds to the view across line A-A shown in FIG. 1G.

[0028] The fuse switch compartment 102 may include a panel board 110, e.g. a distribution board. The panel board 110 may include a disconnecter and a plurality of fuses, as well as bus bars electrically connecting the disconnecter and the plurality of fuses. The one or more incoming cables (providing power supply from the external power source) may be electrically connected to the panel board 110 via the first group of the plurality of electrical pins 106b, while the one or more outgoing cables may provide electrical currents from the panel board to downstream electrical devices via the second group of the plurality of electrical pins 106b. In various embodiments, the panel board 110 may divide power supply received from the external power source into a plurality of electrical currents for the downstream electrical devices. Each of the electrical currents may pass through a fuse on the panel board 110 before being coupled to an outgoing cable to the downstream device. The power supply from the external power source may pass through a switch connector before being divided.

[0029] A fuse may break when the voltage of the power supply exceeds a predetermined threshold voltage, thus protecting the downstream electrical device. As such, the fuses may help protect the distribution network. The switch connector may be turned off (e.g. during maintenance) to de-energize the panel board 110.

[0030] FIG. 1H shows the sealing structure 112 as described earlier. The sealing structure 112 may be a rubber gasket arranged around the door 102c. The housing may include one or more heat sinks 114.

[0031] As the compartment 102 is effectively sealed when the door 102c is in the closed position, temperature management within the compartment 102 may be required to prevent or substantially reduce the likelihood of overheating within the enclosure. The one or more heat sinks 114 may be critical in heat transfer.

[0032] FIG. 1J is a schematic showing a cross-sectional view across a width of a heat sink 114 according to various embodiments. FIG. 1K is a schematic showing a perspective view of a heat sink 114 of the side cover 102a of the fuse switch compartment 102 according to various embodiments. FIG. 1L is a schematic showing a perspective view of an external heat sink 114 of the top cover 102b of the fuse switch compartment 102 according to various embodiments. FIG. 1M is a schematic showing a perspective view of an internal heat sink 114 of the top cover 102b of the fuse switch compartment 102 according to various embodiments. FIG. 1L may correspond to each of the two heat sinks 114 facing the external environment as shown in FIG. 1H, while FIG. 1M may correspond to the heat sink 114 facing the interior of the compartment 102.

[0033] Each of the one or more heat sinks 114 may include a base 114a and a plurality of fins 114b extending from the base 114a. The plurality of fins 114b may protrude out from the fuse switch compartment 102. The heat generated by the panel board 110 may be transferred to the one or more heat sinks 114 (for instance via conduction) and may be dissipated to the external environment (for instance via convection and radiation). The plurality of fins 114b may increase the surface area in which heat may be dissipated to the external environment. The fins 114b of the two external heat sinks 114 facing the external environment, as shown in FIG. 1L, may have fins 114b protruding outwards towards the external environment, while the fins of the internal heat sink 114 facing the interior of the compartment 102 may have fins 114b protruding into the interior of the compartment 102.

[0034] Heat dissipation may be a problem upon dustproofing and waterproofing the enclosure. After repeated tests, it has been found that heat sinks 114 may be effective in managing the temperature of the enclosure while meeting the sealing requirements.

[0035] FIG. 1N is a schematic showing a perspective view of the cable termination compartment 104 of the feeder pillar 100 according to various embodiments. FIG. 1O is a schematic showing another perspective view of the cable termination compartment 104 of the feeder pillar 100 according to various embodiments. As highlighted above, the front and back surfaces 104b of the cable termination compartment 104 may include louver openings 104c. Further, FIG. 1N shows the metal cover 104d while FIG. 1O shows the exposed side cable entry opening 104e when the cover 104d is removed. As shown in FIG. 1N, the cable termination compartment 104 may include neutral busbar 116a and neutral busbar supports 116b attaching the neutral busbar 116a to the back cover 104b. FIG. 1O shows an earth bus bar 118, as well as a plurality of cable clamps 120a-b configured to hold the incoming cables and the outgoing cables. The plurality of cable clamps 120a-b may be divided into incoming cable clamps 120a configured to hold the incoming cables, and outgoing cable clamps 120b configured to hold the outgoing cables.

[0036] FIG. 1P is a schematic showing a cross-sectional front view of the cable termination compartment 104 of the feeder pillar 100 according to various embodiments. FIG. 1Q is a schematic showing a cross-sectional side view of the cable termination compartment 104 of the feeder pillar 100 according to various embodiments. FIG. 1Q may correspond to the view across line A-A shown in FIG. 1P. FIG. 1R is a schematic showing a cross-sectional top view of the cable termination compartment 104 of the feeder pillar 100 according to various embodiments. FIG. 1R may correspond to the view across line B-B shown in FIG. 1P. FIG. 1S is a schematic showing a cross-sectional bottom view of the cable termination compartment 104 of the feeder pillar 100 according to various embodiments. FIG. 1S may correspond to the view across line C-C shown in FIG. 1P.

[0037] As shown in FIGS. 1P-1Q, the cable termination compartment 104 may also be defined by the base 104f in addition to the front and back covers 104b, side covers 104a, and the partition 106 separating the cable termination compartment 104 and the fuse switch compartment 102. The neutral bus bar 116a (attached to back cover 104b via bus bar supports 116b) may be above the earth bus bar 118 and cable clamps 120a-b.

[0038] FIG. 1T is a schematic showing a cross-sectional view of the feeder pillar 100 according to various embodiments. The panel board 110 may include a plurality of fuse rails.

[0039] FIG. 1U is a general illustration of the remote sensing capabilities of the feeder pillar 100 according to various embodiments.

[0040] The feeder pillar 100 or the fuse switch compartment 102 may include one or more sensors 122. The one or more sensors 122 may include a temperature sensor, a current sensor, a voltage sensor, a moisture sensor, and/or a contact sensor. The temperature sensor may be configured to detect or determine a temperature of the feeder pillar 100 or the fuse switch compartment 102. The current sensor may be configured to determine a current flowing through the panel board 110 or bus bar. The current sensor may be in electrical connection with the panel board 110 or bus bar. The voltage sensor may be configured to determine a voltage or a potential difference between two points of the panel board 110 or bus bar. The voltage sensor may be in electrical connection with the panel board 110 or bus bar. The moisture sensor may be configured to detect or determine a moisture or humidity level of the feeder pillar 100 or the fuse switch compartment 102. In various embodiments, the panel board 110 may be a smart low voltage (LV) board including the one or more sensors 122. The contact sensor may be configured to detect or sense whether the feeder pillar 100, e.g. the door 102c is opened.

[0041] The feeder pillar 100 or the fuse switch compartment 102 or the cable termination compartment 104 may also include a processor 124. The one or more sensors 122 may be electrically connected or coupled (via wired means or wireless means) to the processor 124. The processor 124 may be any circuit arrangement or chip that is configured to process data received from the one or more sensors 122. The feeder pillar 100 or the fuse switch compartment 102 or the cable termination compartment 104 may further include a communications module 126, e.g. a transceiver, electrically connected to or coupled to the processor 124. The module 126 and the processor 124 may be integrated together. When the transceiver is included within the compartment 102, an antenna of the transceiver may protrude out of the compartment 102 or the feeder pillar 100. The processor 124 may be configured to generate one or more electrical signals based on the data received from the one or more sensors 122. The one or more electrical signals may be sent to the communications module 126. The communications module 126 may be configured to transmit one or more wireless signals (e.g. 3rd Generation (3G) or 4th Generation (4G) signals) based on the one or more electrical signals received from the processor 124. The information contained in the one or more wireless signals may be collected and analyzed by

software that may assist the system operator in analyzing the patterns of use for optimal Distributed Energy Resource (DER) management. In addition, system operators may be better able to detect and isolate faults thereby enhancing response time and overall network reliability. In various other embodiments, the communications module 126 may be coupled to an external system via wired means, such as via optical cables, ethernet cables etc.

[0042] There have been efforts to move towards smart grid. However, there is currently no remote monitoring systems for low voltage power distribution networks. Conventional electrical distribution systems are not equipped to collect data such as current, voltage, temperature and/or moisture for predictive maintenance. This may reduce the ability to detect and isolate faults which prolongs response time during power outages. Various embodiments may address the abovementioned issues.

[0043] Suitable software may be developed to integrate and analyze large amounts of data coupled with an intuitive user interface. Extensive research has been carried out to develop the software to meet the requirements.

[0044] FIG. 2 is a general illustration of a feeder pillar 200 according to various embodiments. The feeder pillar 200 may include a fuse switch compartment 202. The feeder pillar 200 may also include a cable termination compartment 204. The fuse switch compartment 202 may include a housing, and a panel board within the housing. The cable termination compartment 204 may include or be configured to receive one or more incoming cables configured to electrically connect an external power source to the panel board. The cable termination compartment 204 may also include or be configured to receive one or more outgoing cables configured to electrically connect the panel board to one or more electrical devices. The housing may include an interface assembly. The interface assembly may include a molded structure including a plurality of through-holes extending from a first surface of the molded structure to a second surface of the molded structure opposite the first surface. The interface assembly may further include a plurality of electrical pins in electrical connection with the panel board. The plurality of electrical pins may protrude from the plurality of through-holes into the cable termination compartment 204. A first group of electrical pins may be or configured to be in contact with the one or more incoming cables and configured to electrically connect the external power supply to the panel board via the one or more incoming cables. A second group of

electrical pins may be or configured to be in contact with the one or more outgoing cables and configured to electrically connect the panel board to the one or more electrical devices via the one or more outgoing cables.

[0045] In other words, the feeder pillar 200 may include a fuse switch compartment 202 including a panel board, and a housing to hold the panel board. The housing may be such that the cable termination is led out to external of the fuse switch compartment 202 using the interface assembly. The pillar may be such that cables are terminated within the cable termination compartment 204.

[0046] In various embodiments, the housing may include a door. The door may include an outer surface including a plurality of perforations, and a solid or continuous inner surface. The out surface and the inner surface may be separated by an air pocket or an enclosed space. The door may be movable between a closed position and an open opposition. The housing or the door may include a sealing structure for sealing the housing when the door is in a closed position.

[0047] In various embodiments, the door may be a hinged door. In various other embodiments, the door may be of any other types of suitable doors, e.g. a sliding door.

[0048] The interface assembly and the sealing structure may allow the fuse switch compartment 202 to increase protection against dust and water. In various embodiments, the feeder pillar 200 or fuse switch compartment 202 may achieve IP 67 rating. In other words, the feeder pillar 200 or fuse switch compartment 202 may be dust tight, with no ingress of dust from 2 to 8 hours. The feeder pillar may have protection against the effects of immersion in water of between 15 cm and 1 m for 30 minutes.

[0049] Various embodiments may provide better protection against dust and water as compared conventional feeder pillars/ electrical distribution systems, which may only achieve IP 55 rating. Under the IP55 rating, the system may be dust protected (limited ingress of dust permitted, dust will not interfere with operation of equipment) from 2 to 8 hours, and may be protected against jets of water (limited ingress permitted).

[0050] As shown above, the IP 67 rating is more stringent than the IP 55 rating.

[0051] Various embodiments may offer better protection against environmental or weather events such as flooding. Various embodiments may prevent or reduce the likelihood of water

getting into the feeder pillar. Water getting into the feeder pillar may cause discharge of current into the water, leading to electrocution and damage.

[0052] In various embodiments, the molded structure may include cured dough molded compound (DMC). In various other embodiments, the molded structure may include a copper-clad laminate, any suitable thermoplastic material, and/or any suitable thermoset material. In yet various other embodiments, the molded structure may include any other suitable materials that provide electrical insulation, and may withstand high temperatures.

[0053] In various embodiments, the sealing structure may be a gasket. The gasket may include rubber cork or silicone. The rubber cork may include neoprene.

[0054] The housing may also include one or more heat sinks. The one or more heat sinks may improve the heat dissipation of the fuse switch compartment 202. With the better sealing of the fuse switch compartment 202, various embodiments may face thermal management issues due to poorer ventilation. In various embodiments, the feeder pillar 200 may include a heat dissipation mechanism or structure(s) such as the one or more heat sinks to address or mitigate the thermal management issues. The one or more heat sinks may be bound, welded, or attached via any other suitable means to one another, and/or to the rest of the housing.

[0055] In various embodiments, each of the one or more heat sinks may include a base and a plurality of fins extending from the base.

[0056]

[0057] Various embodiments may include a remote sensing system that allows parameters such as temperature, current, voltage and/or moisture to be determined or detected and transmitted off-site without opening of the feeder pillar 200. Various embodiments may allow for more efficient monitoring so that faults can be identified and isolated in a shorter period of time, thereby enhancing response time and overall network reliability.

[0058] In various embodiments, the feeder pillar 200 may include the remote sensing system. The feeder pillar 200 may include one or more sensors. The feeder pillar 200 may also include a processor in electrical connection with or coupled to (via wired or wireless means) the one or more sensors. The feeder pillar 200 may also include a communications module in electrical connection with the processor. The communications module may be configured to transmit data to an external system via wireless means, e.g. 3G or 4G signals, or wired means. The

communications module may be a transceiver. The one or more sensors may include a temperature sensor, a current sensor, a voltage sensor, a moisture sensor, and/or a contact sensor. The one or more sensors may include any other suitable types of sensors.

[0059] In various embodiments, the cable termination compartment 204 may include a plurality of louver openings. The plurality of louver openings may improve ventilation.

[0060] In various embodiments, the cable termination compartment 204 may include a plurality of cable clamps configured to hold the one or more incoming cables and the one or more outgoing cables. A first group of the plurality of cable clamps may be configured to hold the one or more incoming cables, while a second group of the plurality of cable clamps may be configured to hold the one or more outgoing cables.

[0061] In various embodiments, the cable termination compartment 204 may include a side cable entry opening. The cable termination compartment 204 may also include a metal cover to cover the side cable entry opening during normal operation. During maintenance or when required, the metal cover may be removed or detached to expose the side cable entry opening. A cable may then be inserted through the opening to connect to the panel board (through electrical pin(s)). The opening may allow easy access of the feeder pillar 200 without dismantling of the feeder pillar 200.

[0062] FIG. 3 is a general illustration of a method of forming a feeder pillar according to various embodiments. The method may include, in 302, forming or assembling a fuse switch compartment. The fuse switch compartment may include a housing, and a panel board within the housing. The method may also include, in 304, forming or assembling a cable termination compartment. The cable termination compartment may include or configured to receive one or more incoming cables configured to electrically connect an external power source to the panel board. The cable termination compartment may further include or configured to receive one or more outgoing cables configured to electrically connect the panel board to one or more electrical devices. The housing may include an interface assembly. The interface assembly may include a molded structure including a plurality of through-holes extending from a first surface of the molded structure to a second surface of the molded structure opposite the first surface. The interface assembly may further include a plurality of electrical pins in electrical connection with the panel board. The plurality of electrical pins may protrude from the plurality of through-holes

into the cable termination compartment. A first group of electrical pins may be or configured to be in contact with the one or more incoming cables and configured to electrically connect the external power supply to the panel board via the one or more incoming cables. A second group of electrical pins may be or configured to be in contact with the one or more outgoing cables and configured to electrically connect the panel board to the one or more electrical devices via the one or more outgoing cables.

[0063] In other words, the feeder pillar may be formed or assembled by housing the panel board in a housing that has an interface assembly. The cables connected to the panel board may be attached to the electrical pins of the interface assembly, i.e. outside of the fuse switch compartment and within the cable termination compartment.

[0064] For avoidance of doubt, FIG. 3 is not intended to be in sequence. Step 302 may occur before, after, or at the same time as step 304.

[0065] In various embodiments, the method may include forming the interface assembly by forming the molded structure and inserting the plurality of pins through the plurality of through-holes. The molded structure may include cured dough molded compound.

[0066] In various embodiments, forming the molded structure may include providing uncured dough molded compound in a mold, and heating the uncured dough molded compound (in the mold) to cure the uncured dough molded compound. The uncured dough molded compound (DMC) may include a resin (e.g. unsaturated polyester resin, or epoxy resin), glass fibers, and other substances such as a catalyst, a release agent and additives. During the curing process, the polymers present in the resin may cross-link with one another. The glass fibers may be held in place by the cross-linked polymers to form the cured dough molded compound.

[0067] The method may also include assembling one or more heatsinks to one or more metal covers to form the housing. The one or more heat sinks may be attached, bound, or welded to the one or more metal covers.

[0068] In various embodiments, the method may also include arranging one or more sensors in the fuse switch compartment. The method may further include electrically connecting or coupling (i.e. via wired means or wireless means) a processor to the one or more sensors. The method may also include electrically connecting a communications module to the processor. The communications module may be configured to transmit data to an external system via wireless

means or via wired means. The one or more sensors may include a temperature sensor, a current sensor, a voltage sensor, a moisture sensor, and/or a contact sensor.

[0069] FIG. 4 shows information pertaining to Ingress Protection (IP) ratings. Various embodiments may achieve an IP 67 rating.

[0070] While the invention has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

CLAIMS

1. A feeder pillar comprising:

a fuse switch compartment comprising:

a housing; and

a panel board within the housing; and

a cable termination compartment configured to receive one or more incoming cables configured to electrically connect an external power source to the panel board, and one or more outgoing cables configured to electrically connect the panel board to one or more electrical devices;

wherein the housing comprises an interface assembly comprising:

a molded structure comprising a plurality of through-holes extending from a first surface of the molded structure to a second surface of the molded structure opposite the first surface; and

a plurality of electrical pins inserted through the plurality of through-holes such that the housing forms a sealed enclosure, the plurality of electrical pins in electrical connection with the panel board; the plurality of electrical pins protruding from the plurality of through-holes into the cable termination compartment;

wherein a first group of electrical pins is configured to be in contact with the one or more incoming cables and configured to electrically connect the external power supply to the panel board via the one or more incoming cables; and

wherein a second group of electrical pins is configured to be in contact with the one or more outgoing cables and configured to electrically connect the panel board to the one or more electrical devices via the one or more outgoing cables.

2. The feeder pillar according to claim 1,

wherein the molded structure comprises cured dough molded compound.

3. The feeder pillar according to claim 1 or claim 2,

wherein the housing comprises a door; and

wherein the housing comprises a sealing structure for sealing the housing when the door is in a closed position.

4. The feed pillar according to claim 3,

wherein the sealing structure is a gasket comprising rubber cork or silicone.

5. The feeder pillar according to any one of claims 1 to 4,

wherein the housing further comprises one or more heat sinks.

6. The feeder pillar according to claim 5,

wherein each of the one or more heat sinks comprises a base and a plurality of fins extending from the base.

7. The feeder pillar according to any one of claims 1 to 6, further comprising:

one or more sensors; and

a processor in electrical connection with the one or more sensors.

8. The feeder pillar according to claim 7, further comprising:

a communications module in electrical connection with the processor;

wherein the communications module is configured to transmit data to an external system via wireless means or wired means.

9. The feeder pillar according to claim 7 or claim 8,

wherein the one or more sensors comprise a temperature sensor, a current sensor, a voltage sensor, a moisture sensor, and a contact sensor.

10. The feeder pillar according to any one of claims 1 to 9,

wherein the cable termination compartment comprises a plurality of louver openings.

11. The feeder pillar according to any one of claims 1 to 10,

wherein the cable termination compartment comprises a plurality of cable clamps configured to hold the one or more incoming cables and the one or more outgoing cables.

12. The feeder pillar according to any one of claims 1 to 11,

wherein the cable termination compartment comprises a side cable entry opening.

13. A method of forming the feeder pillar, the method comprising:

forming a fuse switch compartment comprising:

a housing; and

a panel board within the housing;

forming a cable termination compartment configured to receive one or more incoming cables configured to electrically connect an external power source to the panel board, and one or more outgoing cables configured to electrically connect the panel board to one or more electrical devices;

wherein the housing comprises an interface assembly comprising:

a molded structure comprising a plurality of through-holes extending from a first surface of the molded structure to a second surface of the molded structure opposite the first surface; and

a plurality of electrical pins inserted through the plurality of through-holes such that the housing forms a sealed enclosure, the plurality of electrical pins in electrical connection with the panel board; the plurality of electrical pins protruding from the plurality of through-holes into the cable termination compartment;

wherein a first group of electrical pins is configured to be in contact with the one or more incoming cables and configured to electrically connect the external power supply to the panel board via the one or more incoming cables; and

wherein a second group of electrical pins is configured to be in contact with the one or more outgoing cables and configured to electrically connect the panel board to the one or more electrical devices via the one or more outgoing cables.

14. The method according to claim 13, further comprising:

forming the interface assembly by forming the molded structure and inserting the plurality of pins through the plurality of through-holes.

15. The method according to claim 13 or claim 14,

wherein the molded structure comprises cured dough molded compound.

16. The method according to claim 15,

wherein forming the molded structure comprises:

providing uncured dough molded compound in a mold; and

heating the uncured dough molded compound to cure the uncured dough molded compound.

17. The method according to any one of claims 13 to 16, further comprising:

assembling one or more heatsinks to one or more metal covers to form the housing.

18. The method according to any one of claims 13 to 17, further comprising:

arranging one or more sensors in the fuse switch compartment; and

electrically connecting a processor to the one or more sensors.

19. The method according to claim 18, further comprising:

electrically connecting a communications module to the processor;

wherein the communications module is configured to transmit data to an external system via wireless means or wired means.

20. The method according to claim 18 or claim 19,

wherein the one or more sensors comprise a temperature sensor, a current sensor,
a voltage sensor, a moisture sensor, and a contact sensor.