AN INTERCONNECTION AND INSULATION MODULE FOR BUSBARS

TECHNICAL FIELD

The disclosure relates generally to low voltage electrical switchgear and control gear assembly and more particular to an improved modular bus bar interconnection and insulation system for power distribution in multi-compartment switchboards.

BACKGROUND

Low Voltage Switchgear and ControlGear Assemblies (LVSCA) are used to distribute electrical power in residential, commercial and industrial applications. For the purpose of explanation embodiments of the invention will be described in the context of high end commercial and Industrial market segments.

Within these market segments there are generally two types of LVSCA

- Commercial applications generally use electrical switchboards which predominately are for the distribution of electrical power for Light and Power applications. These would include, major shopping centres, office buildings, factories. The switchboard distributes power for lighting, air conditioning, refrigeration, air conditioning and electrical equipment including power for general use and computer installations.

- Industrial installations can use electrical switchboards but also use Motor Control Centres. MCC are used to control the starting and stopping of electrical motors in mining, water treatment, processing, conveyors, mills and like installations. These applications are generally further controlled by programmable logic controllers PLCs that are programmed for each application.

building up and creating short circuit conditions or arcing fault conditions between the bars. Foreign matter can be any number of things, dust, rodents, swarf from drilling or cutting, insects, carbon. In addition, the bare bus bars 1, 3 present a shock risk to a person doing maintenance or modifications to the LVSCA.

It is an object of the present disclosure to provide an apparatus to assist in interconnection of busbars that overcomes one or more of the problems of the prior art that have been discussed above.

SUMMARY

The invention is defined in the independent claims. Further embodiments of the invention are defined in the dependent claims.

According to a first aspect of the present disclosure there is provided an interconnection and insulation module arranged to locate about a plurality of busbar pairs, each busbar pair including first and second busbars with an inter-busbar gap therebetween, said module including:

opposed sides for accommodating the busbar pairs therebetween;

corresponding windows formed through the opposed sides; and

formations extending from interior surfaces of at least one of the opposed sides to locate inter-busbar gaps for each bus bar pair between one or more of the corresponding windows;

whereby passages are defined between the corresponding windows of the opposed sides via the inter-busbar gaps for insertion of an electrical interconnection member.

In a preferred embodiment of the invention the windows formed through the opposed sides are in respective square arrays.

Preferably the support housing comprises first and second opposed portions. It is preferred that busbar dividers extend from internal walls of the first and second portions.

Opposed ends of the module may include unidirectional mating formations whereby a number of modules may be interconnected end to end so that all of the number of modules are orientated in the same direction.

The module may include alignment formations located around a periphery of the module for assisting face-to-face alignment of windows of the module with another corresponding module in use.

The formation for locating the bus bar pairs preferably includes a number of separators which extend from one or more internal walls of the support housing and which penetrate a space between pairs of the busbars.

An endplate may be mounted across one end of the housing.

According to a further aspect of the disclosure there is provided an insulated busbar assembly comprising:

a first plurality of parallel busbars;

a module as previously described, disposed about the first plurality of parallel busbars.

The busbar assembly may comprise a second plurality of parallel busbars orthogonal to the first plurality of busbars and a second module of the previously described type disposed about the second plurality of parallel busbars wherein windows of the first module and windows of the second module are aligned.

One or more interconnection members, for example in the form of bolts or pins, may be disposed through respective of the aligned windows thereby interconnecting busbars of the first plurality of busbars with busbars of the second plurality of busbars.

Each of the plurality of busbar assemblies are preferably contiguously covered by modules of the previously described type.

According to another aspect of the present disclosure there is provided an insulated busbar assembly comprising:

a first busbar assembly including a plurality of parallel busbars;

a first plurality of interconnection and insulation modules disposed contiguously about the busbar assembly.

Preferably each of the modules comprise:

a support housing encircling the busbars;

a number of dividers extending from one or more internal walls of the support housing to locate the busbars and to maintain electrical separation therebetween;

a regular array, or "matrix" of windows formed in the support housing;

detachable covers corresponding to the windows;

wherein the dividers and the windows are located relative to each other for a conductive member inserted through a window to come into electrical connection with a busbar.

The insulated busbar assembly may include one or more additional busbar assemblies each having respective additional pluralities of interconnection and insulation modules disposed contiguously thereabout wherein conductive members electrically interconnect busbars of the first busbar assembly and of the one or more additional busbar assemblies. The additional busbars fit into an overall matrix structure of the busbar assembly.

According to a first aspect of the present disclosure there is provided an interconnection and insulation module for busbars, the module comprising:

a support housing encircling the busbars;

a number of dividers extending from one or more internal walls of the support housing to locate the busbars and to maintain electrical separation therebetween;

a regular array of windows formed in the support housing;

detachable covers corresponding to the windows;

wherein the dividers and the windows are located relative to each other for a conductive member inserted through a window to come into electrical connection with a busbar.

Preferably the windows are arranged in respective square arrays or matrices.

In a preferred embodiment of the invention the support housing comprises first and second opposed portions wherein the dividers extend from internal walls of the first and second portions.

It is preferred that opposed ends of the module include unidirectional mating formations whereby a number of modules may be interconnected end to end so that all of the number of modules are orientated in the same direction.

The busbars may be provided in pairs, in that case it is preferable that the module includes a number of separators which extend from one or more internal walls of the support housing and which penetrate a space between pairs of the busbars.

The module may include an endplate mounted across one end of the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred features, embodiments and variations of the invention may be discerned from the following Detailed Description which provides sufficient information for those skilled in the art to perform the various embodiments. The Detailed Description is not to be regarded as limiting the scope of the preceding Summary in any way. The Detailed Description will make reference to a number of drawings as follows:

FIG. 1 is a view of a prior art horizontal to vertical bus bar joining detail.

facilitates easier assembly and maintenance and reduces the possibility of creating short circuits or arcing faults.

The busbar support also has provision to mount a shutter mechanism to it. When using a withdrawable switchgear and control gear module which is common in MCCs it is necessary to have a 'plugin' connection. Therefore each window in the busbar support must be removed so that a plug can connect to the busbar. When the module is removed the busbar is then exposed, in this design requirement a shutter mechanism will be mounted directly to the busbar insulating support.

Fully insulated busbars provide much improved operator safety when it is necessary for an operator to carry out maintenance work on the LVSCA while the system is still energised. There is a reduced danger of inadvertent contact with live parts and the danger of wires or tools creating electrical faults is practically eliminated.

The standardization of busbar size and matrix busbar system used in preferred embodiments of the present invention reduces the design and engineering input and also the technical expertise of the personnel required during the assembly process.

The modular matrix concept of the insulated busbar system ensures that every application can be verified as compliant with type test certification. This can be guaranteed when the LVSCA is built in accordance with the instructions as all connections are on the predetermined matrix.

A busbar system is the fundamental building block of any LVSCA. However generally manufacturers design all other elements and then work out how to connect it all together. The design concept behind the present disclosure is to develop a matrix insulated busbar system and then build all other aspects around it. Ultimately the busbar system is only a part of the LVSCA, additional components are still required such as a metal enclosure, a connection system to the busbar, a

switchgear and controlgear compartment and cable access for both supply of power and distribution of power to the field devices.

A preferred embodiment of the present invention has been described with particular reference to a 50mm inter-window spacing and also with reference to the dimensions of preferred busbars. It will be realised that the present disclosure is not limited to any particular dimensions since the dimensions may be varied depending on the application and whether a metric or imperial system of measurement is standard where the various embodiments are implemented. Furthermore, the preferred embodiment of the invention has been concerned with a three phase insulated busbar system which entailed four pairs of busbars (one for each phase and one for neutral) so that the modules provided a square array (or "matrix") of 4 4 x 4 = 16 connection points and detachable windows thereover. However, the system may be readily modified to accommodate a different number of windows within a different matrix. Further variations will also be apparent to those skilled in the art.

In compliance with the statute, the present disclosure has been described in language more or less specific to structural or methodical features. The term "comprises" and its variations, such as "comprising" and "comprised of" is used throughout in an inclusive sense and not to the exclusion of any additional features. It is to be understood that the disclosure is not limited to specific features shown or described since the means herein described comprises preferred forms of putting the various embodiments into effect. The disclosure is, therefore, claimed in any of its forms or modifications within the proper scope of the appended claims appropriately interpreted by those skilled in the art.

Throughout the specification and claims (if present), unless the context requires otherwise, the term "substantially" or "about" will be understood to not be limited to the value for the range qualified by the terms.

Any embodiment of the invention is meant to be illustrative only and is not meant to be limiting to the disclosure. Therefore, it should be appreciated that various other

changes and modifications can be made to any embodiment described without departing from the spirit and scope of the disclosure.

Features, integers, characteristics, compounds, chemical moieties or groups described in conjunction with a particular aspect, embodiment or example of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein unless incompatible therewith.

CLAIMS:

1. An interconnection and insulation module arranged to locate about a plurality of busbar pairs, each busbar pair including first and second electrically insulated busbars with an inter-busbar gap therebetween, said module including:

opposed sides for accommodating the busbar pairs therebetween;

corresponding windows formed through the opposed sides; and

formations extending from interior surfaces of at least one of the opposed sides to locate and provide inter-busbar gaps for each bus bar pair between one or more of the corresponding windows;

whereby passages are defined between the corresponding windows of the opposed sides via the inter-busbar gaps for insertion of an electrical interconnection member; and

wherein each of the inter-bus gaps provided by the formations are less than each of the gaps between two adjacently located busbar pairs accommodated between the opposed sides of the module.

2. A module according to claim 1, wherein the windows formed through the opposed sides are in respective square arrays.

3. A module according to claim 1 or claim 2, wherein the opposed sides comprise first and second opposed portions.

4. A module according to claim 3, wherein busbar dividers extend from internal walls of the first and second portions.

5. A module according to any one of claims 1 to 4, wherein opposed ends of the module include unidirectional mating formations whereby a number of modules may be interconnected end to end so that all of the number of modules are orientated in the same direction.

6. A module according to any one of claims 1 to 5 including alignment formations located around a periphery of the module for assisting face-to-face alignment of windows of the module with another corresponding module in use.

7. A module according to any one of claims 1 to 6 wherein the formation for locating the bus bar pairs include a number of separators which extend from one or more internal walls of the opposed sides and which penetrate a space between pairs of the busbars.

8. A module according to claim 3 including an endplate mounted across one of the first and second opposed portions.

9. An insulated busbar assembly comprising:
a first plurality of parallel busbars;
a module according to any one of claims 1 to 8, disposed about the first plurality of parallel busbars.

10. The busbar assembly of claim 9 further including a second plurality of parallel busbars orthogonal to the first plurality of busbars and a second module according to any one of claims 1 to 8 disposed about the second plurality of parallel busbars wherein windows of the first module and windows of the second module are aligned.

11. The busbar assembly of claim 10 including one or more interconnection bolts disposed through respective of the aligned windows thereby interconnecting busbars of the first plurality of busbars with busbars of the second plurality of busbars.

12. An assembly comprising:
a plurality of insulated busbar assemblies according to any one of claims 9 to 11, wherein each of the plurality of insulated busbar assemblies are contiguously covered by modules according to any one of claims 1 to 8.