

Description

Metal-encapsulated, gas-insulated switchgear assemblies with gas-filled containers

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The invention relates to metal-encapsulated, gas-insulated switchgear assemblies, in particular for medium voltage-technology, having switch panels with a modular structure, in which three-position switches and busbars are arranged jointly in a hermetically sealed first switch area and circuit breakers are arranged in a hermetically sealed second switch area one behind the other, with the busbars being connected to the circuit breakers via bushings by means of the three-position switches, the circuit breakers being provided with a corresponding number of cable bushings for connection of cable connections, and the switch areas being bounded by pressure-relief channels.

20 Switchgear assemblies of the type defined initially are known from the document A. Aufermann, et al. "Schaltanlagentechnik wird zur Systemfamilie" [switchgear assemblies become a system family] from ETZ, Volume 118, No. 15/16, August 1, 1997, pages 16-25 19.

Depending on the requirement, these switchgear assemblies are equipped with single or double busbars, with each single busbar being accommodated with the respective three-position switch in a separate gas area. The gas area containers are directly connected to one another and must be physically matched to one another, depending on the requirements.

Furthermore, DE 44 45 06 A1 has disclosed switchgear assemblies in which the three-position switch and the circuit breaker, in this case in the form of a vacuum contactor, are in each case accommodated together in gas-filled containers.

The three-position switches, which are located in the containers, are connected to the busbars which are arranged completely outside the containers via so-called bushings, which pass through the upper regions of the containers in a gas-tight manner. Further bushings are provided in the lower region of the containers for the cable connections, which are likewise supplied from the outside, while cable plug connections are accessible via gas-tight bushings on the front face.

In this case, each of the containers generally has at least six bushings which are welded in such that they are gas-tight and onto which the cable plug connections can be plugged directly, for example via external cone systems. Depending on the requirement, surge arresters or cable test sets may then be connected to the cable plug connections.

The containers in these systems are thus hermetically welded and are therefore metallically closed without any seals. Welded switchgear assemblies of this type are subject to very stringent requirements with regard to the design and the quality control accompanying manufacture, since faults which occur require very costly repair work not only in the final test phase but also later during operation, in difficult cases, may result in complete replacement of one or more switch panels in a switchgear assembly.

The object on which the invention is based is to considerably improve the concept of the physical design of these metal-encapsulated, gas-insulated switchgear assemblies and, furthermore and in particular, also to simplify the actions when faults occur without, however, constricting the highly advantageous characteristics of these switchgear assemblies in terms of their life and their operational reliability.

According to the invention, this is achieved by the following features:

- 1.1 the three-position switches are arranged alongside one another in the respective first switch areas controlled by a single push rod,
- 1.2 pressure-relief channels for the first switch areas are provided towards the outside, each having a pressure-reducing, fault-arc-resistant section cover with an air outlet which is free upward,
- 1.3 the bushings are provided by gas-tight module coupling devices,

Switch panels structured in such a way allow the switchgear assemblies to be produced and maintained in functional units which are less complex overall.

The switch areas are in this case provided in a particularly advantageous manner with bushings which, as gas-tight module coupling devices, allow these switchgear assemblies to be assembled and disassembled with virtually no additional effort relating to the insulating gasses. This also applies, in particular, to the replacement of individual components in the switchgear assembly, such as the three-position switches or the circuit breakers, in the event of defects, in which case in comparison with known switchgear assemblies, only the defective part need be replaced. The use of standard module coupling devices as a gas-tight connecting element between the various switch areas improves the modular-structured design of the switch panels in a particularly simple manner. The three-position switches, which are arranged alongside one another in the first switch area, are arranged with the rotation plane of their contacts parallel to the front face of the switch panel and, corresponding thereto, require only a small installation volume, allows them to be operated jointly by relatively simple control mechanisms with a push rod.

The panel cover, which bounds the first switch area at the top, and the pressure-relief channel for the switch panel, allow the safety requirements for personnel protection to be satisfied despite the compact
5 structure of these switchgear assemblies.

Slightly modified metal-encapsulated, gas-insulating switchgear assemblies provide the following features:

- 10 2.1 the three-position switches are arranged alongside one another in the respective first switch areas controlled by a single push rod
- 2.2 pressure-relief channels for the first switch areas are provided towards the outside, each having a pressure-reducing, fault-arc-resistant
15 section cover with an air outlet which is free upward,
- 2.3 the bushings are provided by gas-tight module coupling devices,
- 2.4 the switch panels have a hermetically sealed third
20 switch area for accommodating the cable bushings,
- 2.5 the circuit breakers in the second switch areas are connected to the cable bushings of the third switch areas via the module coupling devices.

25 These switchgear assemblies differ from those mentioned above essentially by the additionally provided third switch area, in which the cable connections are accommodated - separately from the circuit breakers. As in the first type of switchgear assembly, the switch
30 areas, in this case the second and third switch areas, are once again connected in a gas-tight manner to the module coupling devices, so that the advantages mentioned initially apply to a greater extent to these switchgear assemblies. For measurement purposes, the
35 module coupling devices are equipped with corresponding, easily accessible transformer devices outside the switch areas.

According to advantageous refinements of this invention, the cable bushings may contain both internal cone connections as claimed in patent claim 3, and external cone connections as claimed in patent claim 4.

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In metal-encapsulated, gas-insulated switchgear assemblies whose switch panels are functionally interconnected to form so-called bus ties, the following features are provided according to a further, particularly advantageous refinement of the invention:

- 10 5.1 the switch panels of a switchgear assembly are connected to a number of gas-tight section coupling devices, corresponding to the number of busbars,
- 15 5.2 the section coupling devices are physically identical to the module coupling devices,

The module coupling devices of an identical type allow the switch panels, which thus have a modular structure, to be joined together to form the most widely differing switchgear assembly versions, in a simple manner and without effort.

The invention will be explained in more detail using two Figures, by means of highly simplified exemplary embodiments, which are illustrated in the Figures, and in which:

25 Figure 1 shows a right-hand front view of one possible refinement of a switchgear assembly with two separate switch areas which, as can be seen from the side view shown on the left, is in the form of a switchgear assembly with a bus tie, while

30 Figure 2 shows a modified switchgear assembly with three mutually independent switch areas.

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Figure 1 shows a front view and side view of a metal-encapsulated, gas-insulated switchgear assembly, which

contains the switch panel SF and a further switch panel SFn to form a switchgear assembly version having a bus ties. The first hermetically sealed switch area R1 is provided in the upper region of the switch panel SF, together with the three-position switches DS... (which are located in this switch area and can be controlled by means of a push rod SG) and the corresponding busbars SS..., and the second, hermetically sealed switch area R2 is provided in the lower region of this switch panel SF, together with the circuit breakers LS, cable bushes KD and connector sockets SB located in it. Furthermore, it can be seen that the switch area R1 is bounded at the top by the fault-arc-resistance section cover SA which, in conjunction with the pressure-relief channel DK which passes through the switch panel SF, deliberately carries the hot gasses in the event of a fault out of the switch panel SF upward in the direction of the arrow. The metal mesh inserts SM within the section cover SA indicate that, in conjunction therewith, this also provides corresponding heat dissipation, so that the personnel protection is fully effected in the event of a fault. The Figure also shows a number of module coupling devices, of which only one module coupling device is shown, for the sake of clarity, and is denoted by MK, this device connecting the first and second switch area R1, R2 to one another in such a way that no gas exchange can take place between the hermetically sealed switch areas R1, R2 between these switch areas R1, R2 either when the switch panel SF is fitted, or when it is removed. These module coupling devices MK ensure that there is no longer any need for any additional effort relating to the gas either during assembly or during disassembly in the event of maintenance.

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The module coupling devices MK are designed in such a way that, if necessary, they can accommodate current

transformers SW designed in the form of toroidal core transformers - as shown.

5 The side view of the switch panel SF and of an additional, further switch panel SFn can be seen to the left alongside the front view of the switch panel SF, as are provided to create a switchgear assembly having a bus tie. In-addition to the connection of the two switch areas R1, R2 to the module coupling devices, of
10 which only one module coupling device, denoted by MK, is shown for the sake of clarity, it can be seen that the switch panel SF is connected to the further switch panel SFn via section coupling devices, of which only one is shown here, and is denoted by FK. These section
15 coupling devices FK have the same characteristics as the module coupling devices MK and are physically identical to them, and may be equipped with current transformers SW - as indicated - in the same way, for measurement purposes.

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Figure 2 shows a further, metall-encapsulated, gas-insulating switchgear assembly, in which, in contrast to the switchgear assembly shown in Figure 1, the cable bushings KD are accommodated in a separate, third
25 switch area R3 in the switch panel SF. As can be seen, the second switch area R2 is connected not only to the first switch area R1 but also to the third switch area R3 by the module coupling devices MK. In this way, if required, the cable bushings KD can also be replaced,
30 without having to access the first or second gas-filled switch areas R1, R2.



Patent Claims

1. Metal-encapsulated, gas-insulated switchgear assemblies, in particular for medium voltage technology, having switch panels with a modular structure, in which three-position switches and busbars are arranged jointly in a hermetically sealed first switch area and circuit breakers are arranged in a hermetically sealed second switch area one behind the other, with the busbars being connected to the circuit breakers via bushings by means of the three-position switches, the circuit breakers being provided with a corresponding number of cable bushings for connection of cable connections, and the switch areas being bounded by pressure-relief channels, characterized by the following features:
- 1.1 the three-position switches (DS) are arranged alongside one another in the respective first switch areas (R1) controlled by a single push rod
 - 1.2 pressure-relief channels for the first switch areas (R1) are provided towards the outside, each having a pressure-reducing, fault-arc-resistant section cover (SA) with an air outlet which is free upward,
 - 1.3 the bushings are provided by gas-tight module coupling devices (MK).
- 2 The metal-encapsulated, gas-insulated switchgear assemblies, in particular for medium voltage technology, having switch panels with a modular structure, in which three-position switches and busbars are arranged jointly in a hermetically sealed first switch area and circuit breakers are arranged in a hermetically sealed second switch area one behind the other, with the busbars being connected to the circuit breakers via bushings by



- means of the three-position switches, the circuit breakers being provided with a corresponding number of cable bushings for connection of cable connections, and the switch areas being bounded by pressure-relief channels,
- 5 characterized by the following features:
- 2.1 the three-position switches (DS) are arranged alongside one another in the respective first switch areas (R1) controlled by a single push rod
- 10 2.2 pressure-relief channels for the first switch areas (R1) are provided towards the outside, each having a pressure-reducing, fault-arc-resistant section cover (SA) with an air outlet which is free upward,
- 15 2.3 the bushings are provided by gas-tight module coupling devices (MK).
- 2.4 the switch panels have a hermetically sealed third switch area (R3) for accommodating the cable bushings (KD),
- 20 2.5 the circuit breakers (LS) in the second switch areas (2) are connected to the cable bushings (KD) of the third switch areas (R3) via the module coupling devices (MK).
- 25 3. The metal-encapsulated, gas-insulated switchgear assemblies as claimed in patent claim 1 or 2, characterized by the following feature:
- 3.1 the cable bushings (KD) are equipped with integrated internal cone connections.
- 30 4. The metal-encapsulated, gas-insulated switchgear assemblies as claimed in patent claim 1 or 2, characterized by the following feature:
- 35 4.1 the cable bushings (KD) are equipped with integrated external cone connections.



5. The metal-encapsulated, gas-insulated switchgear assemblies as claimed in one of patent claims 1 or 2, as well as patent claims 1 and 3 or 2 and 3, characterized by the following features:

5 5.1 the switch panels (SF) of a switchgear assembly (SA) are connected to a number of gas-tight section coupling devices (FK), corresponding to the number of busbars,

10 5.2 the section coupling devices (SK) are physically identical to the module coupling devices (MK).