K 1202

EQUIPMENT CABINET FOR ELECTRICAL AND ELECTRONIC SYSTEMS

The invention relates to an equipment cabinet, particularly a switch and control cabinet, for electrical and electronic systems with a functional area sealed in dustproof and watertight manner, having at least one door closing in dustproof and watertight manner. In the same structural form and equipment, the equipment cabinet is suitable for external use in widely differing climatic zones, e.g. temperate, arctic, subtropical and tropical zones.

Equipment cabinets are e.g. known from the publication by Gottfried Klingberg "Schaltschrank und Gehäuse-Klimatisierung", (switch cabinet and case climatization), Mähling Werbung, Düsseldorf.

With the aim of ensuring a permanent, faultless operation of the electrical and electronic systems in the case of variable external climatic conditions, as a function of the functional area climatic requirements equipment cabinets are designed therein in such a way that by heat dissipation via the cabinet surface and/or by heat transfer means, the exceeding of a maximum permitted functional area temperature is prevented and the dropping below a minimum function area temperature is prevented by heaters.

DE 295 19 260 U1 discloses a weatherproof electronic equipment cabinet for installation in the open and which is at least partly enveloped by a removable cover spaced from the outer faces of the electronic switch cabinet. The thus

formed gap is linked to the external air. In the case of strong insolation, the cover is intended to reduce heating and, at low temperatures, the cooling of the cabinet.

DE-AS 11 35 065 discloses the adjustment of the air supply to the interior of the equipment by means of air openings in the equipment wall, whose cross-section is variable.

DD 212 871 is based on a known arrangement for removing heat from closed cases, in which equipment producing heat losses are arranged in several planes, which contains a heat exchanger constructed as a door, wall or part of a door or wall and through which flows the heated internal air in an internal circuit and cool external air in an external circuit, together with at least two fans, a channel being formed by a cover in the internal circuit. In order to ensure a planned heat removal from subassemblies, the inner space is subdivided by horizontal partitions into separate circuits, which are connected to the heat exchanger and equipped with separate fans.

Even in the case of relatively low internal heat loads, despite a clearly positive difference between the maximum permitted functional area temperature and the maximum external air temperature, in the known cabinets the load removal (cabinet cooling) is only possible through additional technical means, such as e.g. air-air heat transfer means, air-water coolers, refrigerating machines, etc. The fault susceptibility, as well as operational and maintenance costs of such equipment are comparatively high.

It is also disadvantageous that the function area is occupied by said coolers and it is also disadvantageous to have to constructionally adapt the functional area to the requirements of the coolers.

The object of the invention is to so arrange substantially maintenance-free elements with the components which are in any case required for the other equipment cabinet functions in such a way that in particular the "passive cooling" for the operating area is increased compared with known equipment cabinet constructions, whilst reducing maintenance and operating costs and it is also ensured that the functional area is not occupied by coolers.

According to the invention, this object is achieved with the features of claim 1. Advantageous further developments form the subject matter of subclaims 2 to 13.

It is essential to the invention that certain surface areas are so constructed in multishell manner that there is a formation on the inside and outside of channel-like spaces, relative to the functional area wall. Depending on the load situation, said channel-like spaces can be more or less intensively supplied with air or sealed in a substantially airtight manner, so that apart from cooling the functional area, a heat insulation can be obtained. Advantageously the functional area wall is equipped with a rib system, in order to increase its surface area and improve the convective heat transfer.

In the inner, channel-like space, the air flow is produced only by fans and in the outside channel-like space by fans and buoyancy. The air flow is guided by channels in the vicinity of the functional area wall and in the functional area is adapted to the heat loss sources.

The rib system is advantageously constructed in needle or strip form connected in a tight, heat-cunducting manner to the functional area wall. As a function of the particular use, the rib system can project in cantilevered manner into

the channel-like spaces or can be constructively externally connected to the outer jacket or internally to baffle plates. As a result the heat transfer coefficient can be further increased.

Further advantageous developments can be gathered from the subclaims.

The advantage of the inventive solution is that, accompanied by the addition of low maintenance components to the already existing equipment cabinet elements, an arrangement is provided having a "controllable" heat transfer, so that in particular the cooling, but also the heat insulation of the functional area is possible, as a function of the individual case. Energy costs are low for operation and can be covered exclusively or additionally by photovoltaic modules on or in the vicinity of the equipment cabinet. In addition, the functional area is not constricted by coolers and the operative management becomes simpler and less expensive.

The invention is described in greater detail hereinafter relative to an embodiment. Fig. 1 is a view of a longitudinally sectioned construction of an inventive equipment cabinet, the essential elements being represented diagrammatically, in order to particularly stress the multishell structure of certain areas of the envelope construction.

In the embodiment, the sealed functional area wall 2 of a functional area 1 of width B, height H (and depth T), is provided in the region of the two side walls and the rear wall with a rib system 3, 4, exemplified embodiments of the latter being shown in the form of needle ribs 3 and strip ribs 4.

On the functional area side, the fan 8 used for moving the air in the functional area 1 is so connected to baffle plates 11, that the air initially scavenges the electrical equipment in the functional area 1 and in the case of cooling operation removes the power loss from the equipment and then flows along the ribbed functional area wall 2 at a relatively high speed and transfers thermal energy there to the ribbed functional area wall 2. The good heat transfer sought in the wall area in the case of cooling is achieved in that the internal air, driven by the fan 8, necessarily flows through the internal flow channel 6 formed between the baffle plates 11 and functional area wall 2 and in particular when using needle ribs 3 high heat transfer coefficients occur thereon. However, even on the unribbed wall parts between the needle ribs, due to the local turbulence, there is also an increased heat transfer coefficient level, compared with that achieved under otherwise identical conditions on a smooth wall.

In place of separate baffle plates 11, the inside flow channel 6 can at least partly be formed by the side walls of the slide-in modules.

Since for the heat transmission through the functional area wall 2 it is also necessary to have a good heat transfer to the outside, so that in the case of cooling, even with minor temperature differences between the internal and external air, better-than-average high heat flow densities can be achieved, externally in the case of cooling constructional precautions are taken in order to achieve this.

As represented in the embodiment, this is advantageously achieved in that through an outer jacket 5, which spacedly surrounds the ribbed functional area wall zones in such a

way that there is an upper and lower open, external, channel-like space 6' (as on the inside), through which either by thermal buoyancy or driven by fans 8' in the roof area, external air flows from bottom to top. For cooling this external air has a lower temperature than the functional area wall 2 and dissipates most of the power loss.

The fans 8, 8' can be controlled in cooling load-dependent manner.

As in the external air channel in general higher air velocities can be achieved than in the functional area, the rib system can be less high than on the inside.

The heat dissipation in the external air shaft would be reduced by insolation on the outer jacket leading to the outer jacket surface assuming higher temperatures than the air flowing in said shaft. To avoid this, either (as shown in fig. 1) to the outside of the outer jacket 5 are applied shading-acting additional elements 10 (e.g. artificial ivy) or the outer jacket is constructed in double-wall manner, the inner surfaces of the double-wall outer jacket having lower emission coefficients for the radiant energy and the air in the double-wall outer jacket acts as a thermal insulation layer.

In order to obtain static air layers in the outer flow channel 6' for winter operation, the external flow channel 6' can be closed by flaps 7. Other precautions can be taken in place of the flaps 7. They are always operated if a change from cooling to heating or vice versa is required.

A filter 12 is also provided for the external air entering the external channel-like space 6'.

The fans 8, 8' assisting cooling are advantageously supplied by photovoltaically produced electrical energy, because through adaptable variation curves of the electrical power supply and the necessary fan drive capacity control is simplified. Through photovoltaic modules 9 having the size of the roof surface and which are installed in spaced manner and therefore back-ventilated over the cabinet roof, additionally the shading of the roof area is brought about.

LIST OF REFERENCE NUMERALS

1	Functional area
2	Functional area wall
3	Needle rib
4	Strip rib
5	Outer jacket
6	Internal channel-like space
6'	External channel-like space
7	Flap
8/8'	Fan
9	Photovoltaic module
10	Shade-giving additional element
11	Baffle plate
12	Filter

CLAIMS

1. Equipment cabinet for electrical and electronic systems, particularly a switch and control cabinet, with a functional area (1) closed in dustproof and watertight manner and at least one door closing in dustproof and watertight manner,
c h a r a c t e r i z e d in that,
a multishell structure is provided round the functional area (1) and comprises baffle plates (11), a functional area wall (2) and an outer jacket (5), between the baffle plates (11) and functional area wall (2) is formed an internal, channel-like space (6) and between the functional area wall (2) and outer jacket (5) an external, channel-like space (6') and the two channel-like spaces (6, 6') can be supplied by controllable volume flows indepentently of one another in load-dependent manner, the volume flows being adjustable from 0 to a maximun value and the maximum value is determined by the hydraulic resistances of the elements (12, 7, 6') and the characteristics of the fan (8') on the one hand and the hydraulic resistances of the functional area equipment, the internal, channel-like space (6) and the characteristics of the fan (8) on the other hand consequently the heat transfer from the functional area (1) to the exterior is intensified or from the exterior into the functional area (1) can be intensified and/or redcuced.

2. Equipment cabinet according to claim 1,
c h a r a c t e r i z e d in that,
the baffle plates (11) are at least partly formed by the side walls of slide-in modules.

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3. Equipment cabinet according to claims 1 or 2, c h a r a c t e r i z e d in that, the channel-like spaces (6', 6) are flown through by thermal buoyancy and/or separate drive, or static air layers bring about an insulation.

4. Equipment cabinet according to claims 1 to 3, c h a r a c t e r i z e d in that, the functional area wall (2) at least partly has a two-sided rib system (3, 4), which projects into the channel-like spaces (6', 6).

5. Equipment cabinet according to claim 4, c h a r a c t e r i z e d in that, the rib system (3, 4) is constructed in the form of needle and/or strip ribs, the ribs (3, 4) being connected tightly and in heat-conducting manner to the functional area wall (2).

6. Equipment cabinet according to claim 5, c h a r a c t e r i z e d in that, the height of the ribs (3, 4) differs to the outside and inside.

7. Equipment cabinet according to one of the claims 1 to 6, c h a r a c t e r i z e d in that, on the top of the outer jacket (5) and spaced therefrom and/or in the vicinity of the equipment cabinet are provided photovoltaic modules (9), which provide the drive energy for the externally driven convection in either a partial or complete manner.

8. Equipment cabinet according to one of the claims 1 to 7,
c h a r a c t e r i z e d in that,
the outer jacket (5) has a double wall construction, the insides of the double wall outer jacket (5) having a low emission coefficient for the radiant energy.

9. Equipment cabinet according to one of the claims 1 to 8,
c h a r a c t e r i z e d in that,
the outer jacket (5) is provided with shade-giving additional elements (10).

10. Equipment cabinet according to claim 9,
c h a r a c t e r i z e d in that,
the additional elements (10) are natural and/or artificial plants.

11. Equipment cabinet according to claim 1,
c h a r a c t e r i z e d in that,
when the air from the internal, channel-like space (6) enters the functional area (1) it is distributed in such a way that preferably cooling air is supplied to the main loss sources.

12. Equipment cabinet according to claim 11,
c h a r a c t e r i z e d in that,
air entry into the functional area (1) takes place through a perforated plate.

13. Equipment cabinet according to claim 1,
c h a r a c t e r i z e d in that,
the external, channel-like space (6') is supplied with filtered external air.