SIEMENS
Ingenuity for life

Higher ratings through energy-efficient cooling

SIVACON S8 – cubicle in circuit-breaker design and in universal mounting design with forced cooling

Safe and reliable power distribution

Low-voltage switchboards are subject to continuously increasing technical requirements with high demands for personnel and operational safety. This is manifested by a further increase in packing density associated with a high degree of protection for the switchboard and a high form of internal separation. The rated currents in the switchboard increase. As a consequence, the higher operational power loss results in a higher development of heat where more power is required in confined spaces, for example, in incoming feeder cubicles and in the compact withdrawable design.

The higher temperature rise leads to a derating at the installed components and can have an influence on the service life of sensitive electronic devices. Relief is provided by different measures such as enlarged busbar cross-sections.

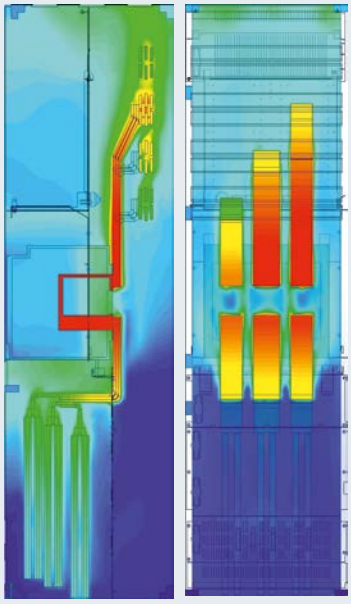
To improve the heat dissipation and cooling, cubicle dimensions can be increased or the degree of protection and the form of internal separation reduced as an alternative. However, these measures no longer satisfy the current demands placed on low-voltage switchboards, which means that higher ratings of the devices must be enabled by means of energy-efficient cooling.

The reliable way to more cost-efficiency

With the feature package SIVACON S8^{plus}, Siemens offers the possibility to equip cubicles of the SIVACON S8 low-voltage switchboard in circuit-breaker design and in universal mounting design with forced cooling. The targeted use of fans will considerably reduce the device derating caused by operational power loss. This allows to increase the rated current without costly expansions or enlargements of the switchboards. Cubicle properties such as a high degree of protection and a high form of internal separation are not restricted thereby.

Your benefit

- Cubicle in circuit-breaker design and in universal mounting design with increased rated current due to forced cooling
- Reduced derating of integrated components
- High operational safety thanks to controlled and monitored cooling system with redundant fans
- Safety for personnel and switchboard by means of tests according to IEC 61439-2
- High personnel and switchboard safety in case of arcing by means of tests under conditions of arcing according to IEC/TR 61641



Temperature rise in circuit-breaker cubicle without forced cooling

Cooling system with fans underneath the 3WL circuit breaker

Innovative solution

SIVACON S8 offers a patented forced cooling technology for cubicles in circuit-breaker design and in universal mounting design. The system was designed and optimised by Computational Fluid Dynamics (CFD) simulation, and was confirmed by numerous design verifications according to IEC 61439-2. It reduces the derating and provides a low temperature profile inside a cubicle to ensure safe and long life operation of sensitive electronic equipment. The control system monitors the temperature at critical spots, ensuring energy-efficient cooling at any time. To increase the service life of the fans, these are speed-controlled according to the temperature development. Moreover, the system has been designed redundantly.

Technical features

- Optimally dimensioned cooling system
- Effective cooling directly at the required positions
- Three or four temperature-controlled, variable-speed fans
- Factory-set control, no further settings required
- Degree of protection possible up to IP54
- Internal separation possible up to form 4
- No restrictions for installation of devices
- No space restrictions in the connection compartment
- Safety for personnel and switchboard by means of tests according to IEC 61439-2
- High level of safety for personnel and switchboard in case of arcing thanks to testing under conditions of arcing in accordance with IEC/TR 61641

Functional principle

- Cooling of the limiting measuring points determined in temperature-rise tests
- Improved heat dissipation thanks to additional heat sinks and a boosted, directional airflow using fans and air ducts (forced convection)

Security of operation

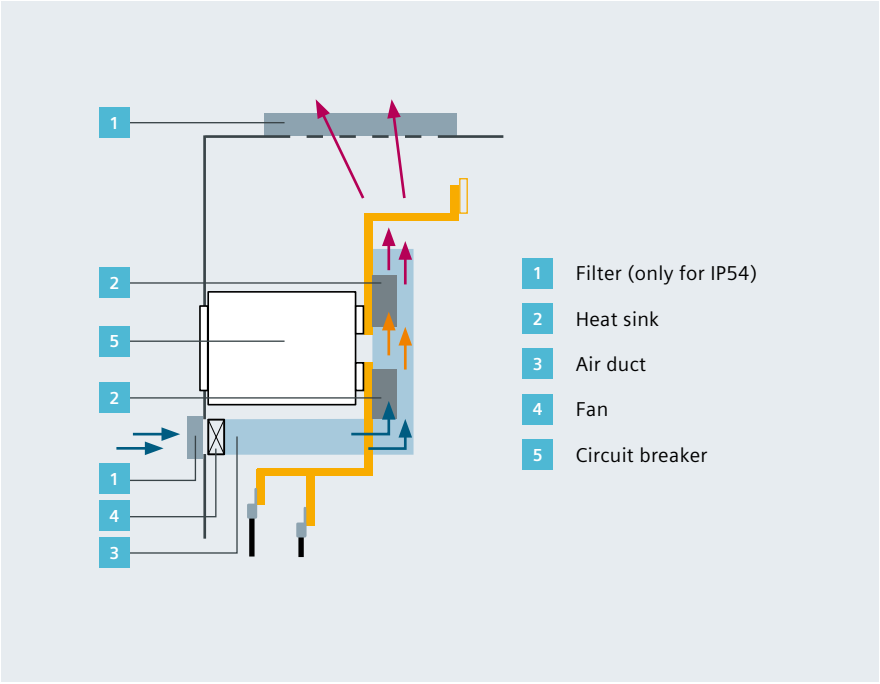
- Three or four controlled, monitored fans
- Redundant safety concept
- Failure of one fan has no effect on the rated current of the cubicle
- Emergency operation is possible should the complete cooling system fail
- An alarm is output when a fan fails and/or if an impermissible temperature rise occurs
- Factory-set fan control without further settings (incorrect parameterisation impossible)
- Control voltage from power system (failure only possible with interruption in line voltage)
- Use of long-life quality fans
- Temperature-controlled low fan speed increases the service life

Maintenance

All measures are incorporated in the maintenance concept for the switchboard. For checking and cleaning of fans and filter pads:

- No change required regarding inspection intervals
- Easy accessibility for maintenance and repair
- Fan replacement possible during operation
- Spare parts available

Other components of the cooling system are maintenance-free.



Forced cooling for circuit-breaker design

Your advantages

Reduction in derating

As a result of forced cooling with fans, the rated current of cubicles in circuit-breaker design and in universal mounting design can be increased. This is possible without additional costs for larger busbar cross-sections or a circuit breaker with a larger type of construction in the cubicle in circuit-breaker design. Further demands placed on the switchboard such as a high degree of protection or a high form of internal separation are not restricted by the forced cooling. The low temperature profile inside a MCC enables safe and long-life operation of sensitive electronic equipment.

Safety thanks to redundant cooling system

The monitored cooling system of redundant design provides high operational safety. Cubicles with forced cooling in circuit-breaker design and in universal mounting design are completely integrated into the SIVACON S8 low-voltage switchboard. Design verifications with tests in accordance with IEC 61439-2 and testing under conditions of arcing in accordance with IEC/TR 61641 provide a high level of safety for personnel and switchboard.

Safe and user-friendly

For high personnel safety, in the case of the 3WL air circuit breaker in withdrawable design, moving to the connected, test, or disconnected position takes place with the door closed. The cubicle dimensions are tailored to the size of the circuit breakers. The circuit-breaker design provides optimum connection conditions for every rated current range. As an alternative to cable connections, the system also includes design verified connections to the SIVACON 8PS busbar trunking systems. The busbar trunking system connection units, specially developed for SIVACON S8, are an integral component of the cubicles in circuit-breaker design. Withdrawable units of all sizes in universal mounting design are equipped with integrated operating error protection and a uniform, clear indication of the withdrawable unit positions. Here, moving to the test, disconnected, or connected position also takes place with the door closed and without eliminating the degree of protection.

High personnel and switchboard safety

Requirement of the IEC 61439 standard

Low-voltage switchboards, defined in the standard as “power switchgear and controlgear assemblies”, are developed, manufactured, and tested following the specifications of IEC 61439-2. In order to provide evidence that the switchboard is fit for purpose, this standard requires two main forms of verification – design verifications and routine verifications:

- Design verifications are tests carried out during the development process and are the responsibility of the original manufacturer (developer).
- Routine verifications must be performed by the manufacturer of the power switchgear and controlgear assembly on every manufactured switchboard prior to delivery.

Verification of temperature rise

One of the most important verifications according to IEC 61439-2 is the “verification of temperature rise”. Thereby it is verified that the switchboard is fit for purpose when the temperature rises due to operational power loss. In view of the ever increasing rated currents, together with higher requirements relating to the degree of protection and internal separation, this is one of the greatest challenges for the switchboards. According to the standard, this verification can be performed by calculation up to a rated current of 1,600 A. In SIVACON S8 low-voltage switchboards, the verification is always done with tests.

Rules governing the selection of the test specimens (worst-case test), as well as the testing of complete switchgear and controlgear assemblies, ensure that the entire product range is systematically covered and that this verification always includes the devices. Tests on randomly selected specimens is just as insufficient as the replacement of a device without retesting.

Design verification with tests

The SIVACON S8 low-voltage switchboard offers safety for personnel and switchboard by means of design verification with tests according to IEC 61439-2. The physical properties are dimensioned at the testing laboratory for both operation and failure situations, thus leading to a high level of safety for personnel and switchboard. Design verifications as well as routine verifications are a decisive part of quality assurance, and the prerequisite for CE marking according to the EU directives and laws.

Testing under conditions of arcing

An arc is one of the most dangerous faults, associated with the most serious consequences, which can occur inside a switchboard. It can also damage adjacent feeders, cubicles, or the entire switchboard. Arcing can be caused by incorrect dimensioning and reductions in insulation due to pollution, etc., but it can also be the result of handling errors. The high pressure and extremely high temperatures caused by the arc can have serious consequences for the operator and the switchboard, and even for the building. Testing of low-voltage switchboards under conditions of arcing is a special test in accordance with IEC/TR 61641. SIVACON S8 offers the verification of personnel safety by testing under conditions of arcing.

Additional measure for increased safety

Furthermore, SIVACON S8 can also be equipped with an active protection system against internal arcing comprising an arc detection system, a quenching device, and sensors. For this purpose, optical sensors are installed, whose signals are assessed in an evaluation unit in combination with a current detection system. If an internal arc is detected, this evaluation unit activates a quenching device which extinguishes the arc within a few milliseconds. The system limits the arcing time, the pressure wave, and the temperature rise significantly, which minimises damages to the switchboard and reduces downtimes. With SIVACON S8, Siemens offers an innovative solution that can be used several times without replacing components. Thus, the switchboard remains fully protected after an internal arcing event without the need of replacement measures.

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