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Presentation

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Thermal management system

Thermal problems in enclosures Evolution of the electrical switchboard

An electrical switchboard is an assembly formed of the following components: The enclosure;

- Switchgear and controlgear;
- Electrical conductors; and
- Miscellaneous functions (indications, controls, information processing).
- It has evolved in three directions: Enclosures increasingly made of insulating materials:
- Switchgear and controlgear incorporating more and more electronics which
- concentrates a growing number of functions in an increasingly small volume;
- An increasingly high filling rate.

Industrial safety studies, a concept which covers:

- The safety of personnel and equipment;
- The availability of electric power;

show that this is one of the critical points of all industrial and service-sector activities. Its operation must therefore be perfectly under control; and this control must concern not only the operation of its components but also their operating conditions in a given environment.

Temperature and humidity in the enclosure

Analysis of the malfunctions and stoppages of an electrical installation shows that they are mostly of thermal origin: temperature too high or too low inside the enclosure.

The rise in the average temperature, which may exceed the limits tolerated by the equipment, can be explained by the changes in electrical switchboards:

- Use of insulating materials for the enclosure, which limits heat removal;
- -Widespread adoption of electronics and a higher filling rate increase the temperature.

This overheating may concern only certain areas: hot spots.

The excessively low temperature is due to installation of the electrical switchboard in a very cold environment. It can cause the formation of condensation, a phenomenon which is harmful for the equipment.

Consequences

The presence of humidity or an excessively high temperature inside the enclosure can cause numerous malfunctions:

- Nuisance tripping of protective devices;
- Fire inside the enclosure;
- Burns for the users;
- Premature equipment ageing;

The consequence of these malfunctions is an increase in the installation's operating costs:

- Maintenance costs,
- Costs entailed by stoppage of the installation.

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Solution: thermal management

Objective

The thermal management solution adopted shall:

■ Maintain the temperature and the humidity level inside the enclosure at values

- corresponding to normal operation of the equipment.Establish a uniform temperature to prevent hot spots.
 - Establish a uniform temperature to prevent not s

Choice of solution

The products constituting the thermal management solution are chosen by producing the thermal balance of the installation. This comprises 2 parts:

Thermal balance inside the enclosure;

■ Evaluation of the climatic conditions (temperature, humidity level) or environmental conditions (pollution) of the place in which the electrical switchboard is located.

The Schneider Electric solutions

With the ClimaSys range Schneider Electric proposes a comprehensive offer meeting all needs:

- Cooling
- Heating
- Regulating
- Homogenizing

Schneider Electric also proposes a thermal design software program, ProClima, which produces the thermal balance and proposes one or more thermal management solutions.



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Thermal management system Solutions overview



	Homogenize	Cool			
Solution	Stirring	Natural ventilation	Forced ventilation	Air-air exchanger	
Description	Stirring fan inside the enclosure.	Air circulation achieved by installing grids (side or roof-mounted) with or without filter, or by elevating the roof.	A fan (with or without filter) sucks fresh air from outside to inside the enclosure, thereby creating a slight overpressure which causes removal of the hot air through an outlet grid. The air circulation homogenizes the temperature and the overpressure prevents dust from entering. Side or roof mounting. Can be combined with a thermostat.	Cooling system provided with an aluminum exchange coil to separate the internal and external air circuits, two centrifugal fans to blow in the air circuits, and a thermostat to regulate the temperature in the enclosure. Side or roof mounting.	•
Use	Prevent hot spots.	Low power to be dissipated. Dusty environment.	High power to be dissipated. Dusty and non- hazardous environment. Prevent hot spots.	Medium power to be dissipated. Corrosive environment (food processing industry). Relatively cold environment (about 25°C).	
Temperature conditions *	None	Td > Ta + 5℃	Td > Ta + 5°C 3°C < Ta ≤ 35°C	Td > Ta + 5°C	÷
Independent internal and external air circuits?	No	No	No	Yes	
Advantages	Uniform temperature inside the enclosure.	 Very economical solution No maintenance Easy, fast installation. 	 Economical solution Easy maintenance Easy, fast installation Uniform temperature inside the enclosure Guaranteed level of protection: IP55 (IP54 for roof models). 	 Easy maintenance (no filter) Far lower maintenance frequency than for fans IP55 guaranteed. 	
Disadvantages		 Low power dissipated Reduction in the degree of protection IP Risk of ingress of particles and dust if no filter. 	 Internal temperature always higher than the external temperature Maintenance required: change of filters. 	 Internal temperature always higher than the external temperature. 	
Illustration		8			
	A6-1001094	Outlet grids	Fans	e Buschangers	
		Outlet yrius	1 0113		

*Ta = ambient temperature (outside the enclosure) Td = desired temperature inside the enclosure

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Thermal management system Solutions overview

DB30040-24	DB30451-47	DB30042.40	
Cool		Hoat	
	Capling unit		
All-water exchanger Cooling system provided with an exchange coil supplied with cold water and separated from the internal air circuit, a centrifugal fan for the air circuit, and a thermostat to regulate the temperature in the enclosure. Side or roof mounting.	Operates like a heat pump: A condenser removes to the ambient air the calories absorbed by an evaporator. The air inside the enclosure is thus cooled and dried. Side, floor or roof mounting.	The heating resistors prevent the formation of condensation and ensure an ideal temperature inside the enclosure.	
Large quantity of heat to be removed. Difficult environments (cement plant, production lines, greasy workshops, etc.) or humid environments (sewage plant, bottling factory, etc.). Do not discharge calories into the environment.	Highly polluted environment but which permits the use of a filter for external protection of the cooling unit. Do not use ambient air in the cooling circuit.	To heat the inside of the enclosure and prevent condensation.	
Ta > Td	Ta > Td and Ta ≤ 55°C	Ta < Td	
Yes	Yes	-	
 Internal temperature independent of the external temperature Security system against any leaks Calories dissipated outside Guaranteed level of protection: IP55 (IP54 for roof models). 	 Internal temperature independent of the external temperature Uniform temperature inside the enclosure. Guaranteed level of protection: IP54 for roof and floor models, IP55 for side models and the SLIM range Use of an ecological gas. 	 Small size (1.6 mm thick for the ultra-thin version) Low surface temperature (< 70°C for insulated version, 75°C for aluminum version) Uniform temperature inside the enclosure with the version equipped with a fan. 	
 There must be a cold water circuit of stable temperature and flow rate Installation of special piping. 	 Installation of a system from removal of condensation water from the evaporator Maintenance required: change of filters. 		
91-90900984 Air-water exchangers	Cooling units	4 - 450 Heating resistors	