Ambient temperature

Maximum permissible ambient temperature for relays
Our relays are designed for a maximum ambient temperature of +55 °C at 110% of rated voltage.

The permissible ambient temperature stated for a relay means the average temperature surrounding the relay itself and not the temperature in the control room where the cubicle or panel with relays is located. If the relays are mounted in cubicles, cases, or other sealed enclosures, consideration must be given to the increase in temperature which is obtained depending on the power losses of the equipment.

Permissible temperature increases
The maximum permissible ambient temperature for relays mounted in a case or cubicle is less than the specified +55 °C depending on the temperature rise in the case and cubicle. Allowance must be made for this in the design of control rooms. In the limit, the temperature rise for the "room" ambient temperature to the "relay" ambient temperature could be 15 °C if the maximum permissible power losses given in Table 2 are applicable. In general the actual power losses will be less than the maximum permissible values and the temperature rise will be less than 15 °C. In the limit, the maximum permissible "room" ambient temperatures corresponding to +55 °C "relay" ambient temperatures could be +40 °C.

If the room temperature is higher it is necessary to keep the increase lower than 15 °C. This can be achieved by dividing the relaying equipment in several cubicles or cases to reduce the supplied power per cubicle or case to less than that specified in the tables or by improving the cooling through increased natural ventilation or by forced ventilation using a fan.

The total power losses of the relays incorporated in a case or cubicle are usually too low to cause 15 °C temperature increase. However, there are two situations when it is necessary to observe the total power losses and rearrange the relaying equipment and if necessary, reduce the total losses per frame or cubicle.

The first case is when the auxiliary voltage supply is 220 or 250 V dc for more than three of some types of static relays, for example, RXIG 2, RXEG 2 or RXPE 4, positioned in the same equipment frame or in equipment frames mounted close to each other. It is not possible to fill all positions in a cubicle or a rack or otherwise pack the above relays too closely and stay within the 15 °C rise in the air surrounding the relay.

The other situation concerns auxiliary relays. There is a limit of the number of continuously energized auxiliary relays that may be included in an RHGX case or equipment frame and still stay within the 15 °C rise. For example, in an application of continuously energized interposing relays. Note that the emphasis is on "continuous energized" relays. The temperature rise rather that the physical space may limit the number of relays in a case of frame.

Permissible power losses

Permissible power losses of relays in cases type RHGX and type RHGS
Consideration must be given to how the case is mounted when defining the permissible power losses. When a case, for example, is flush-mounted in the front of a cubicle, it is necessary to add the temperature increase of the air of the cubicle to that temperature increase that is calculated to be within the case to obtain the total temperature increase in the case relative to the room temperature.

Permissible power losses of relaying equipment in cubicles
Table 2 states recommended values of permissible power losses of relaying equipment mounted in the D-plane (the hinged frame) and the B-plane (the rear mounting plane).

Relays are not recommended to be mounted in the B-plane as the air circulation is minimal. It is recommended to mount only transformers, resistors and similar apparatuses in the B-plane.

Temperature rise

Calculation of temperature rise within RHGX and RHGS case flush mounted in a cubicle

$$\theta_{relay} = K_H \times P_H + K_S \times P_S$$

where

θ_{relay} = the increase of the ambient temperature of the relay

K_H = the RHGX case thermal resistance

P_H = The total power losses of the relays in the case

K_S = the thermal resistance of the cubicle (for cubicles acc. to Table 2)

P_S = the total power losses in the cubicle

Table 1: Permissible power losses for 15 °C temperature increase in RHGX and RHGS cases

Case type	K_H °C/W	W

Table 2: Permissible power losses in a cubicle type VSH 200 (700 mm) for maximum 15° C temperature increase in the relay ambient

Cubicle location	Code	Cubicle design	Permissible power losses				Thermal resistance of the cubicle
			Equipment[1] frames above and underneath each other	Equipment[1] frames with 4S space between each frame	Totally in the cubicle		K_S
			W/4S-equipment frame		W/cubicle	Example of cubicle locations	°C/W
Freestanding cubicle	A1	Sealed cubicle	17	28	170	170 W	0,09
	A2	Tropical [3]					
	A3	Ventilated [5]	25	40	250	170 W	0,06
Mounted at the side of **one** cubicle with approx. the same power losses [4]	B1	Sealed cubicle	13	21	130	130 W | 130 W	0,12
	B2	Tropical [3] design					
	B3	Ventilated [5]	22	35	220	220 W | 220 W	0,07
Several cubicles located in a row with max. permissible power losses.	C1	Sealed cubicle	11	17	110	130 W | 110 W | 110 W | 130 W	0,14
	C2	Tropical [3] design					
	C3	Ventilated [5]	20	30	200	220 W | 200 W | 220 W	0,08

1) Refers to several similar equipment frames with regard to power losses and with the power distributed over the complete equipment frame

2) Also applicable for equipment frames mounted close to each other if every alternate equipment frame has a low continuous power loss (approximately 5 W). It is desirable to mount the equipment frames in the cubicles with the maximum possible space between to ensure the best possible heat dissipation.

3) The heater should be disconnected by a thermostat at maximum 45° C.

4) Is also applicable for locations where the cubicle are located back-to-back or close to a wall (with approximately a 50 mm distance between the back of the cubicle and the wall).

5) Self-ventilated design according to Fig. 1

Self-ventilated design of the cubicle

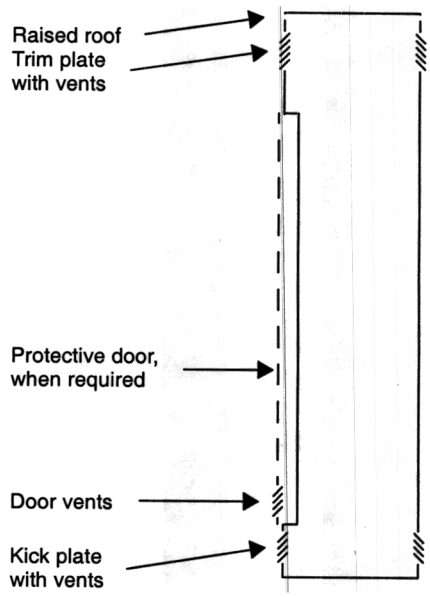

Fig. 1 Self-ventilated design of the cubicle

Raised roof:
The roof plate is raised 20 mm to provide an outlet for heated air.

Trim plate with vents:
Provides an outlet for heated air.

Protective door when required.

Kick plate with vents:
Provides cool air for the rear mounting plane (B).

Table 2 is applicable for convection in sealed cubicles or self-ventilated cubicles with designs according to Fig. 1. When the power losses are approximately evenly distributed in the equipment frames, the temperature increase will not exceed 15 °C.

Sources of maximum heat loss such as power supplies for static relays and continuously energized auxiliary relays should preferably not be located in close to each other but with the maximum possible spacing to ensure the lowest temperature in their surrounding air.

The equipment frames containing relays with the highest power losses should preferably be positioned as low as possible in the cubicle.

The temperature increase should be calculated when designing the layout of a relaying equipment. This is done by adding the power losses at rated voltage for all the relays in the cubicle that are simultaneously energized including auxiliary relays, and comparing the calculated values with those in Table 2. It is normally sufficient to calculate with only the power losses of the auxiliary voltage supply for static and numerical relays and ignore the losses of the signal circuits.

The power losses in Table 2 shall be calculated on the basis of the losses at 100% of rated voltage, as obtained from the technical data tables. The temperature rise of 15° C has, however, been based on the relays operating at their maximum permissive voltage. For relays operating at their rated voltage the permitted losses in Table 2 will result in a temperature rise less than the specified.

References

Relay and control cubicles type VSH 200	1MRK 514 002-BEN
Cases type RHGX	1MRK 513 003-BEN
Cases type RHGS	1MRK 513 003-BEN

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