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TECHNICAL REPORT

RAPPORT TECHNIQUE

AMENDMENT 1
AMENDEMENT 1

Guidance concerning the permissible temperature rise for parts of electrical equipment, in particular for terminals

Guide concernant l'échauffement admissible des parties des matériels électriques, en particulier les bornes de raccordement

IEC/TR 60943:1998/A1:2008

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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FOREWORD

This amendment has been prepared by IEC technical committee 32: Fuses.

The text of this amendment is based on the following documents:

DTR	Report on voting
32/187/DTR	32/188/RVC

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition; or
- amended.

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Replace the existing Table 6 with the following new table:

Table 6 – Typical values of temperature rise and temperature limits*

Description of component			Column A Maximum temperature rise K[u] (Θ_{an} = 20 °C)	Column B Maximum temperature °C (Θ_{an} = 40 °C)	Remarks
Nature of contact [a, c, e]	Spring contacts	Copper and copper alloys uncoated			
		– in OG [t]	35[p]		
		– in NOG[t]	75[q]		
		– in oil	40		
		Tinned in OG, NOG[t], oil[b e]	50		
		Silver- [b, s] or nickel-plated [b]			
		– in OG[t]or NOG[t]	75[q]		
		– in oil	50		
		For contactors, in oil		105	Deterioration of the oil
	Bolted connections	Copper, aluminium, and their alloys, uncoated			
		– in OG[t]	60[q]		
		– in NOG[t]	75[q]		
		Tinned[b] in OG or NOG[t],		105	Creep point of tin
		Silver- [b, s] or nickel-plated [b]			
		– in OG or NOG[t]	75[q]		
		– in oil		100	Deterioration of the oil
		For contactors, in oil		105	Deterioration of the oil
	Terminals [d, f,r]	To be connected to exterior conductors by screws or bolts			
		Uncoated	60[q]		
		Tinned [b]		105	Creep point of tin
		Silver- or nickel-plated [b]	75[q]		
	Other contact materials			[g, h]	
Metallic parts	In contact with	Insulation class [i]:			Ageing of insulation
		Y		90	
		A		105	
		E		120	
		B		130	
		F		155	
		H		180	
		enamel: oil base		100	
		synthetic		120	
		acting as springs at position of a tin soldering		[j]	Permanent deterioration
				100 [k]	Breaking
Oil for oil-immersed switchgear[l, m]				90	Deterioration of the oil
All parts which are metallic or of insulating material in contact with oil, except for contacts [m]				100	
Electric motors and resistance			[n]		
Surfaces[o]	Manual control components				IEC 60364-4-42 :1980
	– metallic			55	
	– non-metallic			65	
	Expected to be touched in normal operation but not to be held continuously in the hand				
	– metallic			70	
	– non metallic			80	
	Accessible, but not designed to be touched in normal operation				
	– metallic			80	
	– non metallic			90	

* For notes, see following page.

NOTES

a For connection units in vacuum, the limit values of temperature and temperature rise do not apply to the components in the vacuum. The other components must not exceed the temperature and temperature rise values given in Table 6. Maximum acceptable temperature rises in NOG[t] are the same for silver-plated or nickel-plated copper as for bare copper, because of the absence of oxygen.

b The following are considered as silver contacts: solid silver contacts, contacts with inlaid silver strips, silver-plated contacts. In general, for all plated metals, the quality of the plating must be such that a protective layer remains in the contact zone:

1) after the making and breaking tests (if any);

2) after the permissible short period current test;

3) after mechanical test,

in accordance with the correct specification for each material. If not, the contact must be considered as “bare”.

For nickel-plated contacts, the contact resistance and contact life will be equivalent to those of silver if the temperature rise is kept within the prescribed limits. This can be achieved by higher contact forces, for example.

c When engaging parts have different coatings, or one part is of bare metal, the permissible temperatures and temperature rises shall be:

1) for spring-contacts, those of the surface material having the lowest value permitted in Table 6;

2) for bolted connections, those of the surface material having the highest value permitted in Table 6.

d Values of the tightening torque for screws are given in the appropriate product standard, for example Table IV of IEC 60947-1:1988.

e For fuses, the temperature rise to be considered can be increased to take into account the proportion of heat from the fuse element transmitted by conduction to the contacts. Refer to the appropriate specifications for these components.

f The temperature and temperature rise values are valid even if the conductor connected to the terminals is not protected by a covering.

g When materials other than those shown in Table 6 are used, their properties shall be taken into consideration.

h Limited by the necessity of not damaging surrounding parts.

i The classification of insulation is given in IEC 60085:1984.

j Temperature shall not reach such a value that the elasticity of the material is reduced.

k This applies when soldering is the main method of joining the two parts; otherwise, this limit may be increased to 110 °C.

l The measurement must be made in the upper part of the oil.

m It is recommended that particular attention be paid to questions of vaporisation and oxidation when using oil with a low flash-point.

n Regulations in force.

o For manual control components located inside enclosures which are accessible upon opening the enclosure, and which are not used frequently, higher temperatures may be allowed.

The distinction between metallic and non-metallic surfaces depends on the thermal conductivity of the surface. Coats of paint and varnish are not considered to modify the thermal conductivity of the surface. On the other hand, certain plastic coatings can noticeably reduce the thermal conductivity of a metallic surface and allow it to be considered as non-metallic.

This rule does not apply to materials which comply with standards which state that the temperature or temperature-rise limits for accessible surfaces are fixed.

p This limit can be increased to:

45 K – for low voltage supply equipment downstream from meter boxes or rising mains;

– for contactors operating on continuous service.

65 K – for contactors operating on 8 h, intermittent or temporary service, where conditions of use are those permitted in the appropriate product standards.

q Limited by the necessity of causing no damage to adjacent parts and in particular to the insulation in contact.

r For terminals intended for connection to insulated conductors, see 5.3.2.

s For some low-voltage industrial equipment, the temperature rise is limited only by the need not to damage surrounding parts.

t NOG = Not oxidizing gas; OG = Oxidizing gas.

u Higher values can be admitted, respecting in any case Note q, if:

– products standards admit higher values,

or

– manufacturers can prove a correct long term ageing behaviour of the contacts. In this case, agreement on the acceptable values should be reached between the user and the manufacturer.

AVANT-PROPOS

Le présent amendement a été établi par le comité d'études 32 de la CEI: Coupe-circuit à fusibles.

Le texte de cet amendement est issu des documents suivants:

Projet d'enquête	Rapport de vote
32/187/DTR	32/188/RVC

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cet amendement.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de maintenance indiquée sur le site web de la CEI sous «http://webstore.iec.ch» dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite;
- supprimée;
- remplacée par une édition révisée; ou
- amendée.

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Remplacer le Tableau 6 existant par le nouveau tableau suivant:

Tableau 6 – Valeurs types de limites d'échauffement et de température*

Désignation de l'organe			Colonne A Echauffement maximal K^u (Θ_{an} = 20 °C)	Colonne B Température maximale °C (Θ_{an} = 40 °C)	Remarques
Nature du contact [a, c, e]	Contacts élastiques	Cuivre et alliage de cuivre, nus			
		– dans GO[t]	35[p]		
		– dans le GNO[t]	75[q]		
		– dans l'huile	40		
		Etamés dans, GO, GNO[t], l'huile[b e]	50		
		Argentés [b, s] ou nickelés [b]			
		– dans GO [t] ou GNO [t]	75[q]		
		– dans l'huile	50		
		Pour contacteurs, dans l'huile		105	Dégradation de l'huile
	Connexions boulonnées	Cuivre, aluminium et leurs alliages, nus			
		– dans GO[t]	60[q]		
		– dans GNO[t]	75[q]		
		Etamés[b] dans GO ou GNO[t],		105	Fluage de l'étain
		Argentés[b s] ou nickelés [b]			
		– dans GO ou GNO[t]	75[q]		
		– dans l'huile		100	Dégradation de l'huile
		Pour contacteurs, dans l'huile		105	Dégradation de l'huile
	Bornes [d, f, r]	Destinées à être raccordées à des conducteurs extérieurs au moyen de vis ou de boulons,			
		Nues	60[q]		
		Etamées [b]		105	Fluage de l'étain
		Argentées ou nickelées [b]	75[q]		
	Autres matériaux de contact			[g, h]	
Pièces métalliques	En contact avec	Les isolations de la classe [i]:			Vieillissement des isolants
		Y		90	
		A		105	
		E		120	
		B		130	
		F		155	
		H		180	
		émail: à base d'huile		100	
		synthétique		120	
		formant ressort à l'endroit d'une		[j]	Fléchissement permanent
		soudure à l'étain		100 [k]	Rupture
Huile pour appareillage dans l'huile [l, m]				90	Dégradation de l'huile
Toute pièce métallique ou en en matériau isolant en contact avec l'huile, à l'exception des contacts [m]				100	
Moteurs électriques et résistances			[n]		
Surfaces[o]	Des organes de commande manuels:				CEI 60364-4-42 :1980
	– métalliques			55	
	– non métalliques			65	
	Prévues pour être touchées en service normal mais non destinées à être tenues à la main de façon continue:				
	– métalliques			70	
	– non métalliques			80	
	Accessibles mais non destinées à être touchées en service normal:				
	– métalliques			80	
	– non métalliques			90	

* Pour les notes, voir page suivante.