



Commentary on IEE Wiring Regulations

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Introduction to amendment to 6.1.3

The recent interest shown in the section on ageing of cables has shown that engineers are interested in this rather non specific aspect of installation design and prompted the provision of a little more information and a specific reference.

6.1.3 Ageing of cables 131-06, 433-01

Estimating the life of a cable can only be approximate because of the obvious difficulties in accumulating data. There is a general understanding that p.v.c. cables with a continuous conductor operating temperature of 70 °C have a life of 20 years. There is also a rough guide that for each 8 °C increase in core conductor continuous operating temperature above 70 °C the life of the cable will be halved. A p.v.c. cable running with an overload such that its core conductor temperature is 78 °C will last for 10 years.

The general equation for ageing is:

$$\text{Log}_e t = \frac{A}{T} + A^1$$

where:

t = time in hours

T = absolute temperature K (273 + °C)

A = a constant 15 028 for PVC, 14 500 for EPR and PRC

A^1 = a constant -31.6 for PVC, -27.19 for EPR and PRC

Table 6 provides further guidance.

Life termination is assumed to be on the appearance of cracks on samples of cables wound on their own diameter.



TABLE 6 Life until deterioration against conductor core temperature

Life until deterioration ¹				
Material	PVC		EPR and PRC ⁵	
Temperature (°C) ²	Permanent Rating ³	Normal Rating ⁴	Permanent Rating ³	Normal Rating ⁴
70	23 yrs	69 yrs		
75	12 yrs	37 yrs		
80	7 yrs	20 yrs		
85	4 yrs	11 yrs	69 yrs	
90	2 yrs	6 yrs	39 yrs	
95	14 mths	43 mths	23 yrs	69 yrs
100	8 mths	25 mths	13 yrs	40 yrs
105	5 mths	15 mths	8 yrs	24 yrs
110	3 mths	9 mths	5 yrs	15 yrs
115	2 mths	5 mths	3 yrs	9 yrs
120			23 mths	69 mths
125			14 mths	43 mths
130			9 mths	27 mths
135			6 mths	18 mths
140			4 mths	12 mths
Temperature indices: Duration 5000 h	101 °C		133 °C	
Duration 20000 h	89 °C		118 °C	

Notes: 1. The values indicated are only orders of magnitude due to the different types of materials and the great dispersion of the complex ageing phenomena of these materials.

2 The temperature referred to is that of the cable conductor resulting from the ambient temperature and its own temperature rise.

3 Permanent rating – load/temperature maintained 24 hours a day

4 Normal rating – load/temperature maintained 8 hours a day

5 PVC-polyvinyl chloride, EPR-ethylene/propylene rubber, PRC - chemically reticulated polyethylene.

From IEC 943, 1989

Cable loadings are rarely constant, estimates can be made of the combined affects of different loadings by the use of the formulae below:

$$\frac{1}{L} = \frac{1}{24} \left\{ \frac{a}{L^1} + \frac{b}{L^2} + \frac{c}{L^3} \right\} \quad \text{where:}$$

L^1, L^2 and L^3 = lives at specific temperature
 a, b, c , etc. = hours in day at these temperatures

Bibliography

Chapter 6

IEC 943: Guide for the specification of permissible temperature and temperature rise for parts of electrical equipment, on particular for terminals