
Vplivi električnega toka na ljudi, živali in ptice 3. del: Vplivi tokov, ki tečejo skozi telo živali

Effects of current on human beings and livestock - Part 3: Effects of currents passing through the body of livestock

PREVIEW

Effets du courant sur l'homme et les animaux domestiques - Partie 3: Effets de courant passant par le corps d'animaux domestiques

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Part 3: Effects of currents passing through the body of livestock

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EFFECTS OF CURRENT ON HUMAN BEINGS AND LIVESTOCK –

Part 3: Effects of currents passing through the body of livestock

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but no immediate possibility of an agreement on an International Standard;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

Technical reports of types 1 and 2 are subject to review within three years of publication to decide whether they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

IEC 60479-3, which is a technical report of type 2, has been prepared by IEC technical committee 64: Electrical installations of buildings.

The text of this technical report is based on the following documents:

Committee draft	Report on voting
64/937/CDV	64/994/RVC

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

IEC 60479 consists of the following parts under the general title *Effects of current on human beings and livestock*

- Part 1:1994, General aspects;
- Part 2:1987, Special aspects – Chapter 4: Effects of alternating current with frequencies above 100 Hz – Chapter 5: Effects of special waveforms of current – Chapter 6: Effects of unidirectional single impulse currents of short duration;
- Part 3: Effects of currents passing through the bodies of livestock.

This document is issued in the type 2 technical report series of publications (according to G.3.2.2 of part 1 of the *ISO/IEC Directives*) as a "Prospective standard for provisional application" in the field of electrical installations of buildings (and the effects of current on human beings and livestock) because there is an urgent requirement for guidance on how standards of this format should be used to meet an identified need.

This technical report is not to be regarded as an "International Standard". It is proposed for provisional application so that information and experience of its use in practice may be gathered. Comments on the content of this document should be sent to the IEC Central Office.

A review of this type 2 technical report will be carried out not later than three years after its publication, with the options of either extension for a further three years or conversion to an International Standard or withdrawal.

This technical report has the status of a basic safety publication in accordance with *IEC Guide 104*.

INTRODUCTION

This technical report provides basic guidance on the effects of electric currents on livestock and is for use in the establishment of electrical safety requirements.

There are, however, other aspects to be taken into account, such as probability of faults, probability of contact with live or faulty parts, touch voltage, fault voltage, experience gained, technical feasibility and economics. These parameters need to be considered carefully when fixing safety requirements, for example operating characteristics of protective devices for electrical installations.

For protection against indirect contact of livestock, the threshold of ventricular fibrillation is the criterion on which safety requirements should be fixed. For this reason, information is presented in this part of IEC 60479 on the body impedance of livestock and on the current magnitude of the threshold of ventricular fibrillation. As there is only little information on the impedance of animals, the lowest impedance value for cattle, forelegs to hindlegs (see table 2), has been used as the basis for calculation.

For the purpose of this report the following species of animals are considered to be livestock which might in rural installations suffer from an electric shock: cattle, sheep, pigs and horses.

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EFFECTS OF CURRENT ON HUMAN BEINGS AND LIVESTOCK –

Part 3: Effects of currents passing through the body of livestock

1 General

1.1 Scope

This technical report indicates values for the electrical impedance of the body of livestock as a function of the touch voltage, the degree of moisture of the hide or skin and the current path.

At this time values are only available for cattle.

It describes the effects of sinusoidal alternating current within the frequency range from 15 Hz to 100 Hz passing through the body of livestock.

NOTE – Unless otherwise specified, the current values defined in this technical report are r.m.s. values.

1.2 General remarks

For a given current path through the body, the danger depends mainly on the magnitude and duration of the current flow. However, the time/current relations specified in clause 5 are, in many cases, not directly applicable in practice for designing protection against electric shock. The necessary criterion is the admissible limit of touch voltage (i.e. the product of the current through the body and the body impedance) as a function of time. The relationship between current and voltage is not linear because the impedance of the body of livestock varies with the touch voltage, and data on this relationship is accordingly required.

The different parts of the body of livestock (such as the hide, skin, blood, muscles, other tissues and joints) present to the electric current an impedance composed of resistive and capacitive components. The dry hides in particular, in the range of voltages up to several hundred volts, frequently present a high resistance.

The value of these impedances depends on a number of factors, in particular the species of the animal, the current path, the touch voltage, the duration of current flow, the frequency, the degree of moisture of the hide and/or the skin, the surface area of contact, the pressure exerted and the temperature.

The impedance values indicated in this report result from close examination of the experimental results available from measurements carried out principally on living animals.

Clause 5 is primarily based on the findings related to the effects of current at frequencies of 50 Hz or 60 Hz which are the most common in electrical installations. The values given are deemed applicable to the frequency range from 15 Hz to 100 Hz, threshold values at the limits of this range being higher than those at 50 Hz and 60 Hz.

This clause considers principally the risk of ventricular fibrillation which is the main cause of fatal accidents in that range of frequencies.

1.3 Normative references

The following normative documents contains provisions which, through reference in this text, constitute provisions of this technical report. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this technical report are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60479-1:1994, *Effects of current on human beings and livestock – Part 1: General aspects*

IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publication*

ISO/IEC guide 51:1990, *Guidelines for the inclusion of safety aspects in standards*

1.4 Definitions

For the purpose of this part of IEC 60479, the definitions given in IEC 60479-1, as well as the following definitions apply.

1.4.1

internal impedance of the body (Z_i)

impedance between two electrodes in contact with two parts of the body, neglecting hide and skin impedances and the impedance of the hooves, if any

1.4.2

impedance of the hide and skin (Z_p)

impedance between an electrode on the hide and/or skin and the conductive tissues underneath

1.4.3

impedance of the hoof (Z_h)

impedance between an electrode under the hoof and the conductive tissues above it

1.4.4

total impedance of the body (Z_T)

vectorial sum of the internal impedance and the impedances of the hide, skin and hooves, if any (see figure 1)

1.4.5

initial resistance of the body (R_0)

resistance limiting the peak value of the current at the moment when the touch voltage occurs omitting the resistance of the hide, if any, but including the resistance of the hooves, if any

1.4.6

threshold of reaction

the minimum value of current which causes involuntary muscular contraction