SLOVENSKI STANDARD
SIST EN 60282-1:1995

01-december-1995

High-voltage fuses - Part 1: Current-limiting fuses (IEC 282-1:1985 + A1:1988 + A2:1992)

High-voltage fuses -- Part 1: Current-limiting fuses

Hochspannungssicherungen -- Teil 1: Strombegrenzende Sicherungen

Fusibles à haute tension -- Partie 1: Fusibles limiteurs de courant

Ta slovenski standard je istoveten z: **EN 60282-1:1993**

ICS:

29.120.50	Varovalke in druga medtokovna zaščita	Fuses and other overcurrent protection devices

SIST EN 60282-1:1995 **en**

EUROPEAN STANDARD EN 60282-1

NORME EUROPEENNE

EUROPÄISCHE NORM August 1993

UDC 621.315.61 Supersedes HD 492.1 S2:1989

Descriptors: Fuse, high voltage, current-limiting fuse, rating, condition of use, test, definition, application guide

ENGLISH VERSION

High-voltage fuses
Part 1: Current-limiting fuses
(IEC 282-1:1985 + A1:1988 + A2:1992)

Fusibles à haute tension
Première partie: Fusibles limiteurs de courant
(CEI 282-1:1985 + A1:1988 + A2:1992)

Hochspannungssicherungen
Teil 1: Strombegrenzende Sicherungen
(IEC 282-1:1985 + A1:1988 + A2:1992)

This European Standard was approved by CENELEC on 1993-07-06. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Ref. No. EN 60282-1:1993 E

FOREWORD

At the request of CENELEC Technical Committee TC 32A, High-voltage fuses, and as decided by the 73rd Technical Board, HD 492.1 S2:1989 (IEC 282-1:1985 + A1:1988) was submitted to the CENELEC voting procedure for conversion into a European Standard.

The CENELEC questionnaire procedure, performed for finding out whether or not the amendment 2:1992 to the International Standard IEC 282-1:1985 could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as European Standard. The reference document was submitted to the CENELEC members for formal vote.

The documents were combined and approved by CENELEC as EN 60282-1 on 6 July 1993.

The following dates were fixed:

- latest date of publication of an identical national standard	(dop)	1994-03-01
- latest date of withdrawal of conflicting national standards	(dow)	1994-03-01

For products which have complied with HD 492.1 S2:1989 and its amendment A1:1990 before 1994-03-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1999-03-01.

Annexes designated "normative" are part of the body of the standard. In this standard, annex ZA is normative.

ENDORSEMENT NOTICE

The text of the International Standard IEC 282-1:1985 and its amendments 1:1988 and 2:1992 was approved by CENELEC as a European Standard without any modification.

ANNEX ZA (normative)

OTHER INTERNATIONAL PUBLICATIONS QUOTED IN THIS STANDARD WITH THE REFERENCES OF THE RELEVANT EUROPEAN PUBLICATIONS

When the international publication has been modified by CENELEC common modifications, indicated by (mod), the relevant EN/HD applies.

IEC Publication	Date	Title	EN/HD	Date
50(151)	1978	International Electrotechnical Vocabulary (IEV) - Chapter 151: Electrical and magnetic devices	-	-
50(441)	1984	Chapter 441: Switchgear, controlgear and fuses	-	-
56 (mod)	1987	High-voltage alternating-current circuit-breakers	HD 348 S4	1991
60-1	1973*	High-voltage test techniques Part 1: General definitions and test requirements	-	-
60-2	1973*	Part 2: Test procedures	-	-
85	1984	Thermal evaluation and classification of electrical insulation	HD 566 S1	1990
265-1	1983	High-voltage switches for rated voltages above 1 kV and less than 52 kV	HD 355.1 S2**	1991
420	1973	High-voltage alternating current fuse-switch combinations and fuse-circuitbreaker combinations	EN 60420	1993
549	1976	High-voltage fuses for the external protection of shunt power capacitors	-	-
644	1979	Specification for high-voltage fuse-links for motor circuit applications	EN 60644	1993
787	1983	Application guide for the selection of fuse-links of high-voltage fuses for transformer circuit applications	-	-

Other publications

ISO 179:1982 - Plastics - Determination of Charpy impact strength of rigid materials

ISO R/442:1965 - Verification of pendulum impact testing machines for testing steels

---

* IEC 60-1:1973 + IEC 60-2:1973 have been superseded by IEC 60-1:1989, which was harmonized as HD 588.1 S1:1991

** HD 355.1 S2 includes A1:1984 to IEC 265-1

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

NORME DE LA CEI

INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC STANDARD

65

Publication 282-1

Troisième édition – Third edition

1985

Fusibles à haute tension

Première partie: Fusibles limiteurs de courant

High voltage fuses

Part 1: Current-limiting fuses

Bureau Central de la Commission Electrotechnique Internationale

3, rue de Varembé

Genève, Suisse

Prix
Price Fr s 125.–

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE FUSES

Part 1: Current-limiting fuses

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 32A: High-voltage Fuses, of IEC Technical Committee No. 32: Fuses.

This third edition replaces the second edition of IEC Publication 282-1 (1974) and Amendments No. 1 (1975), No. 2 (1978), No. 3 (1980), No. 4 (1981) and No. 5 (1984).

In addition, this edition includes Report No. 282-1A (1978), first supplement, the text of which forms Appendix D of this standard. Consequently, Publication 282-1A has been cancelled.

The text of this standard is also based upon the following documents:

Six Months' Rule	Report on Voting	Two Months' Procedure	Report on Voting
32A(CO)59 32A(CO)67 32A(CO)68 32A(CO)69 32A(CO)70 32A(CO)72	32A(CO)63 32A(CO)73 32A(CO)74 32A(CO)75 32A(CO)76 32A(CO)78	32A(CO)64	32A(CO)66

Further information can be found in the relevant Reports on Voting, indicated in the table above.

The following IEC publications are quoted in this standard:

Publication Nos. 50(151) (1978): International Electrotechnical Vocabulary (IEV), Chapter 151: Electrical and Magnetic Devices.
50(441) (1984): Chapter 441: Switchgear, Controlgear and Fuses.
56: High-voltage Alternating-current Circuit-breakers.
60-1 (1973): High-voltage Test Techniques, Part 1: General Definitions and Test Requirements.
60-2 (1973): Part 2: Test Procedures.
85 (1984): Thermal Evaluation and Classification of Electrical Insulation.
420 (1973): High-voltage Alternating Current Fuse-switch Combinations and Fuse-circuit-breaker Combinations.

Other publications:

ISO Standard 179 (1982): Plastics — Determination of Charpy impact strength of rigid materials.
ISO Recommendation R/442 (1965): Verification of pendulum impact testing machines for testing steels.

HIGH-VOLTAGE FUSES

Part 1: Current-limiting fuses

SECTION ONE — GENERAL

1. Scope

This standard applies to all types of high-voltage current-limiting fuses designed for use outdoors or indoors on alternating current systems of 50 Hz and 60 Hz and of rated voltages exceeding 1 000 V.

Some fuses are provided with fuse-links equipped with an indicating device or a striker. These fuses come within the scope of this standard, but the correct operation of the striker in combination with the tripping device of the switching device is outside the scope of this standard; see IEC Publication 420: High-voltage Alternating Current Fuse-switch Combinations and Fuse-circuit-breaker Combinations.

2. Conditions in normal service

Fuses complying with this standard are designed to be used under the following conditions:

a) The maximum ambient air temperature is 40 °C and its mean measured over a period of 24 h does not exceed 35 °C.
The minimum ambient air temperature is −25 °C.

Note. — This does not apply to time/current characteristics of fuses which will be modified appreciably at the minimum temperatures.

b) The altitude does not exceed 1 000 m (3 300 ft).

Notes 1. — The rated voltages and insulation levels specified in this standard apply to fuses intended for use at altitudes not exceeding 1 000 m (3 300 ft). When fuses incorporating external insulation are required for use at altitudes above 1 000 m (3 300 ft) one or other of the following procedures should be adopted:

1) The test voltages for insulating parts in air should be determined by multiplying the standard test voltages given in Tables VI and VII by the appropriate correction factor given in column (2) of Table I.

2) The fuses may be selected with a rated voltage which, when multiplied by the appropriate correction factor given in column (3) of Table I is not lower than the highest voltage of the system.

For altitudes between 1 000 m (3 300 ft) and 1 500 m (5 000 ft) and between 1 500 m (5 000 ft) and 3 000 m (10 000 ft), the correction factors can be obtained by linear interpolation between the values in Table I.

TABLE I

Maximum altitude m	(ft) (1)	Correction factor for test voltages referred to sea level (2)	Correction factor for rated voltages (3)
1 000	(3 300)	1.0	1.0
1 500	(5 000)	1.05	0.95
3 000	(10 000)	1.25	0.80

Where the dielectric characteristics are identical at any altitude, no special precautions need to be taken.

2. — The rated current or the temperature-rise specified in this standard can be corrected for altitudes exceeding 1000 m (3300 ft) by using appropriate factors given in Table II, columns (2) and (3) respectively. Use one correction factor from columns (2) or (3), but not both, for any one application.

For altitudes between 1000 m (3300 ft) and 1500 m (5000 ft) and between 1500 m (5000 ft) and 3000 m (10000 ft), the correction factors can be obtained by linear interpolation, between the values in Table II.

TABLE II

Maximum altitude m (ft) (1)	Correction factor for rated current (2)	Correction factor for temperature-rise (3)
1 000 (3 300)	1.0	1.0
1 500 (5 000)	0.99	0.98
3 000 (10 000)	0.96	0.92

c) The ambient air is not excessively (or abnormally) polluted by dust, smoke, corrosive or flammable gases, vapour or salt.

d) For indoor installations, the conditions of humidity are under consideration but, in the meantime, the following figures can be used as a guide:

— the average value of the relative humidity, measured during a period of 24 h, does not exceed 95%;

— the average value of the vapour pressure, for a period of 24 h, does not exceed 22 mbar;

— the average value of the relative humidity, for a period of one month, does not exceed 90%;

— the average value of the vapour pressure, for a period of one month, does not exceed 18 mbar.

For these conditions, condensation may occasionally occur.

Notes 1. — Condensation can be expected where sudden temperature changes occur in periods of high humidity.

2. — To withstand the effects of high humidity and occasional condensation, such as breakdown of insulation or corrosion of metallic parts, indoor fuses designed for such conditions and tested accordingly or outdoor fuses may be used.

3. — Condensation may be prevented by special design of the building or housing, by suitable ventilation and heating of the station or by the use of dehumidifying equipment.

e) Vibrations due to causes external to fuses or earth tremors are negligible.

Besides, for outdoor installations:

f) Account should be taken of the presence of condensation or rain and rapid temperature changes.

g) The wind pressure does not exceed 700 Pa (corresponding to 34 m/s wind speed).

h) The temperature due to sunlight does not exceed an equivalent black body temperature of 80 °C.

Note. — If the fuses are to be used under conditions different from those mentioned in Items *a)* to *h)* above, the manufacturer should be consulted.

SECTION TWO — DEFINITIONS

(The reference numbers in brackets are those of IEC Publications 50(151)* and 50(441)**.)

3. Electrical characteristics

3.1 *Rated value* (151-04-03)

A quantity value assigned, generally by a manufacturer, for a specified operating condition of a component, device or equipment.

Note. — Examples of rated values usually stated for fuses: voltage, current, breaking current.

3.2 *Rating* (151-04-04)

The set of rated values and operating conditions.

3.3 *Prospective current (of a circuit and with respect to a fuse)* (441-17-01)

The current that would flow in the circuit if the fuse were replaced by a conductor of negligible impedance.

Note. — For the method to evaluate and to express the prospective current, see Sub-clauses 13.2.1 and 13.2.2.

3.4 *Prospective peak current* (441-17-02)

The peak value of a prospective current during the transient period following initiation.

Note. — The definition assumes that the current is made by an ideal switching device, i.e. with instantaneous transition from infinite to zero impedance. For circuits where the current can follow several different paths, for example polyphase circuits, it further assumes that the current is made simultaneously in all poles, even if only the current in one pole is considered.

3.5 *Prospective breaking current* (441-17-06)

The prospective current evaluated at a time corresponding to the instant of the initiation of the breaking process.

Note. — For the fuses, this instant is usually defined as the moment of the initiation of the arc during the breaking process. Conventions relating to the instant of the initiation of the arc are given in Sub-clause 13.2.3.

3.6 *Cut-off current* (441-17-12)
Let-through current

The maximum instantaneous value of current attained during the breaking operation of a fuse.

Note. — This concept is of particular importance when the fuse operates in such a manner that the prospective peak current of the circuit is not reached.

3.7 *Breaking capacity* (441-17-08)

A value of prospective current that a fuse is capable of breaking at a stated voltage under prescribed conditions of use and behaviour.

3.8 *Pre-arcing time* (441-18-21)
Melting time

The interval of time between the beginning of a current large enough to cause a break in the fuse-element(s) and the instant when an arc is initiated.

---

* Publication 50(151): International Electrotechnical Vocabulary (IEV), Chapter 151: Electrical and Magnetic Devices.

** IEC Publication 50(441): Chapter 441: Switchgear and Controlgear.

3.9 *Arcing time* (441-17-37)

The interval of time between the instant of the initiation of the arc in a fuse and the instant of final arc extinction in that fuse.

3.10 *Operating time* (441-18-22)
Total clearing time

The sum of the pre-arcing time and the arcing time.

3.11 *I^2t; Joule integral* (441-18-23)

The integral of the square of the current over a given time interval:

$$I^2t = \int_{t_0}^{t_1} i^2 dt$$

Notes 1. — The pre-arcing I^2t is the I^2t integral extended over the pre-arcing time of the fuse.

2. — The operating I^2t is the I^2t integral extended over the operating time of the fuse.

3. — The energy in joules liberated in one ohm (1 Ω) of resistance in a circuit protected by a fuse is equal to the value of the operating I^2t expressed in $A^2 \cdot s$.

3.12 *Virtual time*

The value of the Joule integral divided by the square of the value of the prospective current.

Note. — The values of virtual times usually stated for a fuse-link are the values of pre-arcing time and of operating time.

3.13 *Time-current characteristic* (441-17-13)

A curve giving the time, for example pre-arcing time or operating time, as a function of the prospective current under stated conditions of operation.

3.14 *Cut-off (current) characteristic* (441-17-14)
Let-through (current) characteristic

A curve giving the cut-off current as a function of the prospective current, under stated conditions of operation.

Note. — In the case of a.c., the values of the cut-off current are the maximum values which can be reached whatever the degree of asymmetry. In the case of d.c., the values of the cut-off current are the maximum values reached related to the time-constant as specified.

3.15 *Recovery voltage* (441-17-25)

The voltage which appears across the terminals of a fuse after the breaking of the current.

Note. — This voltage may be considered in two successive intervals of time, one during which a transient voltage exists, followed by a second one during which the power frequency or the steady-state recovery voltage alone exists.

3.16 *Transient recovery voltage (abbreviation T.R.V.)* (441-17-26)

The recovery voltage during the time in which it has a significant transient character.

Notes 1. — The transient recovery voltage may be oscillatory or non-oscillatory or a combination of these depending on the characteristics of the circuit and the fuse. It includes the voltage shift of the neutral point of a polyphase circuit.

2. — The transient recovery voltage in three-phase circuits is, unless otherwise stated, that across the first fuse to clear, because this voltage is generally higher than that which appears across each of the other two fuses.

3.17 *Power frequency recovery voltage* (441-17-27)

The recovery voltage after the transient voltage phenomena have subsided.

3.18 *D.C. steady-state recovery voltage* (441-17-28)

The recovery voltage in a d.c. circuit after the transient voltage phenomena have subsided, expressed by the mean value where ripple is present.

3.19 *Prospective transient recovery voltage (of a circuit)* (441-17-29)

The transient recovery voltage following the breaking of the prospective symmetrical current by an ideal switching device

Note. — The definition assumes that the fuse, for which the prospective transient recovery voltage is sought, is replaced by an ideal switching device, i.e. having instantaneous transition from zero to infinite impedance at the very instant of zero current, i.e. at the "natural" zero. For circuits where the current can follow several different paths, for example a polyphase circuit, the definition further assumes that the breaking of the current by the ideal switching device takes place only in the pole considered.

3.20 *Short-circuit breaking power factor*

No definition at present.

3.21 *Switching voltage* (441-18-31)

The maximum instantaneous value of voltage which appears across the terminals of a fuse during its operation.

Note. — The switching voltage may be the arc voltage or may occur during the time of transient recovery voltage.

3.22 *Minimum breaking current* (441-18-29)

A minimum value of prospective current that a fuse-link is capable of breaking at a stated voltage under prescribed conditions of use and behaviour.

3.23 *Power dissipation (of a fuse-link)*

The power released in a fuse-link carrying a stated value of current under prescribed conditions of use and behaviour.

Note. — The prescribed conditions of use and behaviour usually include a constant r.m.s. value of current until steady temperature conditions are reached.

3.24 *Power acceptance of a fuse-base [fuse-holder]*

The maximum value of power released in a fuse-link which a fuse-base [fuse-holder] is designed to tolerate under specified conditions.

4. Fuses and their component parts

4.1 *Fuse* (441-18-01)

A device that by the fusing of one or more of its specially designed and proportioned components, opens the circuit in which it is inserted by breaking the current when this exceeds a given value for a sufficient time. The fuse comprises all the parts that form the complete device.

4.2 *Terminal*

A conducting part of a fuse provided for an electric connection to external circuits.

Note. — Terminals may be distinguished according to the kind of circuits for which they are intended (e.g. main terminal, earth terminal etc.), but also according to their design (e.g. screw terminal, plug terminal, etc.).

4.3 *Fuse-base* (441-18-02)
Fuse-mount

The fixed part of a fuse provided with contacts and terminals.

Note. — The fuse-base comprises all the parts necessary for insulation. (See Figure 1, page 105.)