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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



78/1442/CD

COMMITTEE DRAFT (CD)

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78/1379/CD, 78/1395B/CC

IEC TC 78 : LIVE WORKING	
SECRETARIAT: France	SECRETARY: Mrs Sophie CHABIN
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

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Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (SEE [AC/22/2007](#) OR [NEW GUIDANCE DOC](#)).

TITLE:

Live working - Insulating ropes

NOTE FROM TC/SC OFFICERS:

This document has been prepared by MT 62192. It is the second CD taking into account the comments according to 78/1395B/CC.

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CONTENTS

1		
2		
3	FOREWORD	5
4	INTRODUCTION.....	8
5	1 Scope	9
6	2 Normative references	9
7	3 Terms and definitions	9
8	3.1 Terms and definitions.....	9
9	3.2 Abbreviated terms, symbols, and units	11
10	4 Requirements.....	11
11	4.1 General.....	11
12	4.2 Physical and dimensional	12
13	4.2.1 General	12
14	4.2.2 Physical.....	12
15	4.2.3 Dimensional.....	12
16	4.3 Electrical.....	12
17	4.4 Mechanical.....	12
18	4.5 Marking.....	12
19	4.6 Instructions for use, maintenance, and care	13
20	5 Tests.....	13
21	5.1 General.....	13
22	5.2 Atmospheric conditions.....	14
23	5.3 Visual verification and dimensional checking	14
24	5.3.1 Visual verification.....	14
25	5.3.2 Dimensional check	14
26	5.4 Electrical tests.....	14
27	5.4.1 General	14
28	5.4.2 Leakage current under dry conditions – Category 1 insulating	
29	rope.....	15
30	5.4.3 Leakage current after water conditioning – Category 1 Insulating	
31	Rope	21
32	5.5 Durability of marking.....	22
33	5.6 Verification of the required instructions for use	22
34	6 Method of assessment of defects and verification of performance	
35	applicable to insulating ropes during the production phase	22
36	6.1 General.....	22
37	6.2 Verification method for insulating ropes during the production phase.....	22
38	6.3 Alternative means to test insulating ropes during the production phase	22
39	7 Test Report	23
40	8 Modifications.....	23

41	Annex A (normative) Suitable for live working; double triangle (IEC 60417-	
42	5216 (2002-10))	24
43	Annex B (normative) Chronology of type tests	25
44	Annex C (informative) Test Requirements and Criterion Overview for Type 1	
45	and Category 2 Insulating Ropes	26
46	Annex D (normative) Classification of defects	27
47	Annex E (informative) Rationale for the classification of defects	28
48	Annex F (normative) Marking to identify insulating rope	29
49	Annex G (informative) Summary Report of Type Testing Example.....	30
50	Annex H (informative) Category 2 insulating rope	31
51	H.1 General.....	31
52	H.1.1 Tests for Category 2.....	31
53	H.1.2 Leakage current under dry conditions – Category 2 Insulating	
54	Rope	31
55	H.1.3 Leakage current After water conditioning	31
56	H.1.4 Electrical Test Procedure.....	31
57	H.1.5 Determination of break strength after wet electrical test	32
58	Annex I (informative) Termination	33
59	Annex J (informative) In-service care and periodic testing.....	34
60	J.1 In-service care and periodic testing - General.....	34
61	J.2 Identification.....	34
62	J.3 Storage	34
63	J.3.1 In the field	34
64	J.3.2 In the storage room.....	34
65	J.4 Handling	35
66	J.5 Periodic testing	35
67	J.5.1 Inspection in the field before each use.....	35
68	J.5.2 Periodic high voltage testing	35
69	J.6 Application safety factor and working load limit.....	36
70	J.7 Use with capstans or pulleys.....	37
71	J.8 Cleaning, repair, and recycling.....	37
72	J.9 Retirement	38
73	Bibliography	39
74		
75	Figure 1 – Electrode arrangement for dry and wet electrical testing.....	15
76	Figure 2 – Example of test set up to measure leakage current.	16
77	Figure 3 – Example of test set up minimum clearance requirements.....	17
78	Figure 4 – Electrical Test Configuration	18
79	Figure 5 - Upper Electrode Plate and Split Brass Die Clamp Insert for the	
80	Insulating Rope	19

81	Figure 6-Lower Electrode Plate and Split Brass Die Clamp Insert for the	
82	Insulating Rope	20
83		
84	Table B.1 – Chronology and group of test pieces	25
85	Table C.1 – Comparison of the two categories of Insulating Ropes	26
86	Table E.1 – Justification for the type of defect.....	28
87		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LIVE WORKING – INSULATING ROPES

FOREWORD

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IEC 62192 has been prepared by IEC technical committee TC 78: LIVE WORKING. It is an International Standard.

This second edition cancels and replaces the first edition published in 2009. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Scope;
- b) Introduction;
- c) Normative references;
- d) Terms and definitions;

- e) Requirements;
- f) Tests;
- g) Introduction of 2 categories of insulating ropes where Category 1 is for direct energized contact and Category 2 is for use outside of the Minimum Approach Distance;
- h) Requirement for the mechanical requirements to be performed and information provided by the manufacture recognizing that this standard provides the requirements and tests for the electrical properties of an insulating rope.
- i) Revision of the test requirements of the insulating ropes which include:
- 1) Same test setup for dry and wet electrical tests;
 - 2) Electrodes which provide capacitive current shielding and a uniform voltage stress;
 - 3) Equal voltage stresses when testing the rope dry and wet;
 - 4) Reduced leakage currents requirement to avoid mechanical degradation;
 - 5) Requirement to record the applied voltage and resulting leakage current;
- j) Updated Annex B and new Annex C which provides a testing and criterion overview;
- k) New Annex E provides the rationale for the classification of defects specified in Annex D;
- l) New Annex F which demonstrates required markings from manufacturer;
- m) New Annex G which provides sample summary report of type testing;
- n) Annex H which provides testing and acceptance criteria information for Category 2 ropes;
- o) Annex I for the termination of insulating ropes;
- p) Annex J which provides comprehensive in-service and periodic testing information for insulating ropes;

The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,

- 179 • replaced by a revised edition, or
180 • amended.
181

INTRODUCTION

Insulating ropes designed and manufactured according to this standard contribute to the safety of the users, provided they are used by trained and qualified persons, in accordance with safe methods of work and the instructions for use.

This document defines the required electrical properties of insulating ropes which already meet other specifications relating to mechanical strength, physical and construction properties, for use as an insulating rope, where the dielectric properties of the insulating rope are required or relied upon, at the power frequency system voltages up to and including 800 kV RMS. The standard testing is performed to reflect AC conditions.

Insulating ropes are needed when working in an energized environment whether utilizing direct-contact live working, non-contact methods while working in electromagnetic fields (capacitive induction) or for de-energized work methods for protection from accidental energization. (i.e. lightning, switching errors, equipment failures etc.) Applications for insulating ropes include but are not limited to general live working methods, pulling, and stringing of conductor, bare hand methods, helicopter human external cargo, safety netting, tree trimming, rescue and escape, rope access, tag lines and hand lines.

Natural fibres such as cotton, sisal, hemp and manilla or synthetic fibres untreated or uncoated such as nylon, polyester, liquid crystal polymer and aramid may be unsuitable for this application, as are any other ropes that exhibit electrical conductivity. Examples of ropes which are able to meet the requirements of this standard are formed from fibres that have an extruded thermoplastic jacket with sealed ends or other form of coating or additives, such as wax, which enhances their dielectric and hydrophobic properties.

The purpose of this standard is to focus on the insulating ropes that are used to insulate the workers from the energized circuits. This standard introduces different testing methods for the Category 1 and 2 insulating ropes with different acceptance criteria for the insulating ropes.

This standard does not propose to address all the safety factors associated with the use of the insulating rope. It is the responsibility of the user to establish appropriate safety practices. The end user is responsible to validate the testing data and reports provided by the supplier and to ensure the conformity and validation prior to choosing an insulating rope and utilizing it in service. The user is responsible for accurately assessing and testing the dielectric properties of the rope in service.

The product covered by this standard may have an impact on the environment during some or all stages of its life cycle. These impacts can range from slight to significant, be of short-term or long-term, and occur at the global, regional, or local level.

This standard does not include requirements and test provisions for the manufacturers of the product, or recommendations to the users of the product for environmental improvement. However, all parties intervening in its design, manufacture, packaging, distribution, use, maintenance, repair, reuse, recovery, and disposal are invited to take account of environmental considerations.

LIVE WORKING – INSULATING ROPES

1 Scope

This document covers insulating ropes that are utilized during Live Working (LW) procedures in contact with parts of installations operating at voltages up to and including 800 kV RMS. They shall already meet other specifications relating to mechanical strength, physical and construction properties. Insulating ropes up to a diameter of 32 mm only are given consideration for the test acceptance criteria and larger diameters may require increased leakage current criteria and engineering analysis for a particular application.

At the present time, insulating rope options include but are not limited to various styles, materials, and construction, including extruded thermoplastic jacket ropes with sealed ends, fiber with overlay/wax coating and additives and fiber without any additives. Extruded thermoplastic jacket ropes with sealed ends are more likely to meet the acceptance criteria for direct contact (Category 1) ropes. Before any electrical testing, a visual test should be done to verify if the ends are sealed.

This standard covers in-service care and periodic testing. The arc flash properties of the insulating rope are not evaluated in this standard but should be given consideration.

An Acceptance Test may be arranged between a manufacturer and the end user in order to demonstrate that the product meets the specifications and requirements of this standard.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60417, *Graphical symbols for use on equipment*

IEC 61318:2021, *Live working - Methods for assessment of defects and verification of performance applicable to tools, devices and equipment*

IEC 61477, *Live working – Minimum requirements for the utilization of tools, devices and equipment*

ISO 2307:2019, *Ropes – Determination of certain physical and mechanical properties*

IEC 60855-1:2016, *Live working – Insulating foam-filled tubes and solid rods – Part 1: Tubes and rods of a circular cross-section.*

3 Terms and definitions

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

260 ISO and IEC maintain terminology databases for use in standardization at the following
261 addresses:

- 262 • IEC Electropedia: available at <https://www.electropedia.org/>
- 263 • ISO Online browsing platform: available at <https://www.iso.org/obp>

264 3.1.1

265 energized environment

266 immediate surroundings of electrical apparatus, equipment and circuits that are or could
267 become energized

268 3.1.2

269 insulating rope

270 rope made of insulating material specifically designed or adapted, tested and
271 maintained for live working

272 Note 1 to entry: ropes can only be considered insulating if they are free of contamination

273 3.1.3

274 Category 1 insulating rope

275 (Direct Contact ropes)

276 synthetic rope designed, manufactured, tested, and maintained to provide direct contact
277 insulation and is intended to come in contact with energized conductors phase to ground
278 or phase to phase.

279 3.1.4

280 Category 2 insulating rope

281 (Proximity ropes)

282 synthetic rope which provides a form of proximity insulation, and which is not designed
283 for direct contact with energized conductors phase to ground or phase to phase but
284 may be used in an energized environment. This rope is intended to be used outside the
285 minimum approach distance.

286 3.1.5

287 rope

288 stout cord made from woven or twisted insulating or non-insulating material used for
289 various handling operations. Non-insulating ropes are not for use in an energized
290 environment.

291 Note 1 to entry: Ropes, which will come into contact with live conductors or relied on as primary insulation, shall
292 be Category 1 insulating rope. Ropes used to move tools and other equipment into place, which are clear of live
293 parts but used in an energized environment, should be insulating ropes as a best practice. Incidents, such as burned
294 or broken ropes and shocks, have occurred in industry as a result of capacitive induction from nearby energized live
295 parts involving non-insulating rope.

296 [SOURCE: IEC 60743 - 2013, 10.1.1, modified – The definition has been changed by
297 adding where the non-insulating ropes cannot be used.]

298 3.1.6

299 overlay finish

300 an oil, emulsion, lubricant, wax or the like applied to a yarn upon completion of textile
301 processing to enhance the intended performance of the finished fibre product.

302 Note 1 to entry: Note 1 to entry For the application of insulating ropes the intended performance enhancement is
303 the dielectric properties of the fibre rope.

[SOURCE: CI 1202-03, modified – Note 1 to entry has been added to refer specifically to live working and arc testing.]

3.1.7

extruded thermoplastic jacket rope

a rope that is manufactured by the extruding process of forming a thermoplastic jacket outer layer by drawing through a die.

[SOURCE: ISO 1968:2004, 4.3.2, modified -The definition has been changed to refer specially to the extruding process of forming a thermoplastic jacket to the outer layer.]

3.1.8

termination

the termination of the insulative rope is a term used to describe how the rope end is finished. It can be with a blunt cut (often a heat melt) or with an eye (soft eye or with a thimble) or with a metallic mechanical assembly. Splicing, sewing methods or crimping are the various methods used to create the eyes.

Note 1 to entry: Note 1 to entry Because insulating rope has special electrical and hydrophobic properties, the cut ends of the rope may need special processes to assure the desired properties are not compromised. Determination as to whether the termination portion is to be considered as insulating shall be made through testing by the end user or by the manufacturer.

3.2 Abbreviated terms, symbols, and units

LW	Live Working
WLL	Working Load Limit
AC	Alternative Current
DC	Direct Current
kV	Kilovolt
A	Ampere
μA	Microampere
RMS	Root Mean Square
mm	Millimetre
m	Metre
kg	Kilogram
s	Second
min	Minute
W	Watt
Ω	Ohm
°C	Degree Celsius
h	Hour

4 Requirements

4.1 General

Insulating ropes covered by this standard shall be deemed compliant by passing all the requirements of clause 4 with results documented in a Report of Type Testing. This shall include proof that the applied voltage and leakage current were recorded continuously at a frequency of at least once per second for the entire duration of the test.