IEC 60794-1-2

Edition 5.0 2021-01
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Optical fibre cables –
Part 1-2: Generic specification – Basic optical cable test procedures – General guidance

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IEC 60794-1-2:2021-01 RLV(en)

Full document details: IEC 60794-1-2 2021 RLV

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 33.180.10

ISBN 978-2-8322-9291-4

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OPTICAL FIBRE CABLES –

Part 1-2: Generic specification – Basic optical cable test procedures – General guidance

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60794-1-2:2017. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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International Standard IEC 60794-1-2 has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

This fifth edition cancels and replaces the fourth edition published in 2017. This edition constitutes an technical revision.

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

a) addition of cross-reference tables listing the new test method numbers and the previous test method numbers.

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

CDV	Report on voting
86A/2009/CDV	86A/2057/RVC

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

This International Standard is to be used in conjunction with IEC 60794-1-1.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60794 series, published under the general title *Optical fibre cables*, can be found on the IEC website.

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

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- withdrawn,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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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INTRODUCTION

~~IEC 60794-1-2:2013 comprised a detailed cross-reference table to the new document set, and general guidance was given in IEC 60794-1-20. These two specifications have been combined in this document, which allows for IEC 60794-1-20 to be withdrawn.~~

A decision has been reached to reorganize the IEC 60794-1-2 set of test methods into single-subject documents. This will be a migration as the existing test methods are revised and as new test methods are promulgated, rather than a wholesale rewrite. Part of this migration is a decision to maintain the traditional letter-number classification and to use a numbering system which maintains connection to the existing numbering system.

The new test method numbering format has been agreed, in line with IEC Secretariat guidelines, to help the cross-referencing from old to new and that will make the updating of the relevant sectional and product specifications easier. Cross-reference tables listing the new test method numbers and the previous test method numbers have been included (see Annex A, Table A.1 to Table A.8).

The format agreed is as follows:

IEC 60794-1-Xnn

where

X = 2nd digit of the old 2-digit reference;

nn = incremental number (starting with old test method number).

For example:

IEC 60794-1-21 method E1 (tensile) becomes IEC 60794-1-101;

IEC 60794-1-22 method F5 (water penetration) becomes IEC 60794-1-205;

IEC 60794-1-23 method G7 (tube kinking) becomes IEC 60794-1-307;

IEC 60794-1-24 method H2 (lightning) becomes IEC 60794-1-402.

Annex A has been added to this document containing a cross-reference between the old and new number scheme.

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OPTICAL FIBRE CABLES –

Part 1-2: Generic specification – Basic optical cable test procedures – General guidance

1 Scope

This part of IEC 60794-1 applies to optical fibre cables for use with telecommunications equipment and devices employing similar techniques, and to cables having a combination of both optical fibres and electrical conductors.

~~The prime objective of this document is to provide the end user with an overview about the content of different parts of the IEC 60794-1 series numbered -2X. Table 1 shows the different parts.~~

An objective of this document is to define general requirements and methodology guidance applicable to all of the cable test methods of IEC 60794-1 (all parts).

A second objective of this document is to provide the end user with an overview of the different test methods contained in the different parts of the IEC 60794-1 series, numbered -Xnn. Table 1 shows the different parts.

Table 1 – Document overview

Test methods	IEC reference	Previous compendium reference	Test method category reference letter
General guidance	IEC 60794-1-2	IEC 60794-1-2	-
Mechanical	IEC 60794-1-1nn	IEC 60794-1-21:2015	Methods E
Environmental	IEC 60794-1-2nn	IEC 60794-1-22:2017	Methods F
Cable elements	IEC 60794-1-3nn	IEC 60794-1-23:2019	Methods G
Electrical	IEC 60794-1-4nn	IEC 60794-1-24:2014	Methods H
NOTE 1 The compendium reference specifications detailed in column 3 will continue in force until all of the test methods therein are revised into the single-subject documents using the new numbering scheme. NOTE 2 For existing test methods, "nn" is the test method number. For new test methods, "nn" is an incremental number following the last test method number for that test category. NOTE 3 Several numbers in the test method numbering sequence are missing. The reasons for these omissions are historical. To avoid confusion, the existing numbering sequence has been retained.			

These documents define test procedures to be used in establishing uniform requirements for the geometrical, transmission, material, mechanical, ageing (environmental exposure) and climatic properties of optical fibre cables, and electrical requirements where appropriate.

Throughout the documents, the wording "optical cable" can also include optical fibre units, microduct fibre units, etc.

The secondary objective of this document is to provide the end user with useful guidance when testing optical fibre cables.

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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 60793-1-40, *Optical fibres – Part 1-40: Attenuation measurement methods ~~and test procedures – Attenuation~~*

IEC 60793-1-46, *Optical fibres – Part 1-46: Measurement methods and test procedures – Monitoring of changes in optical transmittance*

IEC 60793-2-40, *Optical fibres – Part 2-40: Product specifications – Sectional specification for category A4 multimode fibres*

IEC 60794-1-1~~:2015~~, *Optical fibre cables – Generic specification – General*

IEC 60794-1-21:2015, *Optical fibre cables – Part 1-21: Generic specification – Basic optical cable test procedures – Mechanical tests methods*

IEC 60794-1-22:2017, *Optical fibre cables – Part 1-22: Generic specification – Basic optical cable test procedures – Environmental test methods*

IEC 60794-1-23:2019, *Optical fibre cables – Part 1-23: Generic specification – Basic optical cable test procedures – Cable element test methods*

IEC 60794-1-24:2014, *Optical fibre cables – Part 1-24: Generic specification – Basic optical cable test procedures – Electrical test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60794-1-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 General guidance

4.1 Test procedure format

The standard descriptive order of each test method is in general as follows: object, sample, apparatus, procedure, requirement, details to be specified, details to be reported. Additional clauses may be inserted, whilst maintaining this general order.

4.2 Standard atmospheric conditions

Two sets of allowable ambient conditions for cable testing are defined for use in testing in this document:

a) Standard test conditions

– temperature: +23 °C ± 5 °C

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- pressure: site ambient
- relative humidity: 20 % to 70 %

b) Expanded test conditions

- temperature: +25 °C ± 15 ºC
- pressure: site ambient
- relative humidity: 5 % to 95 %

Unless otherwise stated in the particular test, the expanded test conditions shall be used as the default atmospheric conditions when performing tests. The standard test conditions are only for use when specifically requested.

NOTE A tightly-controlled temperature range is considered unnecessary for most cable tests.

Consideration shall be given to the effects of temperature differences and variations on electronic and optical test equipment that may be used in performing the tests. It may be necessary to maintain such equipment at the controlled atmospheric conditions by appropriate means.

4.3 Symbols and abbreviated terms

Symbols and abbreviated terms are given in IEC 60794-1-1.

4.4 Safety and environmental aspects

All applicable safety and environmental regulations shall be met.

4.5 Calibration

4.5.1 Calibration process

Ensure the apparatus is calibrated and adjusted in accordance with the manufacturer's instructions before use in order to minimize measurement uncertainty.

Record relevant information of the calibration process, such as the calibrated value and uncertainty of the reference material or test equipment used.

4.5.2 Assessment of uncertainties

Measurement uncertainty may be defined as the range within which the true value of a measured quantity (the measure) is estimated to lie, within a given likelihood (or confidence level) [1][1]. The measurement uncertainty normally comprises several components, some of which may be estimated using statistical techniques (known as type A uncertainties) whilst others may be estimated on the basis of experience or other information (known as type B uncertainties). Components of uncertainty, or variance, are additive, and a confidence interval may be calculated for the measurements based on the sum of the variance components.

A typical build-up of uncertainty may include the following sources of uncertainty:

- calibration uncertainty of reference materials or equipment used – normally stated on the calibration certificates of the standards;
- transfer uncertainty – estimated changes in the certified values of reference materials or equipment since they were calibrated;
- operational uncertainty – estimated effects of environmental conditions, such as temperature and humidity;

[1] Numbers in square brackets refer to the Bibliography.

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– statistical (random) uncertainty in the measurement of the specimen and the calibration standard – due to, for example, electrical noise, vibration, data quantization, etc.

4.6 Preconditioning

Most tests are performed at ambient conditions or begin at ambient conditions, ~~as per~~ in accordance with 4.2. The intent is that the preconditioning achieve thermal stability. Some test methods address thermal stability in an explicit and detailed manner. Unless otherwise specified, samples shall be preconditioned at ambient conditions for a minimum of 12 h prior to the test.

4.7 Guide to qualification sampling

For qualification purposes, it should only be necessary to test a subset of the fibre and/or element counts that represent a product range. Not all fibres within a cable are required to be tested to qualify a cable. A guide to qualification sampling is found in IEC 60794-1-1. Not all tests are required for a cable design. It depends upon the application and relevant specification.

4.8 Optical launch conditions

Optical measurements shall follow conditions as described in ~~the IEC 60793-1 series, in particular~~ IEC 60793-1-40 for attenuation and IEC 60793-1-46 for monitoring changes in optical transmittance by transmitted power or backscattering.

4.9 Standard optical test wavelengths

The standard optical test wavelengths for type testing of cabled optical fibre, performed ~~per~~ in accordance IEC 60794-1-1, are as given in Table 2, unless otherwise specified in the individual test or in the detail specification.

Table 2 – Standard optical test wavelengths

Fibre type	Wavelength
Single-mode	1 550 nm ± 10 nm
Multimode	1 300 nm ± 20 nm
NOTE Other test wavelengths can require different tolerance ranges.	

Single-mode fibres which are specified for performance in the L band are tested at 1 625 nm, as given in Table 3. In this case, specific performance criteria shall be specified at 1 625 nm by the relevant specification.

For multimode fibres that are optimized for wavelengths lower than 1 300 nm (e.g. 850 nm, as given in Table 3), the highest specified wavelength shall be tested. In this case, the 1 300 nm test criteria specified in the relevant specification shall be used. Category A4 multimode fibres shall be tested at the applicable sub-category wavelength given in IEC 60793-2-40.

Table 3 – Alternative optical test wavelengths

Fibre type	Wavelength
Single-mode	1 625 nm ± 10 nm
Multimode	850 nm ± 20 nm
NOTE Other test wavelengths can require different tolerance ranges.	

Specified changes in optical performance include an allowance for measurement repeatability.

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Annex A
(informative)

Cross-references between new and old test method numbers

Table A.1 to Table A.8 show the cross-references between new and old test method numbers.

Table A.1 – IEC 60794-1-1xx series

New IEC 60794-1-1xx series number	Title	IEC 60794-1-21 method number
IEC 60794-1-101	Tensile performance	Method E1
IEC 60794-1-102	Abrasion	Method E2
	Method A: Abrasion resistance of optical fibre cable sheaths	Method E2A
	Method B: Abrasion resistance of optical fibre cable markings	Method E2B
IEC 60794-1-103	Crush	Method E3
	Method A: Plate/plate	Method E3A
	Method B: Mandrel/plate	Method E3B
IEC 60794-1-104	Impact	Method E4
IEC 60794-1-105	Stripping force stability of cabled optical fibres	Method E5A
IEC 60794-1-106	Repeated bending	Method E6
IEC 60794-1-107	Torsion	Method E7
IEC 60794-1-108	Flexing	Method E8
-	Snatch (deleted)	Method E9
IEC 60794-1-110	Kink	Method E10
IEC 60794-1-111	Bend	Method E11
	Method A: Standard test procedure	Method E11A
	Method B: Alternative test procedure	Method E11B
-	Cut-through resistance (deleted)	Method E12
IEC 60794-1-113	Shotgun damage	Method E13
	Method A: Shotgun test	Method E13A
	Method B: Shotgun simulation	Method E13B
-	[Title unknown] (deleted)	Method E16
IEC 60794-1-117	Bending stiffness	Method E17
	Method A: Three-point bend	Method E17A
	Method B: Cantilever bend	Method E17B
	Method C: Buckling bend	Method E17C
IEC 60794-1-118	Bending under tension	Method E18A
IEC 60794-1-119	Aeolian vibration	Method E19
IEC 60794-1-120	Cable coiling performance	Method E20
IEC 60794-1-121	Sheath pull-off force for optical fibre cable for use in patch cords	Method E21
IEC 60794-1-122	Buffered fibre movement under compression in optical fibre cables for use in patch cords	Method E22
IEC 60794-1-123	Microduct route verification test	Method E23
IEC 60794-1-124	Installation test for microduct cabling	Method E24

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New IEC 60794-1-1xx series number	Title	IEC 60794-1-21 method number
IEC 60794-1-125	Rip cord functional test	Method E25
IEC 60794-1-126	Galloping	Method E26
IEC 60794-1-127	Indoor simulated installation test	Method E27
IEC 60794-1-128	Cable and fibre mechanical reliability test	Method E28
IEC 60794-1-129	Straight midspan access to optical elements	Method E29
IEC 60794-1-130	Coefficient of friction between cables	Method E30
IEC 60794-1-131	Microduct inner clearance test	Method E31
IEC 60794-1-132	Creep behaviour tension test (for ADSS)	Method E32
IEC 60794-1-133	Multiple cable coiling and uncoiling performance	Method E33
IEC 60794-1-134	Coefficient of dynamic friction between cables	Method E34
IEC 60794-1-135	Sheave test (primarily for OPGW and OPAC)	Method E18B

Table A.2 – IEC 60794-1-2xx series

New IEC 60794-1-2xx series number	Title	IEC 60794-1-22 method number
60794-1-201	Temperature cycling	Method F1
-	Deleted	Method F2
-	Deleted	Method F3
-	Deleted	Method F4
60794-1-205	Water penetration	Method F5
	Method A: Water penetration (circumferential)	Method F5A
	Method B: Water penetration (end-on)	Method F5B
	Method C: Water penetration (end-on, for cables with swellable water blocking material)	Method F5C
-	Deleted	Method F6
60794-1-207	Nuclear radiation	Method F7
60794-1-208	Pneumatic resistance	Method F8
60794-1-209	Ageing	Method F9
60794-1-210	Underwater cable resistance to hydrostatic pressure	Method F10
60794-1-211	Sheath shrinkage	Method F11
60794-1-212	Temperature cycling of cables to be terminated with connectors	Method F12
60794-1-213	Microduct pressure withstand	Method F13
60794-1-214	Cable UV resistance test	Method F14
60794-1-215	Cable external freezing test	Method F15
60794-1-216	Compound flow (drip)	Method F16
60794-1-217	Cable shrinkage test (fibre protrusion)	Method F17
60794-1-218	Mid-span temperature cycling test for exposed buffer tubes	Method F18
60794-1-219	Material compatibility	Method F19

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Table A.3 – IEC 60794-1-3xx series

New IEC 60794-1-3xx series number	Title	IEC 60794-1-23 method number
60794-1-301	Bend test for cable elements	Method G1
60794-1-302	Ribbon dimensions and geometry – Visual method	Method G2
60794-1-303	Ribbon dimensions – Aperture gauge	Method G3
-	Ribbon dimensions – Dial gauge (deleted)	Method G4
60794-1-305	Ribbon tear (separability)	Method G5
60794-1-306	Ribbon torsion	Method G6
60794-1-307	Tube kinking	Method G7
60794-1-308	Ribbon residual twist test	Method G8
60794-1-309	Bleeding and evaporation	Method G9
60794-1-310	Stripping	Method G10
	Stripping force stability of cabled optical fibres	Method G10A
	Strippability of optical fibre ribbons	Method G10B
	Strippability of buffered optical fibres	Method G10C
60794-1-311	Tensile strength and elongation at break of buffer tubes and micro tubes	Method G11A
60794-1-312	Elongation of buffer tubes and micro tubes at low temperature	Method G11B

Table A.4 – IEC 60794-1-4xx series

New IEC 60794-1-4xx series number	Title	IEC 60794-1-24 method number
60794-1-401	Short-circuit test (for OPGW and OPAC)	Method H1
60794-1-402	Lightning test method for optical aerial cables along electric power lines (OPGW and OPAC)	Method H2
60794-1-403	Electrical continuity test of cable metallic elements	Method H3

Table A.5 – IEC 60794-1-21 method numbers

IEC 60794-1-21 method number	Title	New IEC 60794-1-Xxx series number
Method E1	Tensile performance	60794-1-101
Method E2	Abrasion	60794-1-102
Method E2A	Abrasion resistance of optical fibre cable sheaths	60794-1-102 Method A
Method E2B	Abrasion resistance of optical fibre cable markings	60794-1-102 Method B
Method E3	Crush	60794-1-103
Method E3A	Plate/plate	60794-1-103 Method A
Method E3B	Mandrel/plate	60794-1-103 Method B
Method E4	Impact	60794-1-104
Method E5A	Stripping force stability of cabled optical fibres	60794-1-105
Method E5B	Strippability of optical fibre ribbons	60794-1-313
Method E5C	Strippability of buffered optical fibres	60794-1-314
Method E6	Repeated bending	60794-1-106
Method E7	Torsion	60794-1-107

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IEC 60794-1-21 method number	Title	New IEC 60794-1-Xxx series number
Method E8	Flexing	60794-1-108
Method E9	Snatch (deleted)	-
Method E10	Kink	60794-1-110
Method E11	Bend	60794-1-111
Method E11A	Standard test procedure	60794-1-111 Method A
Method E11B	Alternative test procedure	60794-1-111 Method B
Method E12	Cut-through resistance (deleted)	-
Method E13	Shotgun damage	60794-1-113
Method E13A	Shotgun test	60794-1-113 Method A
Method E13B	Shotgun simulation	60794-1-113 Method B
Method E14	Compound flow (drip)	60794-1-216
Method E15	Bleeding and evaporation	60794-1-309
Method E16	[Title unknown] (deleted)	-
Method E17	Bending stiffness	60794-1-117
Method E17A	Three-point bend	60794-1-117 Method A
Method E17B	Cantilever bend	60794-1-117 Method B
Method E17C	Buckling bend	60794-1-117 Method C
Method E18A	Bending under tension	60794-1-118
Method E18B	Sheave test (primarily for OPGW and OPAC)	60794-1-135
Method E19	Aeolian vibration	60794-1-119
Method E20	Cable coiling performance	60794-1-120
Method E21	Sheath pull-off force for optical fibre cable for use in patch cords	60794-1-121
Method E22	Buffered fibre movement under compression in optical fibre cables for use in patch cords	60794-1-122
Method E23	Microduct route verification test	60794-1-123
Method E24	Installation test for microduct cabling	60794-1-124
Method E25	Rip cord functional test	60794-1-125
Method E26	Galloping	60794-1-126
Method E27	Indoor simulated installation test	60794-1-127
Method E28	Cable and fibre mechanical reliability test	60794-1-128
Method E29	Straight midspan access to optical elements	60794-1-129
Method E30	Coefficient of friction between cables	60794-1-130
Method E31	Microduct inner clearance test	60794-1-131
Method E32	Creep behaviour tension test (for ADSS)	60794-1-132
Method E33	Multiple cable coiling and uncoiling performance	60794-1-133
Method E34	Coefficient of dynamic friction between cables	60794-1-134

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Table A.6 – IEC 60794-1-22 method numbers

IEC 60794-1-22 method number	Title	New IEC 60794-1-2xx series number
Method F1	Temperature cycling	60794-1-201
Method F2	Deleted	-
Method F3	Deleted	-
Method F4	Deleted	-
Method F5	Water penetration	60794-1-205
Method F5A	Water penetration (circumferential)	60794-1-205 Method A
Method F5B	Water penetration (end-on)	60794-1-205 Method B
Method F5C	Water penetration (end-on, for cables with swellable water blocking material)	60794-1-205 Method C
Method F6	Deleted	-
Method F7	Nuclear radiation	60794-1-207
Method F8	Pneumatic resistance	60794-1-208
Method F9	Ageing	60794-1-209
Method F10	Underwater cable resistance to hydrostatic pressure	60794-1-210
Method F11	Sheath shrinkage	60794-1-211
Method F12	Temperature cycling of cables to be terminated with connectors	60794-1-212
Method F13	Microduct pressure-withstand	60794-1-213
Method F14	Cable UV resistance test	60794-1-214
Method F15	Cable external freezing test	60794-1-215
Method F16	Compound flow (drip)	60794-1-216
Method F17	Cable shrinkage test (fibre protrusion)	60794-1-217
Method F18	Mid-span temperature cycling test for exposed buffer tubes	60794-1-218
Method F19	Material compatibility	60794-1-219

Table A.7 – IEC 60794-1-23 method numbers

IEC 60794-1-23 method number	Title	New IEC 60794-1-3xx series number
Method G1	Bend test for cable elements	60794-1-301
Method G2	Ribbon dimensions and geometry – Visual method	60794-1-302
Method G3	Ribbon dimensions – Aperture gauge	60794-1-303
Method G4	Ribbon dimensions – Dial gauge (deleted)	-
Method G5	Ribbon tear (separability)	60794-1-305
Method G6	Ribbon torsion	60794-1-306
Method G7	Tube kinking	60794-1-307
Method G8	Ribbon residual twist test	60794-1-308
Method G9	Bleeding and evaporation	60794-1-309
Method G10	Stripping	60794-1-310
Method G10A	Stripping force stability of cabled optical fibres	60794-1-310 Method A
Method G10B	Strippability of optical fibre ribbons	60794-1-310 Method B
Method G10C	Strippability of buffered optical fibres	60794-1-314 Method C
Method G11	Tensile strength and elongation at break of buffer tubes	60794-1-311
Method G11A	Elongation of buffer tubes at low temperature	60794-1-312

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Table A.8 – IEC 60794-1-24 method numbers

IEC 60794-1-24 method number	Title	New IEC 60794-1-4xx series number
Method H1	Short-circuit test (for OPGW and OPAC)	60794-1-401
Method H2	Lightning test method for optical aerial cables along electric power lines (OPGW and OPAC)	60794-1-402
Method H3	Electrical continuity test of cable metallic elements	60794-1-403

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