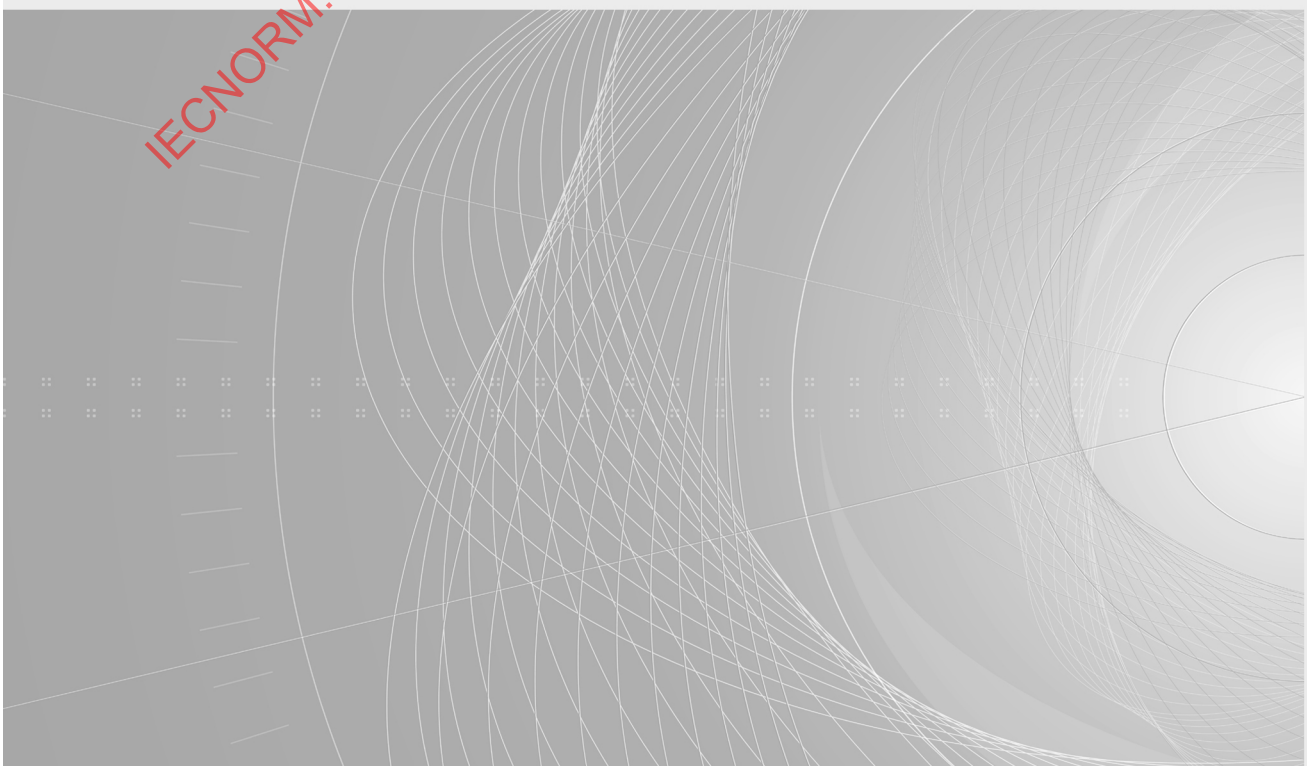
IEC 60794-1-31

Edition 1.0 2018-05

INTERNATIONAL STANDARD

Optical fibre cables –
Part 1-31: Generic specification – Optical cable elements – Optical fibre ribbon



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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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FOREWORD

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International Standard IEC 60794-1-31 has been prepared by subcommittee SC86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

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

CDV	Report on voting
86A/1806/CDV	86A/1840/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 document 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 website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

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OPTICAL FIBRE CABLES –

Part 1-31: Generic specification – Optical cable elements – Optical fibre ribbon

1 Scope

This part of IEC 60794, which is a generic specification, covers optical fibre ribbons. Requirements which are described in this part apply to optical fibre ribbon cables for use with telecommunication equipment and devices employing similar techniques, in particular optical fibre cables in IEC 60794-2 for indoor use and in IEC 60794-3 for outdoor use. Detailed specifications for each application are given in IEC 60794-2 and IEC 60794-3.

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 60304, *Standard colours for insulation for low-frequency cables and wires*

IEC 60793-2-10, *Optical fibres – Part 2-10: Product specifications – Sectional specification for category A1 multimode fibres*

IEC 60793-2-50, *Optical fibres – Part 2-50: Product specifications – Sectional specification for class B single-mode fibres*

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

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

IEC 60794-2, *Optical fibre cables – Part 2: Indoor cables – Sectional specification*

IEC 60794-3, *Optical fibre cables – Part 3: Outdoor cables – Sectional specification*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms, definitions, symbols and abbreviated terms 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 Requirements

4.1 General

Optical fibre ribbons are optical fibres which can be assembled in a composite linear array.

Fibres shall be arranged in parallel and formed into ribbons of typically four, six, eight, twelve, sixteen, twenty-four or thirty-six fibres each according to user requirements, and shall be capable of mass splicing.

Some parameters shall be measured in the ribbon since the corresponding tests on the primary coated fibre or finished cable are not sufficient for complete characterization. These parameters are identified below.

4.2 Construction

4.2.1 Ribbon structure

Ribbon structures are typically designated as edge-bonded, encapsulated or partially-bonded. Edge-bonded and encapsulated structures are differentiated by the amount of buffering afforded to the fibres by the bonding agent. The partially-bonded ribbon may be of either structure but with the buffer applied periodically.

Figure 1 illustrates the edge-bonded structure in which the bonding agent is applied predominantly between the fibres. Figure 2 illustrates the encapsulated structure in which the bonding agent extends well beyond the extreme surface of any fibre. Figure 3 illustrates the partially-bonded structure in which neighbouring fibres are fixed together periodically in the longitudinal direction.

The edge-bonded and encapsulated ribbons are predominantly rigid in the transverse direction. The partially-bonded structure enables the optical fibre ribbon to be rolled up easily and accommodated very tightly in cables.

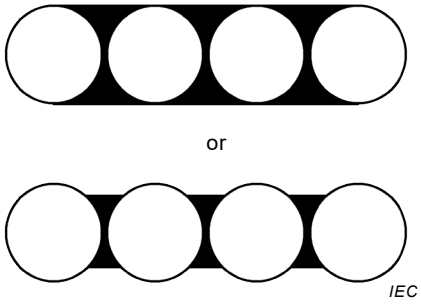


Figure 1 – Cross-section of a typical edge-bonded ribbon (thinner ribbon)

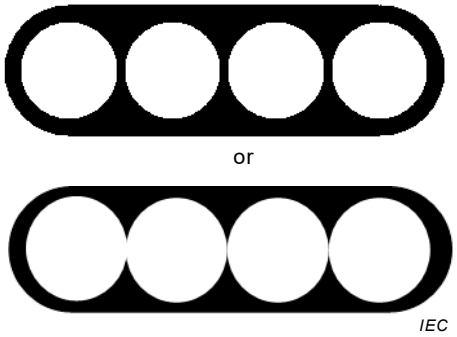


Figure 2 – Cross-section of a typical encapsulated ribbon (thicker ribbon)

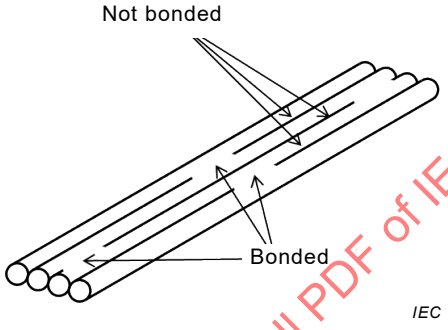


Figure 3 – Overview of a typical partially-bonded ribbon

4.2.2 Optical fibres

Category A1 multimode fibres which meet the requirements of IEC 60793-2-10 or Category B single-mode optical fibres which meet the requirements of IEC 60793-2-50 shall be used. Diameter over the fibre coating is typically 250 μm. Other fibres may be used to construct ribbons meeting the intent of this specification.

NOTE Dimensions for ribbons with fibre coatings other than the typical 250 μm can be established between the customer and supplier. There exist alternative coating diameters (such as 200 μm) which can be used and require additional considerations with respect to connectivity and tools.

4.3 Dimensions

Unless otherwise specified in the detail specification, the maximum dimensions and the structural geometry of optical fibre ribbons shall be as shown in Table 1. The definitions of each dimension are defined in IEC 60794-1-23 and illustrated in Figure 4.

Table 1 – Maximum dimensions of optical fibre ribbons for a typical 250 μm coating fibre

Number of fibres[a]	Width	Height		
			Extreme fibres	Planarity
	w	*h*	*b*	*p*
	μm	μm	μm	μm
4	1 220	360	786	50
6	1 648	360	1 310	50
8	2 300[c]	380	1 834	50
12	3 400	380	2 882	75
16	4 400	380	Per 8-fibre unit[b]	Per 8-fibre unit[b]
24	6 500	380	Per 12-fibre unit[b]	Per 12-fibre unit[b]
32[d]	4 400	ffs [e]	Per 8-fibre unit[b]	Per 8-fibre unit[b]
36	9 800	380	Per 12-fibre unit[b]	Per 12-fibre unit[b]

If the ribbon has flexibility, for example in the case of having a partially-bonded configuration, the dimensions of the ribbon should be measured under the condition of which tested ribbon is aligned to be a coplanar. The example of a typical partially-bonded ribbon is illustrated in Figure 3.

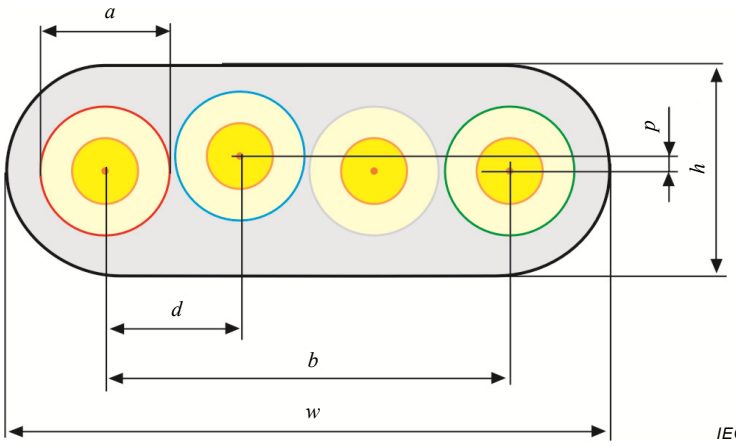
[a] Dimensions for other ribbons with fibre counts not listed above should be established between the customer and supplier.

[b] Per unit values are measured with the ribbon separated into the intended sub-units.

[c] Maximum width shall be 2 300 in case the 8-fibre ribbon can be separated into two four-fibre sub-units.

[d] A thirty-two-fibre ribbon consists of two layers of sixteen-fibre ribbons.

[e] ffs= for further specification.



Key

a diameter of a coloured fibre

w width of that area

h height of that area

d distance between adjacent fibres

b distance between the extreme fibres

p planarity of the ribbon which is defined as the sum of the absolute values of the maximum positive and maximum negative vertical separation from the basis line

Considering the precision of fibre geometric attributes and the relatively larger precision of ribbon geometry requirements, it is acceptable for glass core/glass cladding fibres to use the edge of the cladding for the measurements according to Table 1, and as illustrated in Figure 4, in lieu of the fibre centres. In this case, the measurements shall be made on the same side of all fibres (e.g. top or bottom, left or right side). This is consistent with IEC 60794-1-23, method G2.

NOTE The maximum dimensions and the structural geometry of optical fibre ribbons for a typical 200 μm coating fibre are currently under study.

Figure 4 – Example of cross-sectional drawing illustrating fibre ribbon geometry (4-fibre ribbon)

More stringent requirements may be agreed between the customer and supplier, as needed, depending on the splice or the connector technique employed.

The dimensions and structural geometry can be verified with a type test, described as the visual measurement method (IEC 60794-1-23, method G2), to establish and assure proper control of the ribbon manufacturing process. Once the process is established, and in order to ensure functional performance, the width and height of the ribbons may be controlled and verified, for final inspection purposes, with an aperture gauge (IEC 60794-1-23, method G3) or by the visual measurement method.

4.4 Mechanical requirements

4.4.1 General

Detailed specifications of an optical fibre ribbon shall be verified by application, such as indoor and outdoor use, which are described in the sectional specifications documents for optical cables. Optical fibre ribbon shall satisfy specifications and be tested as indicated below.

4.4.2 Separability of individual fibres from a ribbon

Fibre breakout capability at some level is generally required. Some ribbons of any type may be intended to be separated into predefined units. Specific requirements for breakout and separability shall be as specified in the detail specifications.

The ribbons shall be constructed in such a way that fibres can be separated from the ribbon construction, into sub-units or individual optical fibres, as specified in the detail specification, while meeting the following criteria:

- the ribbon shall be tested for the ability to break out individual fibres using the tear (separability) test shown in IEC 60794-1-23, method G5, or a method agreed upon between the customer and supplier;
- end breakout shall be accomplished without specialized tools or apparatus;
- mid-span breakout shall be accomplished following the ribbon manufacturers' procedures;
- the fibre breakout procedure shall not be permanently detrimental to the optical and mechanical performance of the fibre;
- any colour coding of fibres shall remain sufficiently intact within any 25 mm segment to enable individual fibres to be distinguished from each other.

4.4.3 Ribbon stripping

The coating of individual fibres as well as the residual ribbon bonding material shall be easily removable by an adequate stripping method, preferably thermal stripping. The ribbon bonding materials and primary coating layers should be removed as a "strip" to avoid excess dust generation. The method of removal shall be agreed between the customer and supplier or shall be defined in the detail specification.

4.4.4 Torsion

The mechanical and functional integrity of a fibre ribbon can be verified by carrying out the torsion test shown in IEC 60794-1-23, method G6.

4.5 Identification of ribbon

4.5.1 General

Each fibre within a ribbon cable shall be uniquely identifiable using some scheme of ribbon identification and fibre identification within a ribbon. Common schemes include ribbon coding by printed legends, ribbon positioning (tubes, slots, etc.), fibre positional colour coding, colour coded matrix, and fibre colour coding within a ribbon. The scheme shall be defined in the detail specification.

4.5.2 Identification by positional identification

If positional identification is specified, the scheme may follow the scheme described below and illustrated in Figure 5. The fibre shall be distinguishable by means of colour coding and positioning. For example (see Figure 5):

a) a fibre ribbon has an identification coloured fibre on one side of the ribbon and a sub-identification coloured one on the other side or has two identification coloured fibres on one side. A sub-identification colour code can be used when the optical fibre ribbons are larger in number than the identification colour code;

b) any colour of the identification fibre colours group is different from that of the sub-identification fibre colours group. The side of the identification colours group corresponds to fibre no. 1 in the ribbon;

c) the colour types and the order used for identification and sub-identification should be agreed between the customer and the supplier. The colours of the other fibres shall be agreed between the customer and the supplier;