

TECHNICAL REPORT



Fibre optic interconnecting devices and passive components – Study of an SC connector adaptor with safety lock mechanism

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE
COMPONENTS – STUDY OF AN SC CONNECTOR ADAPTOR
WITH SAFETY LOCK MECHANISM**

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The text of this Technical Report is based on the following documents:

Draft	Report on voting
86B/4883/DTR	86B/4922/RVDTR

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 Technical Report 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.

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INTRODUCTION

Since the very beginning of fibre optic communication technologies, the use of optical connectors has been restricted to technical and professional environments by expert crews for installation, operation, and maintenance.

With the diffusion of fibre optic communication technologies in non-professional and consumer markets, the use of fibre optic communication systems has broadened to users unaware of their correct handling, particularly for the most accessible items: connector cords.

For standard SC connectors, unintentional disconnection is prevented if the pulling force applied to the plug connector is lower than 40 N. Beyond this force, a disconnection occurs, and inconveniences can arise: system optical performance can be impaired; dust can corrupt the ferrules; and radiation that can be harmful to the eye.

A shuttered adaptor is a means to avoid injury to the eyes by laser light and provides protection from dust when the plug is disconnected, but it does not protect the disconnected connector.

This document deals with a proposal that aims to solve this problem with a slight modification of the SC connector adaptor, by introducing a latching mechanism.

Once the latching mechanisms has been unlocked by means of a tool, the disconnection strength is the same as a standard plug connector.

When the latching mechanisms is locked, it withstands the force applied by a typical handling force, i.e. <150 N.

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – STUDY OF AN SC CONNECTOR ADAPTOR WITH SAFETY LOCK MECHANISM

1 Scope

This document deals with a new proposal for an SC adaptor connector which includes a flexible retaining element on its top surface, compared to the SC standard adaptor.

With this solution, when the SC plug connector is in place, any accidental disconnection is difficult, as it employs an external tool or a particular unlocking manoeuvre.

This new adaptor is intended primarily for the home network customer optical fibre termination, but it can be used in every situation where safety issues are important (e.g. main distribution frames in central offices, cross-connect cabinets, street cabinets, termination boxes).

It consists of a push-latch-pull mating sequence connection with the assistance of a suitable tool.

This solution assures compatibility with the existing SC interface standard according to IEC 61754-4.

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 61754-1, *Fibre optic interconnecting devices and passive components – Fibre optic connector interfaces – Part 1: General and guidance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61754-1 apply.

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

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

4 Description

The SC adaptor connector described in interface IEC 61754-4-2 has an open insertion groove to accept the guide key of the plug connector.

A flexible locking projection is added to the top surface of the standard SC adaptor connector.

This flexible locking projection has a slide on the internal surface to facilitate the entry of the plug connector guide key into the closed groove.

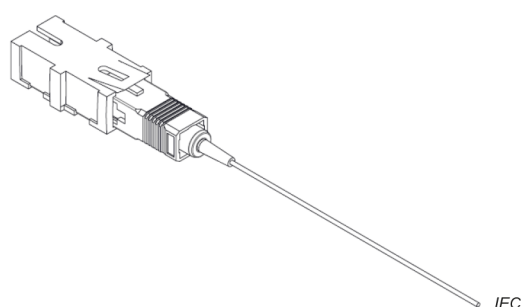
Once the plug connector is completely inserted, the guide key is blocked by the edge of the closed groove, creating a safety lock mechanism that prevents accidental disconnection of the connector. When ready to disconnect the SC optical plug connector, a suitable tool is used to slip under the flexible projection to lift the latch, enabling disconnection.

In addition, the flexible locking projection has a slipway that can also be used to accept a tool for the disconnection of the SC optical plug connector.

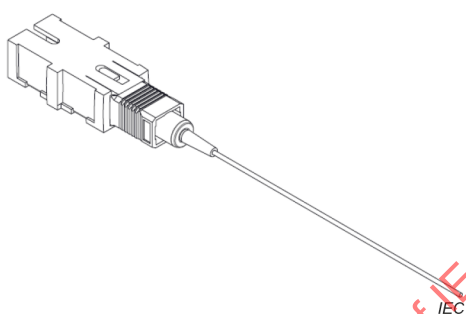
Figure A.1 to Figure A.5 in Annex A illustrate the proposed SC adaptor connector with safety lock mechanism.

Figure 1 shows the functionality of the locking system.

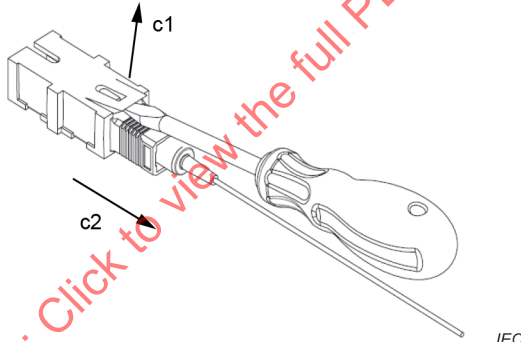
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a) Plug insertion



b) Plug connected



c) Plug disconnection by a suitable tool

Key

- c1 Lift up the latch
- c2 Pull the plug

NOTE When the plural adaptors are mounted side by side, the mounting pitch for each adaptor can be considered in order to maintain a space in which the flexible locking projections can operate. Figure A.4 and Figure A.5 show the examples of the plural adaptors are mounted.

Figure 1 – Simplex SC adaptor connector interface with safety lock mechanism

5 Interface

The new adaptor proposal described in this document relates to an external modification of the interface IEC 61754-4-2: simplex adaptor connector interface – push/pull. It can also be applied to interface IEC 61754-4-4: duplex adaptor connector interface – push/pull.

Figure 2 is an example of a simplex adaptor connector interface with the safety lock mechanism. Table 1 gives the information of the relevant dimensions of the safety lock mechanism.

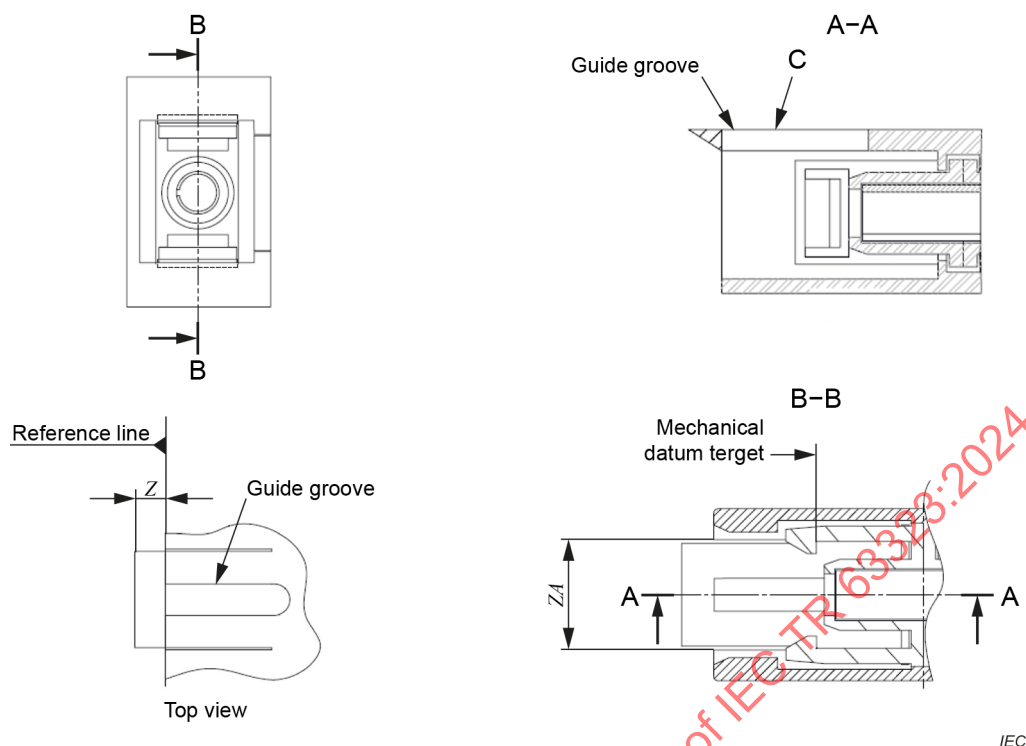


Figure 2 – An example of simplex adaptor with safety lock mechanism

Table 1 – Dimensions of the simplex adaptor connector interface and relevant dimensions of the safety lock mechanism

Reference	Dimensions in millimetres		Remarks
	Minimum	Maximum	
Z	2,5	NA	Length of the flexible locking projection up to the reference line ^a that coincides with the planes of adaptor front face.
ZA	7,0	8,0	Width of the flexible locking projection less than the width of the plug connector (8,89 mm to 8,99 mm) ^a
^a Additional dimensions to supplement IEC 61754-4:2022, Table 5.			

Annex B describes a worst-case calculation of the maximum allowable displacement of the delatch housing before delatching from the adaptor clips and the worst-case length of the safety lock projection for typical SC connectors available in the market. Figure B.1 shows the delatching sequence.

6 Intermateability

The addition of the safety lock projection to the adaptor body does not modify the intermateability characteristics of the adaptor.

As the length of the guide key of the plug connector is not defined, all the plug connectors with the length of guide key greater than the length of the closed guide groove of the adaptor will mate but will not activate the safety mechanism.

Annex A (informative)

Example of safety lock adaptor and use

Figure A.1 to Figure A.5 illustrate the functions of the simplex adaptor with a safety lock mechanism.

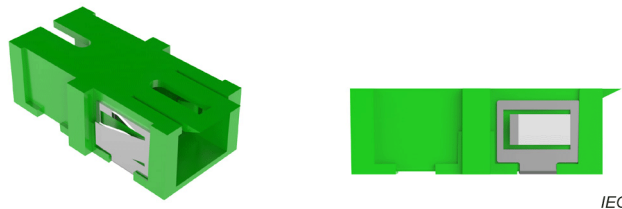


Figure A.1 – Simplex adaptor

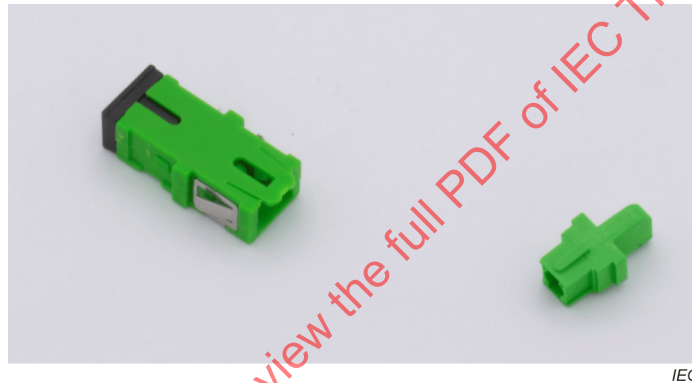


Figure A.2 – Simplex adaptor with specific safety dust cap



Figure A.3 – Simplex adaptor connected to the plug connector



Figure A.4 – Four simplex adaptors stacked in a termination box

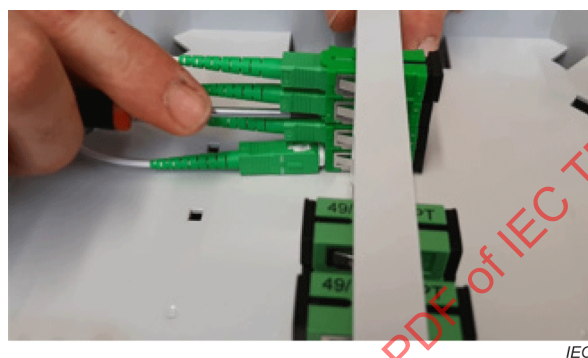


Figure A.5 – Disconnection of simplex adaptor stacked in a termination box

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Annex B (informative)

Delatching condition calculation

Annex B describes a worst-case calculation of the maximum allowable displacement of the delatch housing before delatching from the adaptor clips, and the worst-case length of the safety lock projection for typical SC connectors available in the market. Figure B.1 shows the delatching sequence.

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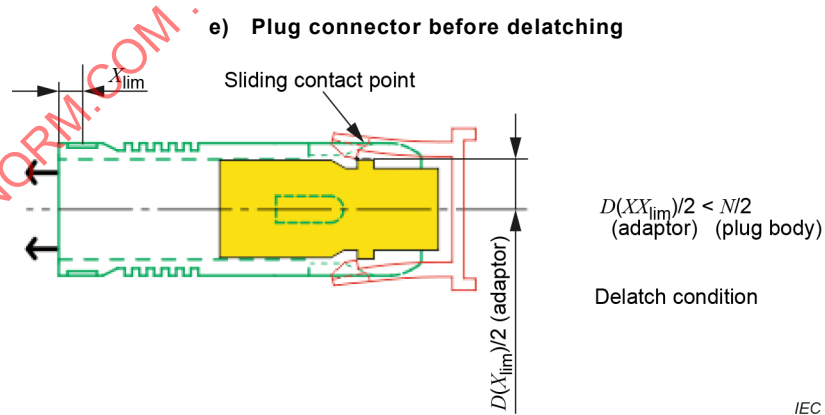
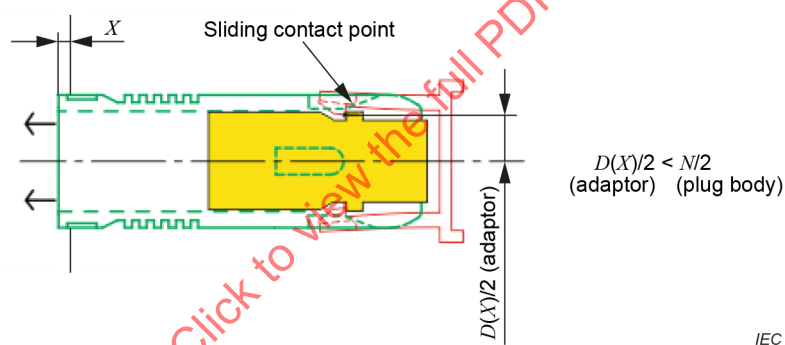
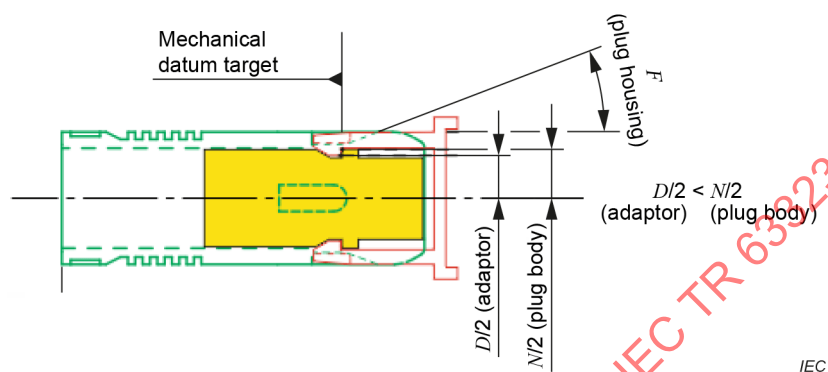
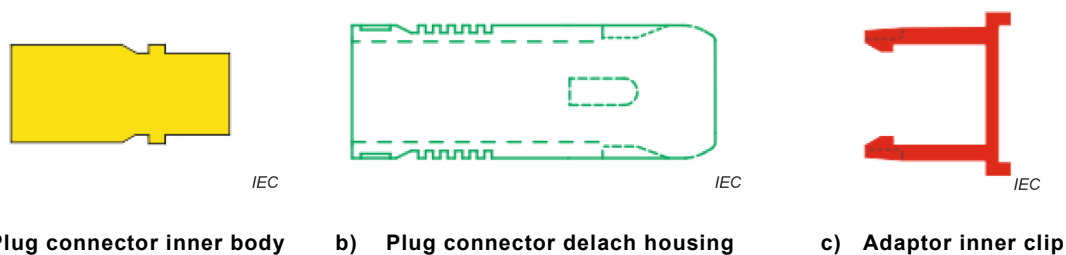


Figure B.1 – Delatching sequence

Displacement of the outer plug connector delatch housing before the delatching of the inner plug body from the clips of the adaptor X_{lim} is calculated using Formula (B.1).

$$X_{lim} = \frac{(N-D)}{2\tan(F)} \quad (B.1)$$

According to Table B.1 and Table B.2, when N is 6,6 mm, F is 23° and D is 5,5 mm, the value of X_{lim} is the worst-case. In the worst-case, X_{lim} is 1,3 mm according to Formula (B.1).

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Table B.1 – Dimensions of the simplex PC plug connector interface

Reference	Dimensions		Remarks
	Minimum	Maximum	
<i>A</i>	See IEC 61754-4:2022, Table 4		
<i>B</i>	4,8 mm	4,9 mm	
<i>C</i>	6,8 mm	7,4 mm	
<i>D</i>	4,9 mm	5,3 mm	
<i>E</i>	6,7 mm	6,8 mm	
<i>F</i>	19°	23°	Angle, unit in degrees
<i>G</i>	25°	35°	Angle, unit in degrees
<i>H</i>	7,15 mm	7,5 mm	^a
<i>I</i>	0,8 mm	1,2 mm	
<i>J</i>	5,3 mm	5,5 mm	
<i>K</i>	–	0,05 mm	
<i>L</i>	2,11 mm	–	^b
<i>M</i>	2,0 mm	2,8 mm	^{b c}
<i>N</i>	6,6 mm	6,8 mm	
<i>O</i>	1,6 mm	1,8 mm	
<i>P</i>	8,89 mm	8,99 mm	
<i>Q</i>	0,80 mm	1,0 mm	
<i>R</i>	7,29 mm	7,39 mm	
<i>S</i>	0,80 mm	0,90 mm	Radius
<i>T</i>	4,05 mm	4,15 mm	
<i>U</i>	5,4 mm	5,6 mm	
<i>V</i>	0 mm	0,5 mm	^b
<i>BC</i>	0 mm	0,5 mm	Chamfer or round
<i>BF</i>	See IEC 61755-3-1		Radius ^d
<i>BG</i>	See IEC 61755-3-1		Diameter
<i>BI</i>	25°	35°	Angle, unit in degrees
^a Dimension <i>H</i> is given for plug endface when not mated. The ferrule is movable by a certain axial compression force, with direct contacting endfaces, and therefore dimension <i>H</i> is variable. Ferrule compression force shall be 7,8 N to 11,8 N when dimension <i>H</i> is 7,0 mm ± 0,1 mm. The compression force shall be measured according to IEC 61300-3-22.			
^b The delatch housing shall be movable to the right or left. Dimensions <i>L</i> , <i>M</i> and <i>V</i> are given when the delatch housing is at the furthest right. Dimension <i>M</i> shall be negative, when the delatch housing is at the furthest left.			
^c The right end of <i>M</i> shall be at the left of the mechanical datum target when the delatch housing is at the furthest left.			
^d Dome eccentricity of the spherical polished endface shall be less than 50 µm.			
SOURCE: IEC 61754-4:2022, Table 3.			