BS EN 50411-3-1:2012

BSI Standards Publication

Fibre organisers and closures to be used in optical fibre communication systems — Product specifications

Part 3-1: Fibre management system, splice wall box, for category C & G

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National foreword

This British Standard is the UK implementation of EN 50411-3-1:2012.

The UK participation in its preparation was entrusted to Technical Committee GEL/86/2, Fibre optic interconnecting devices and passive components.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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English version

Fibre organisers and closures to be used in optical fibre communication systems - Product specifications - Part 3-1: Fibre management system, splice wall box, for category C & G

Organiseurs et boîtiers de fibres destinés à être utilisés dans les systèmes de communication par fibres optiques - Spécifications de produits - Partie 3-1: Système de gestion de fibres, boîtier mural d'épissures, pour les catégories C & G

LWL-Spleißkassetten und -Muffen für die Anwendung in LWL-Kommunikationssystemen - Produktnormen - Teil 3-1: Faser Management System, Wandspleißverteiler für die Kategorien C und G

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CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

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Tables

Foreword

This document (EN 50411-3-1:2012) has been prepared by CLC/TC 86BXA "Fibre optic interconnect, passive and connectorised components".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-05-28
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2015-05-28

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Fibre organisers and closures to be used in optical fibre communication systems – Product specifications
Part 3-1: Fibre management system, splice wall box, for category C & G

Description	**Typical installation application**
Construction: Wall mounted box	**Track box** (2 cables minimum) **Spur box** (3 cables minimum) **Distribution box** (6 cables minimum).
Performance	
Applications: Optical fibre cable networks For indoor; for external above ground;	**IEC 61753-1:2007, category C** IEC 61753-1:2007, category G

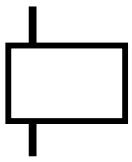
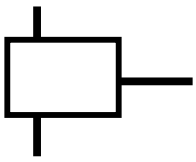
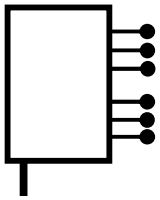
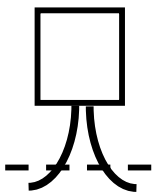
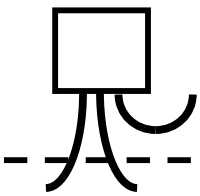
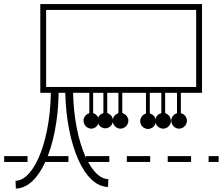
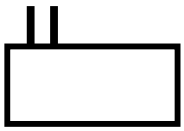
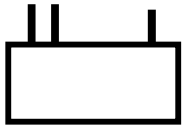
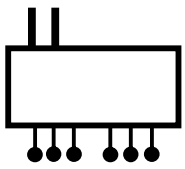
Fibre separation level - FMS splice trays:

Single circuit (>2 fibres per tray),
Single element (>12 fibres per tray),
Multiple element (>144 fibres per tray)
Single ribbon (>4 fibres per tray),
Multiple ribbon (>144 fibres per tray)

For reference on how fibre separation levels fits into the modularity of FMS organisers, see also FMS organiser options in Annexes C to E

Construction and splice tray capacity:

FMS –Number splice trays (maximum) – for each fibre separation level – SC, SE, SR, ME and MR

	S organiser			**M organiser**	
Number of trays needed for:	**Single circuit SC (4f)**	**Single element SE (12f)**	**Single ribbon SR (4f)**	**Multiple element ME (144f)**	**Multiple ribbon MR (144)**
Typical capacity 12 fibres	6	1	3	1	1
Typical capacity 144 fibres	36	12	36	1	1(12 f/R)
Box type - minimum no of cable entries:	**Track box - 2**		**Spur box - 3**		**Distribution box - 6**
Schematic diagrams (Cable entries can be in any orientation)					
Typical installations A Street cabinet or external configurations					
Typical installations B Office internal configurations					

1 Scope

1.1 Product definition

This European Standard covers wall boxes for up to 288 fibre splices. Wall boxes for connectors will be covered in a future part of the EN 50411-3 series.

This European Standard covers two environmental service requirements, for use inside a building under category C and externally of buildings under category G both to EN 61753-1:2007.

This European Standard contains the initial, start of life dimensional, optical, mechanical and environmental performance requirements of a fully installed optical fibre wall box, in order for it to be categorised as an EN standard product.

The wall box must be suitable for fixing to a vertical internal or external surface above ground level.

The wall box is a housing containing a fibre management system, containing splice trays of various fibre separation levels, and may contain one or more of the following:

- storage and/or routing of cable;
- through-box/uncut fibre, cable storage;
- passive devices.

This document specifies the number of splice trays for each fibre separation level.

1.2 Operating environment

The tests selected combined with the severity and duration is representative of indoor and outside plant for above ground environments defined by:

EN 61753-1: - category C: Controlled environment

- category G: Ground level environment

1.3 Reliability

Whilst the anticipated service life expectancy of the product in this environment is 20 years, compliance with this European Standard does not guarantee the reliability of the product. This should be predicted using a recognised reliability assessment programme.

1.4 Quality assurance

Compliance with this European Standard does not guarantee the manufacturing consistency of the product. This should be maintained using a recognised quality assurance programme.

1.5 Allowed fibre and cable types

All types of fibre are permitted for a FMS with a minimum bend radius of 30 mm. A minimum bend of 20 mm can only be used with a B 6 fibre. The box, once tested according to this product specification, will be also suited for other fibre types, for example bend insensitive, dispersion shifted, non-zero dispersion shifted and multimode fibres.

This wall box standard allows both single-mode and multi-mode fibre to be used and covers all IEC standard optical fibre cables with their various fibre capacities, types and designs as long as fitting in the box does not contravene the minimum bend radius.

The minimum bend radius of fibre depends on its type, and is applicable for all operational wavelengths:

- EN 60793-2-10, Type A1 multimode fibre is 30 mm;
- EN 60793-2-50, Type B 1.1 and B 1.3 singlemode fibre is 30 mm; (20 mm is accepted for total lengths less than 2 m)
- EN 60793-2-50, Type B6-a1, B6-a2 singlemode fibre (ITU-T G.657) is 20 mm (15 mm is accepted for total lengths less than 0,5 m)

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50411-2	*Fibre organisers and closures to be used in optical fibre communication systems — Product specifications — Part 2: General and guidance for optical fibre cable joint closures, protected microduct closures, and microduct connectors*
EN 60529	*Degrees of protection provided by enclosures (IP Code)(IEC 60529)*
EN 60695-11-10	*Fire hazard testing — Part 11-10: Test flames — 50 W horizontal and vertical flame test methods (IEC 60695-11-10)*
EN 60793-2-50:2008	*Optical fibres — Part 2-50: Product specifications — Sectional specification for class B single-mode fibres (IEC 60793-2-50:2008)*
EN 60793-2-10	*Optical fibres — Part 2-10: Product specifications — Sectional specification for category A1 multimode fibres (IEC 60793-2-10)*
EN 60794-2	*Optical fibre cables — Part 2: Indoor cables — Sectional specification (IEC 60794-2)*
EN 60794-3	*Optical fibre cables — Part 3: Sectional specification — Outdoor cables (IEC 60794-3)*
EN 61034-1	*Measurement of smoke density of cables burning under defined conditions — Part 1: Test apparatus (IEC 61034-1)*
EN 61300-2-1	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 2-1: Tests — Vibration (sinusoidal) (IEC 61300-2-1)*
EN 61300-2-4	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 2-4: Tests — Fibre/cable retention (IEC 61300-2-4)*
EN 61300-2-9	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 2-9: Tests — Shock (IEC 61300-2-9)*
EN 61300-2-12:2009	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 2-12: Tests — Impact (IEC 61300-2-12:2009)*
EN 61300-2-22	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 2-22: Tests — Change of temperature (IEC 61300-2-22)*
EN 61300-2-26	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 2-26: Tests — Salt mist (IEC 61300-2-26)*
EN 61300-2-33	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 2-33: Tests — Assembly and disassembly of fibre optic closures (IEC 61300-2-33)*
EN 61300-2-34	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 2-34: Tests — Resistance to solvents and contaminating fluids of interconnecting components and closures (IEC 61300-2-34)*
EN 61300-3-1	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 3-1: Examinations and measurements — Visual examination (IEC 61300-3-1)*

EN 61300-3-3:2009	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 3-3: Examinations and measurements — Active monitoring of changes in attenuation and return loss (IEC 61300-3-3:2009)*
EN 61300-3-28	*Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 3-28: Examinations and measurements — Transient loss (IEC 61300-3-28)*
EN 61753-1:2007	*Fibre optic interconnecting devices and passive components performance standard — Part 1: General and guidance for performance standard (IEC 61753-1:2007)*
EN 61756-1	*Fibre optic interconnecting devices and passive components — Interface Standard for fibre management systems — Part 1: General and guidance (IEC 61756-1)*
EN 61758-1	*Fibre optic interconnecting devices and passive components — Interface standard for closures — Part 1: General and Guidance (IEC 61758-1)*
IEC 60754-2	*Test on gases evolved during combustion of materials from cables — Part 2: Determination of acidity (by pH measurement) and conductivity*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
fibre splicing management system
assembly of fibre splicing cassettes built in such a way that the routing of fibres and the storage of the fibres and fibre splices is done in a controlled way. Controlled means in this case that the mechanical stress is controlled by ensuring a minimum bending radius of the fibres.

3.1.2
single circuit fibre management system
fibre system separation level, that is down to the individual customer level achieving the minimum of customer circuit disturbance

3.1.3
cable element
grouping of fibres under the cable sheath

3.2 Abbreviations

PS	Product Specification
OD	Outside Diameter
ID	Inside Diameter
FMS	Fibre Management System

4 Description

4.1 Optical fibre wall box housing

An optical fibre wall box comprises a housing that is attached to wall and the ends of the joined cable sheath. The wall box has a means of containing and protecting the fibres, splices, and other passive optical devices.

Wall boxes used for blowing cable or fibre comprises an access housing that allows the interconnection of cable microducts or tubes where the ends of the microducts or cables containing empty tubes are contained. The wall box also contains an FSM.

The fibre management wall box provides facilities for the environmental protection, housing for fibre management systems and sealing of input and output optical cables for category G. In order to comply with the standard, the optical functionality, physical, geometrical and mechanical requirements are defined.

The following table illustrates the concept of a single wall box design/size being able to accommodate various fibre separation levels in a splice wall box for SC and SE.

Table 1 — Common wall box sizes with splice capacities for fibre separation levels SC and SE

	EN 50411-3-1			
Compatible tray/box envelope (size)	**Number Splices** (SC)	**Number trays** SC (2 fibres/tray)	**Number splices** (SE)	**Number trays** SE (12 fibres/tray)
A and F	**8**	4	**24**	2
A and H	**24**	12	**72**	6
C and K	**48**	24	**144**	12
D and N	**96**	48	**288**	24

The design of the wall box housing shall allow the jointing of two or more cable ends in the following configurations or applications:

Common wall boxes covering:

(T) Track wall box configuration used on customer feed cable with a minimum of 2 cable entries specified for each wall box size in the tables, typical when joining two cables along a track.

(S) Spur wall box configuration used on local feeder cable with minimum of 3 cable entries, typically a cable drop off point to along a track feeder cable.

(D) Distribution wall box configuration used on a local feeder cable with a minimum of 6 cable entries to distribute smaller cables to different locations.

NOTE Cable entries can be more than one cable per cable entry port.

The design of the wall box housing shall allow the joining together of at least one pair of cables which are not at the end of a cable section, without cutting all fibres between both cable openings. This application is generally known as distribution joint or external node, but also called a mid-span or balloon splice wall box.

It is desirable that the wall box can be re-opened when necessary without interruption or disturbance of the traffic of the live circuits.

4.2 Cable seals/fixings

For category G the cable entry or exit ports in the wall box must have a sealing and fixing system that can be either:

a) Dedicated heat activated with heat source, for example, electrical, infrared, hot air or flame:
   1) thermo-shrinkable materials;
   2) hot melt adhesives;
   3) polyethylene injection welding;

b) Cold applied:
   1) mastic, tapes, pastes, potting compounds, gels and cold adhesives;
   2) o-rings, grommets, rubber shapes, pre-expanded tubing are cold processes;

c) Combined heat activated and cold applied:

1) The optical fibre wall box allows for a physical housing structure that provides for optical cable fixing, sealing, anchoring, water and gas blocking, storage and routing up to the input and output fibres of the fibre or microduct management system.

4.3 FMS organiser system

The organiser system provides means for routing, storing and protecting of fibre splices or other passive optical devices in a predetermined order, from one cable sheath opening to another.

Fibre circuits may be separated to an appropriate separation level. This will limit the risk of interruption of traffic to those fibres that belong to the same group of circuits.

- **Single circuit (SC)** is a fibre management system that is a group of fibres providing 1 termination or service of 1 or 2 fibres. In this document a Single Circuit is considered to be a circuit of 2 fibres. If the separation level for one termination is more than 2 fibres, then the appropriate number of fibres can be stored on one tray of the single circuit system.

- **Single element (SE)** is a fibre management system that is a cable subassembly comprising one or more optical fibres inside a common covering e.g. tube or inside one groove of a grooved cable (slotted core cable). Single Elements provide more than one termination or circuit of typically 12 fibres. In this document a Single Element is considered to be a group of 12 fibres.
- **Single ribbon (SR)** is a fibre management system that is a cable subassembly comprising one optical ribbon. Single Ribbon is a group of fibres providing one termination or service of typically 4, 8 or 12 fibres.

- **Multiple element (ME)** is a fibre management system that provides all necessary equipment to connect a defined number of incoming and outgoing fibres/cables. It comprises storage and protection of fibres and interconnections in one splice tray for more than one Single Element. Typically splice tray capacities between 24 and 144 fibres.

- **Multiple ribbon (MR)** fibre management provides all necessary equipment to connect a defined number of incoming and outgoing fibre ribbons that are generally housed within a singe tube or slot within the cable. This tube is fixed to the entry and exit ports of the splice tray. It comprises storage and protection of more than one single ribbon, but typically six or more fibre ribbons and their interconnections in a single splice tray for ribbons between 4 and 36 fibres, but typically 12 fibre ribbons. There are also many different names for this structure, e.g. mass storage or mass ribbons. Typically splice tray capacities are between 36 and 144 fibres.

NOTE The families of organiser systems covered in this document are listed in Annex C.

4.4 Air blown fibre microduct management system

Air blown fibre microduct and protected microduct cables storage and connection systems for microducts, outside diameters from 3 mm to 16 mm.

4.5 Storage and retrieval of fibre and cable element systems

The storage and retrieval of fibre and cable elements within the wall box, typically are one of the following types; single or multiple fibre bundles, ribbons fibres, fibre units, microducts, protected microducts and conventional slotted core, loose tube, compact, ribbon, and hybrid cables.

4.6 Passive optical components

Passive optical components that may be installed inside a FMS splice tray, or in a seperately mounted cartridge or cassette. Typical passive devices system include, wave division multiplexers (WDM), fan outs and other unpowered devices.

4.7 Materials

All materials that are likely to come in contact with personnel shall meet appropriate health and safety regulations.

Wall box and sealing materials shall be compatible with each other and with the materials of the cables.

All components of the wall box shall be resistant to solvents and degreasing agents that are typically used to clean and degrease fibres and cables.

For category G wall boxes, the effects of UV light and fungi on all exposed polymeric materials shall not affect product performance. The effects of fungus and UV light shall be determined by measuring a suitable property (e.g. tensile strength) both before and after exposure.

Metallic parts shall be resistant to the corrosive influences they may encounter during the lifetime of the product.

4.8 Marking and identification

Marking/identification of the 'variant number' (see Clause 4) to be on the product or packaging label along with the following:

a) identification of manufacturer;

b) manufacturing date code: year / month.

There is no preferred colour for the outer wall box material. If a specific colour is required it should be specified to the supplier separately from the 'variant number'.

5 Variants

Table 2 — Optical fibre wall box Type 1, for category C and G - variants

EN 50411-3-1– X_1 — XX_2 — XX_3 —–XX_4 – X_5 – [XX_4 – XX_5] – X_6 – X_7

NOTE 1 For multiple organiser systems **XX_4**, with more than one fibre separation level, each must specify the number of splice trays supplied for each. (example, SE-02 + SC-12, or SE-06 + SC-72+ME-01).

Variant No. X_1	Operating environment
C	Controlled environment (indoor)
G	Ground level environment (outdoor)
B	both controlled and ground level environments

NOTE 2 Additional tests 12a and 12b are required for operating environments C and B covering; flammability, halogen acid gas content and corrosivity as well as smoke density of wall box materials.

Variant No. XX_2	Splice tray minimum fibre storage radius
20	20 mm storage radius for EN 60793-2-50 B6a fibres
30	30 mm storage radius for all fibre types

Variant No. XX_3	**Configuration type** (application and minimum number of ports)
T	Track wall box (2 cables minimum)
S	Spur wall box (3 cables minimum)
D1	Distribution wall box (8 cables minimum)

D2	Distribution wall box (10 cables minimum)
D3	Distribution wall box (18 cables minimum)
D4	Distribution wall box (34 cables minimum)
D5	Distribution wall box (66 cables minimum) (to cover higher fibre count cables, up to 288 fibre capacity)

Variant No. XX_4	**Type of organiser system, (fibre separation level)**	
SC	Single circuit (1 or 4 single fibres)	**S** organisers NOTE in some cases an M organiser tray can be used as SC or SE organiser tray (by reducing number of stored splices per tray);
SE	Single element (12 single fibres)	
SR	Single ribbon (4 or more fibres per ribbon)	
ME	Multiple element (two or more SE units)	**M** organisers
MR	Multiple ribbon (six or more ribbons 4 fibres per ribbons)	

Variant No. XX_5	**Number of FMS splice trays (The maximum number of trays depends on the size and capacity of the box as specified by variants X_7)**
01 to 99	Number of splice trays

Variant No. X_6	**Cable element storage required**
Y	Yes
N	No

Depending on the selection of XX_3, refer to one of the following Tables 3, 4, 5, 6, 7, 8 and 9 to find XX_4 and X_7 (wall box size).

Table 3 — SC Splice tray and wall box selection (2 fibres per tray)

SC trays XX_5 →				04	12	16	20	24	32	36	40	48
Maximum splice capacity (reference) →				8	24	32	40	48	64	72	80	96
X_7 Wall box	Maximum box dimensions mm											
	Wide	Height	Depth									
A	270	340	100	■	■							
B	380	420	180	■	■	■	■					
C	350	510	150	■	■	■	■	■	■			
D	400	600	200	■	■	■	■	■	■	■		
E	460	600	180	■	■	■	■	■	■	■	■	■

Table 4 — SE tray and wall box selection (12 fibres per tray)

SE trays XX_5 →				2		4	6	8	10	12	16	20	24
Maximum splice capacity (ref)				24		48	72	96	120	144	192	240	288
X_7 Wall box	Maximum box dimensions mm												
	Wide	Height	Depth										
F	190	340	60	■									
G	400	350	150	■	■	■							
H	260	400	90	■	■	■	■						
J	330	240	130	■	■	■	■	■					
K	460	610	210	■	■	■	■	■	■	■			
L	400	550	180	■	■	■	■	■	■	■	■		
M	600	300	300	■	■	■	■	■	■	■	■	■	
N	460	600	180	■	■	■	■	■	■	■	■	■	■

Table 5 — SR tray and wall box selection (12 fibres per ribbon/tray)

XX_5 → SR trays				02		04	06	07	08	12	16	18	20	24
Maximum splice capacity (ref)				24		48	72	84	96	144	192	216	240	288
X_7 Wall box	Maximum box dimensions mm													
	Wide	Height	Depth											
P	380	390	180											
Q	380	460	180											
R	380	530	180											
S	380	600	180											

Table 6 — ME splice tray and wall box selection (24 fibres per tray)

ME trays XX_5 →				6
Maximum splice capacity (ref)				144
X_7 Wall box	Maximum box dimensions mm			
	Wide	Height	Depth	
T	150	290	70	

Table 7 — ME splice tray and wall box selection (36 fibres per tray)

ME trays XX_5 →				4	8
Maximum splice capacity (ref)				144	288
X_7 Wall box	Maximum box dimensions mm				
	Wide	Height	Depth		
T	150	290	70		

Table 8 — ME splice tray and wall box selection (144 fibres per tray)

ME trays XX_5 →				1	2
Maximum splice capacity (ref)				144	288
X_7 Wall box	Maximum box dimensions mm				
	Wide	Height	Depth		
V	270	270	310		

Table 9 — MR splice tray and wall box selection (36 fibres per tray)

XX_5→ MR trays				4	8
Maximum splice capacity (ref)				144	288
X_7 Wall box	Maximum box dimensions mm				
	Wide	Height	Depth		
W	270	340	150		

This product specification concerns organisers of only one “type of organiser system” at a given fibre separation level in parameter XX_4. If multiple “types of organisers/levels” in a single wall box are required when ordering; then, typically double the number of SC trays can be inserted in the same organiser envelope as an SE.

Therefore;

Maximum splice capacity ≥ 2 * (number of SC trays) + 12 * (number of SE trays)

Part number format;

EN 50411-3-1– X_1 — XX_2 — X_3 — [XX_4 – XX_5] – X_6 – X_7

Three typical examples as follows;

1) EN 50411-3-1 –- C – 30 – T– [SC – 36] – N

Controlled indoor environment, 30 mm bend radius track wall box, 36 single circuit trays and no cable storage requirement.

2) EN 50411-3-1 – B – 30 – S – [SC – 06] + [SE–01] – N

Both indoor and outdoor environments, 30 mm bend radius, spur wall box, 6 single circuit trays plus 1 Single element tray, and no cable storage requirement.

3) EN 50411-3-1 – G – 20 – D – [SE – 12] – Y

Ground level outdoor environment, 20 mm bend radius Building Distribution box, 12 single element trays and a cable storage requirement.

6 Dimensional requirements - Dimensions of distribution wall box - Fibre splice wall boxes

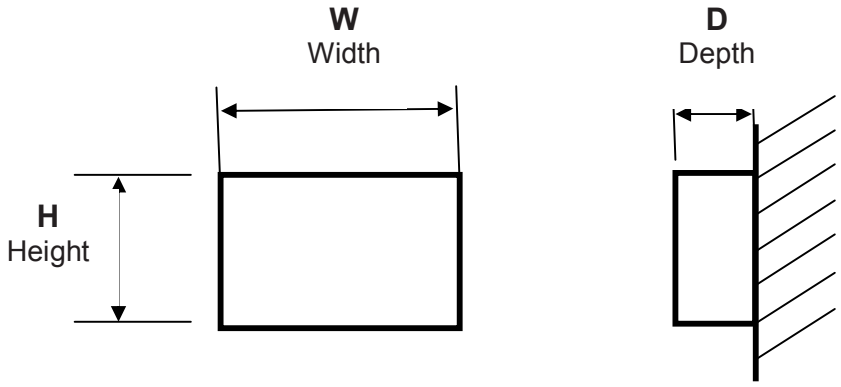


Figure 1 — Dimensions of distribution wall box - Fibre splice wall boxes

See also the cable port orientation from the schematic diagrams in the title page to illustrate some typical applications.

Table 10 — Distribution wall box - Fibre splice wall box dimensions

Wall box size	Number of fibres max.					Maximum overall box dimensions mm		
	SC	SE	SR	ME	MR	Wide	Height	Depth
A	24					270	340	100
B	40					380	420	180
C	64					350	510	150
D	72					400	600	200
E	96					460	600	180
F		24				190	360	60
G		48				400	350	150
H		72				260	400	90
J		96				330	240	130
K		144				460	610	210
L		192				400	550	180
M		240				600	300	300
N		288				460	600	180
P			72			380	390	180
Q			96			380	460	180
R			192			380	530	180
S			288			380	600	180
T (24F/T)				144		150	290	70
T (36F/T)				288		150	290	70
V (144F/T)				288		270	270	310
W (36F/T)					288	270	340	150

NOTE F/T = fibres per tray.

7 Tests

7.1 Sample size

Separate test samples for sealing performance and optical evaluation may be used. For the purposes of this standard, a sealing performance test sample is defined as a wall box installed with several cable ends.

Optical test samples shall be constructed as described in 7.2. Due to their complexity, consecutive testing on the same optical sample is allowed.

The minimum recommended sample sizes are given in Annex B.

7.2 Test sample preparation

Sealing performance test samples shall be installed with cables and/or tubes. The length of the cables and tubes extending from the boxes shall be at least 1 m. The open ends of the cables and tubes shall be sealed. Each applicable cable type with minimum and maximum cable dimensions shall be represented in the test program.

Optical test samples shall be constructed in such a way that they will cover all allowed functions of a wall box. This shall be realised by building optical circuits for each fibre separation level (typical SC, SE, SR, ME or MR splicing) and interconnection method (fibre splice or connectors). The fibres for the optical test samples with 30 mm fibre storage radius are covered in Annex A - Table A.1. The fibres for the optical test samples with 20 mm fibre storage radius are covered in Annex A - Table A.2.

Optical test sample construction:

Both extremities of a looped cable are terminated in the track wall box (see Figure 2).

The length of the cable is chosen in such a way that it is longer than the “dead zone” of an OTDR. The required cable length depends on the selected pulse width and dynamic range of the OTDR. Typically a cable length of 25 m to 50 m is applied for this purpose. This will allow finding the location of the potential causes of optical losses and differentiating if a change in signal is induced by the fibre management system in a single location or distributed over the whole circuit length.

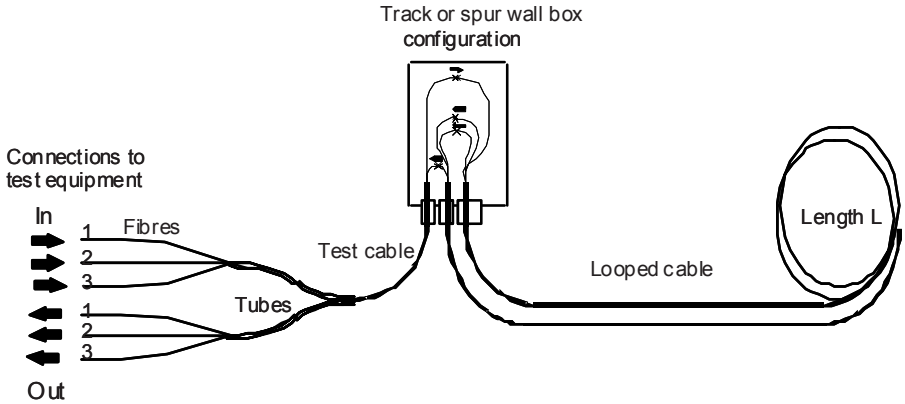


Figure 2 — Track or spur wall box configuration sample

In the track or spur wall box the fibres from one cable end are connected to the fibres of the other cable end in such a way that light will sequentially flow through 10 selected fibres in the cable loop. The first and the last fibre of this circuit will be spliced to the fibres of a drop cable for making external connections to a light source and optical power meter.

All relevant fibre separation levels (SC, SE, SR, ME or MR) are to be represented in the test sample, preferably in separate circuits. If the separation level for one termination is more than 2 fibres, then the appropriate number of fibres can be stored on one tray of the single circuit system.

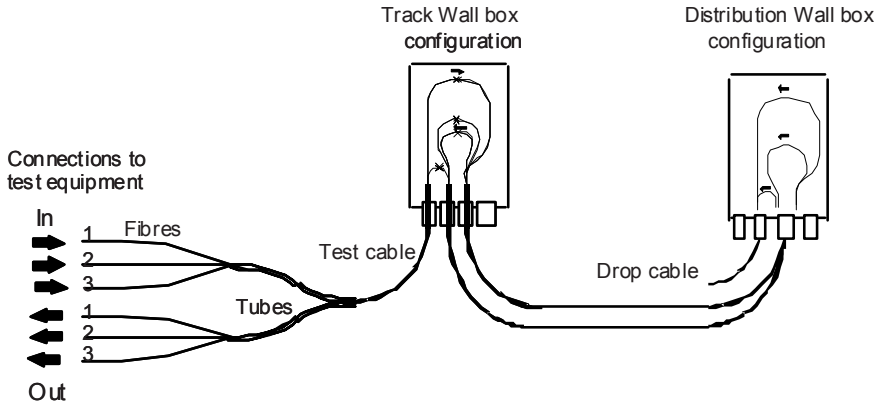


Figure 3 — Distribution wall box configuration sample

In the middle of the looped cable, the cable jacket will be removed over a distance (= window cut) according to the installation instructions (see Figure 3). The bundle of uncut fibres will be inserted and stored inside the distribution wall box. If uncut fibres can be stored in different separation levels (SC, SE, SR, ME or MR), each of these options shall be executed, preferably in separate circuits.

Non-active fibres of the cables will be installed in the wall box and the fibres will be stored randomly in the fibre management system in between the uncut fibres. These fibres will be accessed again during the intervention/reconfiguration test 15.

7.3 Test and measurement methods

All tests and measurements have been selected from EN 61300 series.

Unless otherwise stated in the individual test details, all attenuation measurements shall be performed at 1 310 nm ± 25 nm, 1 550 nm ± 25 nm and 1 625 nm ± 25 nm for the environmental optical tests, and at 1 550 nm ± 25 nm and 1 625 nm ± 25 nm for the mechanical optical tests.

All optical losses indicated are referenced to the initial attenuation at the start of the test.

An “incoming fibre” is defined as a part of an optical circuit containing the fibre entering the product, spliced to a fibre leaving the product. One optical circuit can contain many “incoming fibres”. Light will sequentially flow through all “incoming fibres”.

No deviation from the specified test method is allowed.

7.4 Test sequence

There is no defined sequence in which tests 6 – 16 must be run. Number of tests - check this number after completion of Table 11.

7.5 Pass/fail criteria

A product will have met the requirements of this standard provided no failures occur in any test. In the event of a failure occurring on an intrusion performance test sample, the test shall be re-run using a sample size double that of the original.

Due to the complexity of the optical test samples, consecutive testing on the same optical sample is allowed. In case of a failure during the consecutive testing, a new sample shall be prepared and the failed test shall be redone, if this fails again the qualification procedure has to be redone completely.

8 Test report

A fully documented test report and supporting data shall be prepared and must be available for inspection as evidence that the tests described in Clauses 6 and 9 have been carried out in accordance with this standard.

9 Performance requirements

9.1 Dimensional and marking requirements

Dimensions and marking of the product shall be in accordance with the requirements of Clause 6 and shall be measured using the appropriate EN test method.

9.2 Sealing, optical and appearance performance criteria

Table 11 — Sealing, optical and appearance performance criteria (1 of 2)

No.	Test	Category	Requirement	Details	
1	Intrusion resistance	C	IP 3x No intrusion of objects or wires with diameter larger that 2,5 mm	Method:	EN 60529
				Test temperature:	23 °C ± 3 °C
				Pre-conditioning procedure:	Sample should be conditioned to room temperature for at least 2 h.
		G	IP 5x No intrusion of dust allowed	Method:	EN 60529
				Test temperature:	23 °C ± 3 °C
2	Water intrusion resistance	C	IP x0 No accumulation of water allowed	Method:	EN 60529
		G	IP x4 No ingress of water when exposed to splashing of water from all sides	Method:	EN 60529
				Test temperature:	23 °C ± 3 °C
				Pre-conditioning procedure:	Sample should be conditioned to room temperature for at least 4 h.
3	Visual appearance	C & G	No defects which would affect functionality of the wall box	Method: Examination:	EN 61300-3-1 Product shall be checked with naked eye.
4	Change in attenuation (NOTE 1, NOTE 2)	C & G	Excursion losses: δIL ≤ 0,2 dB at 1 310 nm and 1 550 nm per incoming fibre during test δIL ≤ 0,5 dB at 1 625 nm per incoming fibre during test Residual losses: δIL ≤ 0,1 dB at 1 310 nm, 1 550 nm and 1 625 nm per incoming fibre after test	Method: Wavelengths: Source stability: Detector linearity: Measurements required: Sampling rate:	EN 61300-3-3:2009, Method 1 1 310 nm ± 25 nm 1 550 nm ± 25 nm 1 625 nm ± 25 nm Within ± 0,05 dB over the measuring period Within ± 0,05 dB over the dynamic range to be measured Before, during and after the test Every 10 min

Table 11 — Tightness, optical and appearance performance criteria (2 of 2)

No.	Test	Category	Requirement	Details	
5	Transient loss (NOTE 1)	C & G	Transient losses: $\delta IL \leq 0,5$ dB at 1 550 nm per active circuit during test $\delta IL \leq 1$ dB at 1 625 nm per active circuit during test Residual losses: $\delta IL \leq 0,1$ dB at 1 550 and 1 625 nm per active circuit after test	Method: Wavelengths: Source stability: Detector linearity: Measurements required: Active circuit:	EN 61300-3-28 1 550 nm ± 25 nm 1 625 nm ± 25 nm Within ± 0,05 dB over the measuring period Within ± 0,05 dB over the dynamic range to be measured Before, during and after the test 10 incoming fibres in series

NOTE 1 All optical losses indicated are referenced to the initial attenuation at the start of the test.

NOTE 2 An “incoming fibre” is defined as a part of an optical circuit containing the fibre entering the product, spliced to a fibre leaving the product. One optical circuit can contain many “incoming fibres”. Light will sequentially flow through all “incoming fibres”.

9.3 Mechanical sealing performance requirements

Table 12 — Mechanical optical performance requirements

No.	Test	Category	Requirement	Details	
6	Vibration	C & G	Intrusion performance (test 1 and 2) Visual appearance (test 3)	Method:	EN 61300-2-1
				Frequency range:	5 Hz - 500 Hz at 1 octave/min
				Amplitude / acceleration force:	1.5 mm or 0.5 g_n maximum
				Cross-over frequency:	9 Hz
				Number of sweeps	10 sweeps (5-500-5)
				Number of axes:	3 mutually perpendicular
				Test temperature:	23 °C ± 3 °C
				Pre-conditioning procedure:	Sample should be conditioned to room temperature for at least 4 h.
7	Cable retention	C&G	Intrusion performance (test 1 and 2) Visual appearance (test 3)	Method:	EN 61300-2-4
				Test temperatures:	23 °C ± 3 °C for category C -15 °C ± 2 °C and +45 °C ± 2 °C for category G
				Load:	Patchcord or work area cable: 25 N Cables: $\varnothing_{Cable}$ (mm)/45*500N or 500 N maximum Tubes: 25N
				Duration:	1 h per cable
				Pre-conditioning procedure:	Sample should be conditioned to specified temperature for at least 4 h.
8	Impact	C & G	Intrusion performance (test 1 and 2) Visual appearance (test 3)	Method:	EN 61300-2-12:2009, Method B
				Test temperatures:	+23 °C ± 3 °C for category C -15 °C ± 2 °C and +45 °C ± 2 °C for category G
				Impact tool:	Steel ball of 0,5 kg
				Drop height:	1 m
				Impact locations:	In the middle of the front side
				Number of impacts:	1 per location
				Pre-conditioning procedure:	Sample should be conditioned to specified temperature for at least 4 h.
9	Re-entries	C & G	Intrusion performance (test 1 and 2) Visual appearance (test 3)	Method:	EN 61300-2-33
				Test temperature:	+23 °C ± 3 °C
				Conditioning between each re-entry:	Ageing of minimum 1 temperature cycle as specified in test 16
				Number of re-entries:	10

9.4 Environmental sealing performance requirements

Table 13 — Environmental sealing performance requirements

No.	Test	Category	Requirement	Details	
10	Change of temperature	C	Intrusion performance (test 1 and 2) Visual appearance (test 3)	Method: Extreme temperatures: Dwell time: Rate of change Number of cycles:	EN 61300-2-22 -10 °C ± 2 °C and +60 °C ± 2 °C 4 h 1 °C/min 5
		G	Intrusion performance (test 1 and 2) Visual appearance (test 3)	Method: Extreme temperatures: Dwell time: Rate of change Number of cycles:	EN 61300-2-22 -40 °C ± 2 °C and +65 °C ± 2 °C 4 h 1 °C/min 20
11	Salt mist	G	Sealing performance (test 1) Visual appearance (test 3)	Method: Test temperatures: Salt solution: Duration:	EN 61300-2-26 +35 °C ± 2 °C 5 % NaCl (pH 6,5-7,2) 5 days
12	Resistance to solvents and contaminating fluids	G	On material test samples only Visual appearance (test 3)	Method: Test temperatures: Submersion in: Drying time at 70 °C: Duration:	EN 61300-2-34 +23 °C ± 3 °C HCl at pH 2 NaOH at pH 12 None 5 days
12a	Flammability	C	On material test samples only V0 or V1 rating	Method:	EN 60695-11-10
12b	Zero halogen	C	On material test samples only Halogen content ≤ 5mg/g	Method :	IEC 60754-2
12c	Smoke emission	C	On material test samples only Minimum light transmittance 60 %	Method:	EN 61034-1

9.5 Mechanical optical performance requirements

Table 14 — Mechanical optical performance requirements

No	Test	Category	Requirement	Details	
13	Vibration (sinusoidal)	C & G	Transient loss (test 5) Visual appearance (test 3)	Method: Test temperature: Frequency range: Amplitude / acceleration force: Cross-over frequency: Number of sweeps Number of axes: Optical circuit:	EN 61300-2-1 +23 °C ± 3 °C 5 Hz - 500 Hz at 1 octave/min 1,5 mm or 0,5 g_n maximum 9 Hz 10 sweeps (5-500-5) 3 mutually perpendicular 10 live fibres placed in series
14	Shock	C & G	Transient loss (test 5) Visual appearance (test 3)	Method: Severity: Duration: Wave form: Number of shocks: Axes: Optical circuit:	EN 61300-2-9 15 g 11 milliseconds Half sine 3 per axis 3 mutually perpendicular 10 live fibres placed in series
15	Intervention and reconfiguration	C & G	Transient loss (test 5) Visual appearance (test 3) Operations shall be carried out on fibres in splice trays, installed between other active splice trays (that contain the 10 live fibres). For the distribution joint configuration only Circuit separation (type of organiser system) defined by parameter XX_4 in Table 2.	Method: Test temperature: Operations: Optical circuit:	EN 61300-2-33 +23 °C ± 3 °C All manipulations that will normally occur during an intervention after initial installation. These are typically: 1) open box; 2) gaining access to previously installed fibres in the fibre management system; 3) adding/installing patchcord or drop cables; 4) break splice and connect to other fibre; 5) cut one or more uncut fibres and splice them to other fibres; 6) adding splicing trays. 7) close box 10 live fibres placed in series

9.6 Environmental optical performance requirements

Table 15 — Environmental optical performance requirements

No.	Test	Category	Requirement	Details	
16	Change of temperature	C	Change in attenuation (test 4) Visual appearance (test 3)	Method:	EN 61300-2-22
				Low temperature:	-10 °C ± 2 °C
				High temperature:	+60 °C ± 2 °C
				Duration at temperature extreme:	4 h
				Rate of change of temperature:	1 °C/min
				Number of cycles:	5
				Measurements required:	Before, during (max. interval 10 min) and after the test
				Recovery procedure:	4 h at normal ambient conditions
		G	Change in attenuation (test 4) Visual appearance (test 3)	Method:	EN 61300-2-22
				Low temperature:	-40 °C ± 2 °C
				High temperature:	+65 °C ± 2 °C
				Duration at temperature extreme:	4 h
				Rate of change of temperature:	1 °C/min
				Number of cycles:	20
				Measurements required:	Before, during (max. interval 10 min) and after the test
				Recovery procedure:	4 h at normal ambient conditions

Annex A
(informative)

Fibre for test sample details

Table A.1 — Fibre references

Fibre type	EN 60793-2-50:2008, Type B1.1 Dispersion unshifted single mode fibre
Proof stress strain:	≥ 1 %
Mode field diameter at 1 310 nm:	9,3 µm ± 0,7 µm
Mode field diameter at 1 550 nm:	10,5 µm ± 1,0 µm
Cabled fibre cut off wavelength:	≤ 1 260 nm
1 550 nm loss performance:	< 0,5 dB for 100 turns on 60 mm mandrel diameter
Cladding diameter:	125 µm ± 1 µm
Non coloured primary coating diameter:	245 µm ± 10 µm
Coloured primary coating diameter:	250 µm ± 15 µm

Table A.2 — Fibre references

Fibre type	EN 60793-2-50:2008, Type B6a Low bend loss single mode fibre
Proof stress strain:	≥ 1 %
Mode field diameter at 1 310 nm:	Between 8,2 µm and 9,8 µm
Cabled fibre cut off wavelength:	≤ 1 260 nm
1 625 nm bend loss performance:	< 1 dB for 10 turns on 30 mm mandrel diameter < 1,5 dB for 1 turn on 20 mm mandrel diameter
Cladding diameter:	125,0 µm ± 0,7 µm
Non coloured primary coating diameter:	245 µm ± 10 µm
Coloured primary coating diameter:	250 µm ± 15 µm

Annex B
(informative)

Sample size and product sourcing requirements

Table B.1 — Minimum sample size requirements

No.	Test	Sample size	
		Sealing performance	Optical
NA	Dimensional	3	NA
1	Sealing performance	Criterion	NA
2	Pressure loss during test	Criterion	NA
3	Visual appearance	Criterion	Criterion
4	Change in attenuation	NA	Criterion
5	Transient loss	NA	Criterion
6	Vibration (sinusoidal)	3	NA
7	Cable retention	3	NA
8	Impact	3	NA
9	Re-entries	3	NA
10	Change of temperature	3	NA
11	Salt mist	3	NA
12	Resistance to solvents and fluids	3	NA
13	Vibration (sinusoidal) (optical)	NA	1
14	Shock	NA	1
15	Intervention and reconfiguration (optical)	NA	1
16	Change of temperature (optical)	NA	1
NA = Not Applicable.			

Tests 1 to 5 are performance criteria tests that need to be performed during other mechanical or environmental tests (6 to 16).

Annex C
(informative)

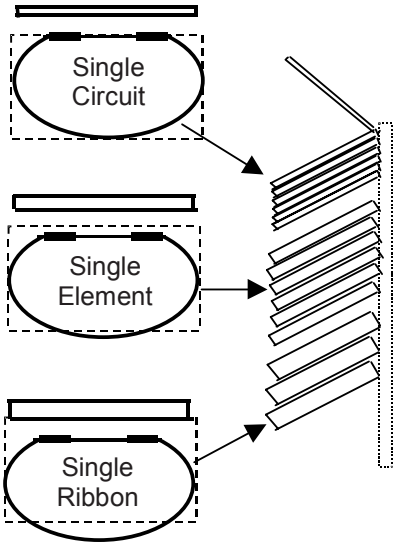
Families of organiser systems covered in this standard

'Tree' style organiser (see Figure C.1a))
Small hinged angled, semicircular, rectangular or oval tray profiles for:
Single Circuit (SC), Single Element (SE) and Single Ribbon (SR)

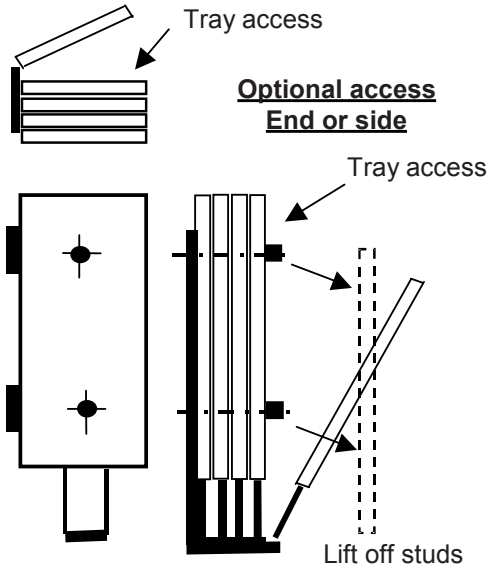
'Book' style organiser (see Figure C.1b))
Medium to large hinged or stacked rectangular tray profiles for:
Multiple Element (ME) and Multiple Ribbon (MR)

'Juke box' style organiser (see Figure C.1c))
Large circular or rectangular tray profiles for:
Single Circuit (SC), Single Element (SE), Single Ribbon (SR), Multiple Element (ME) and Multiple Ribbon (MR)

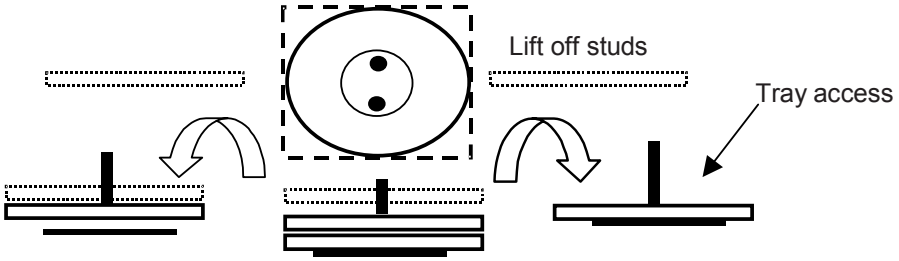
'Shelf' style organiser (see Figure C.1d))
Small pull out semicircular, rectangular or oval tray profiles for:
Single Circuit (SC), Single Element (SE)



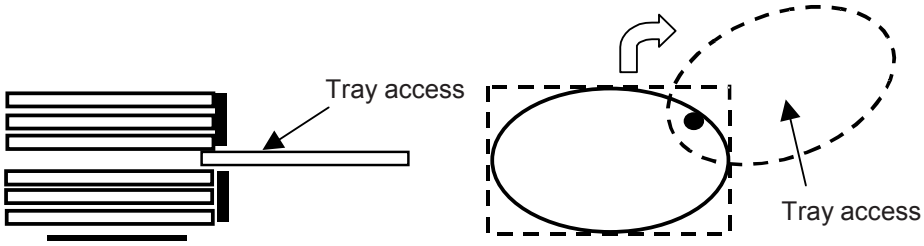
a) 'Tree' style organiser



b) 'Book' style organiser



c) 'Juke box' style organiser



d) – 'Shelf' style organiser

Figure C.1 — 'Tree', 'Book', 'Juke box' and 'Shelf' style organisers

Annex D
(informative)

Dimensions of organisers for multiple elements and multiple ribbon

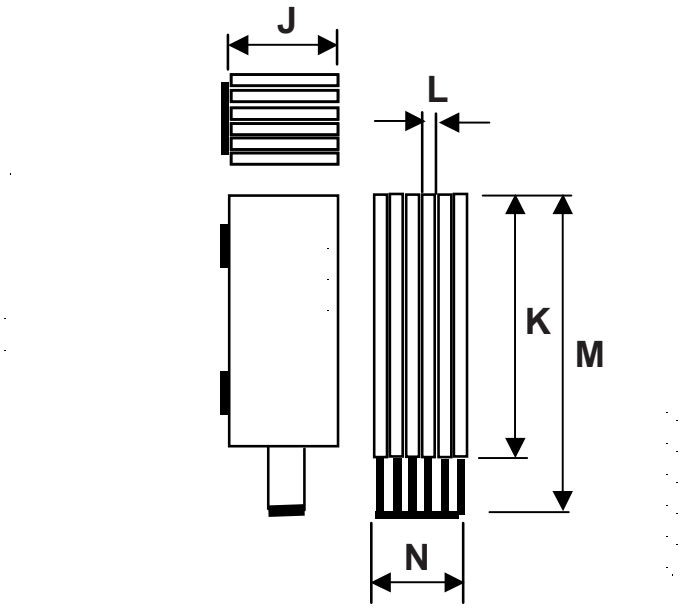


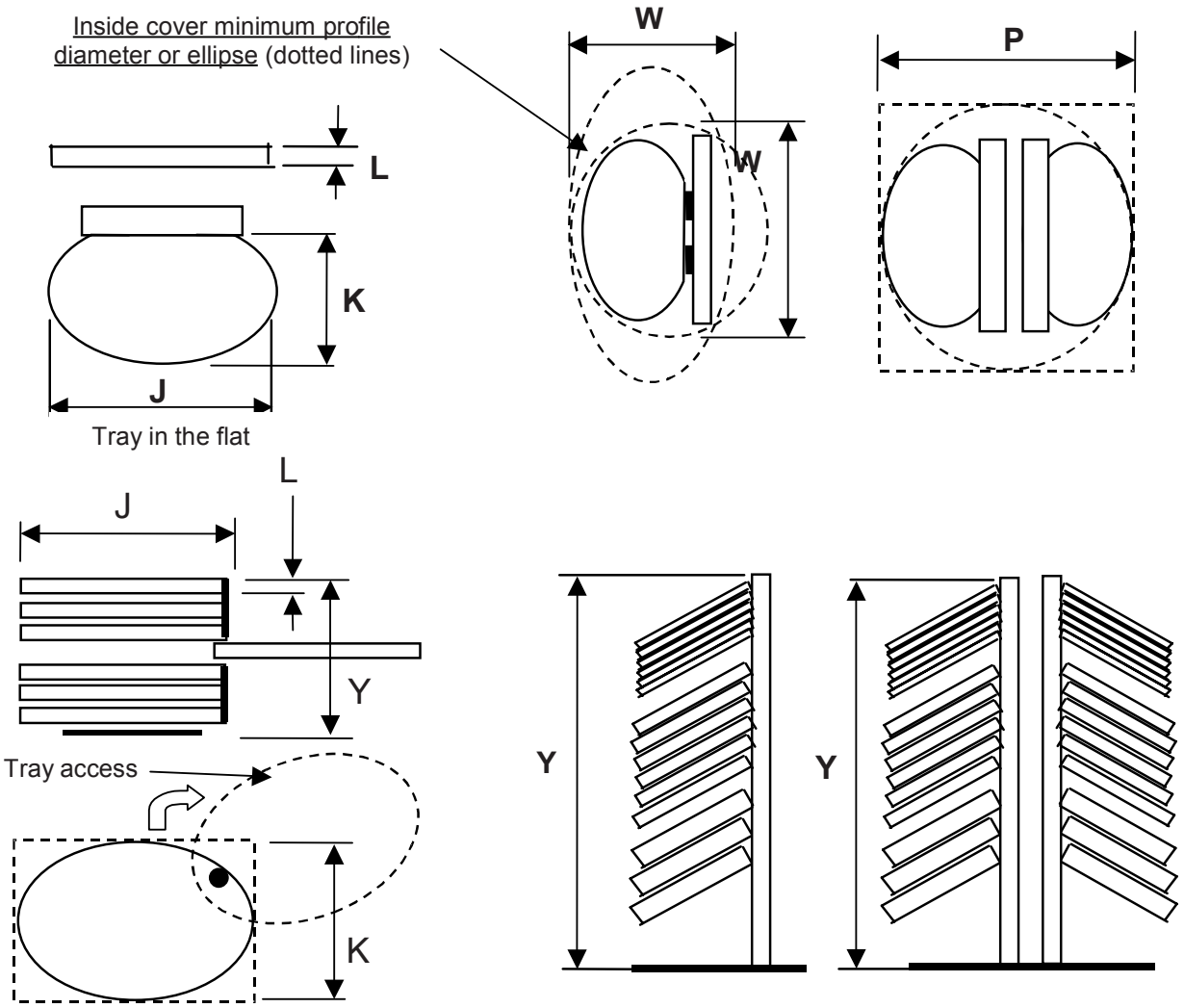
Figure D.1 — Outline dimensions of the M organiser

Table D.1 — M organiser – Multiple element and multiple ribbon fibre

Maximum number of fibres or splices per tray		Outline M organiser envelope dimensions mm				
		Tray envelope			Organiser envelope	
Multiple Element ME	Multiple Ribbon MR	Width max. J	Length max. K	Thickness max. L	Length max. M	Depth max. N
12	NA	100	235	10	395	205
24		100	300	10	426	205
72		152	380	14	576	235
144	144	152	440	20	882	255

Annex E
(informative)

Dimensions of S organisers for single circuit, single element and single ribbon



NOTE Dimension "W" is used for the minor axis of all elliptical shapes (the major axis is not relevant).

Figure E.1 — Outline dimensions of the S organiser

Table E.1 — S organiser – SC, SE and SR

S organiser system	Outline S organiser envelope dimensions mm				
	Tray envelope			Organiser envelope	
	Width max. mm **J**	**Length** max. mm **K**	**Thickness** max. mm **L**	**Single stack diameter** max. mm **W**	**Mixed stack diameter** max. mm **P**
Single circuit	205	150	5	185	223
Single element			10		
Single ribbon			16		

Table E.2

	Maximum capacity Number of fibres (without storage basket)			Organiser envelope
	S organiser system			Length max. mm **Y**
	Single circuit	**Single element**	**Single ribbon**	
Single stacks	12f	72f	48f	430
	24f	144f	72f	450
	48f	288f	144f	580
Double stacks	84f	216f	144f	230
	144f	N/A	N/A	380
	192f	N/A	N/A	430

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