



The Fibreoptic Industry Association

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UNDERSTANDING OM1, OM2, OM3, OS1, OS2 and more!

by
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Currently we have five all-silica optical fibre "types" or "Categories" specified in the generic cabling standards. Internationally, ISO/IEC 11801 specifies OM1, OM2, OM3 and OS1. In addition, ISO/IEC 24702 (Generic cabling for industrial premises) specifies OS2. The international standards call these "OF types". In Europe and the UK, BS EN 50173-1:2007 contains all five and calls them "Optical fibre cable Categories". Whilst there is no difference in the actual specifications as shown in Tables 1 and 2 below, it is important to clarify the intention of these naming schemes

In all the standards the OM/OS system applies to cabled optical fibre. The reason for this is obvious - the cabling standards deal with cables and connecting hardware both as products and "as installed".

Even though they call the OM/OS scheme "OF types", ISO/IEC 11801 and 24702 make it clear that the designation OM1, OM2, OM3, OS1 and OS2 relate to cable transmission performance. The BS EN 50173 series makes it even clearer by describing the OM/OS scheme as "optical fibre cable Categories".

Table 1: Cabled multimode optical fibre specifications

Category	Maximum attenuation (dB/km)		Minimum modal bandwidth MHz×km		
			Overfilled launch		"Laser" launch
	850 nm	1 300 nm	850 nm	1 300 nm	850 nm
OM1	3,5	1,5	200	500	not specified
OM2	3,5	1,5	500	500	not specified
OM3	3,5	1,5	1 500	500	2 000

Table 2: Cabled singlemode optical fibre specifications

Wavelength nm	Maximum attenuation dB/km	
	OS1	OS2
1 310	1,0	0,4
1 383	Not specified	0,4
1 550	1,0	0,4

Both the IEC and EN committees have strengthened this relationship in the production of their cable standards listed below which contain references to OM1, OM2, OM3 and OS1:

- Indoor cables (see Inset 1 overleaf)
 - IEC 60794-2-11:2005 (and BS EN 60794-2-11:2005): Detailed specification for simplex and duplex cables for use in premises cabling
 - IEC 60794-2-21:2006 (and BS EN 60794-2-21:2006): Detailed specification for multi-fibre optical distribution cables for use in premises cabling
 - IEC 60794-2-31:2006 (and BS EN 60794-2-31:2006): Detailed specification for optical fibre ribbon cables for use in premises cabling
- Outdoor cables (see Inset 1 and Inset 2 overleaf)
 - IEC 60794-3-12:2006 (and BS EN 60794-3-12:2006): Detailed specification for duct and directly buried optical telecommunication cables for use in premises cabling
 - IEC 60794-3-21:2006 (and BS EN 60794-3-21:2006): Detailed specification for optical self-supporting aerial telecommunication cables for use in premises cabling

All of these published standards contain the text:

“Depending on the fibre type, the attenuation coefficient of the cabled fibre shall be less than the maximum values in Table 1 for the multimode fibres and less than the maximum values in Table 2 for single-mode fibres - for the wavelengths listed in the column headings.

Table 1 – Multimode maximum cable attenuation coefficient (dB/km)

Fibre type	Attenuation coefficient at 850 nm	Attenuation coefficient at 1 300 nm
IEC 60793-2-10, A1a.1 type	3,5	1,5
IEC 60793-2-10, A1a.2 type	3,5	1,5
IEC 60793-2-10, A1b type	3,5	1,5

Table 2 – Single-mode maximum cable attenuation coefficient (dB/km)

Fibre type	Attenuation coefficient at 1 310 nm	Attenuation coefficient at 1 550 nm
IEC 60793-2-50, B1.1 or B1.3 type	1,0	1,0

NOTE: It is true that the detailed specifications for MMF cables specify the bandwidth of the uncabled optical fibre but this is both because the test is applied to the optical fibre in production, and that bandwidth is not considered to be adversely affected during the cabling process.

Inset 1

The drafts of the outdoor standards contain the text:

“Depending on the fibre type, the attenuation coefficient of the cabled fibre shall be less than the maximum values in Table 1 for the multimode fibres and less than the maximum values in Table 2 for single-mode fibres - for the wavelengths listed in the column headings.

Table 1 – Multimode maximum cable attenuation coefficient (dB/km)

Fibre category	Attenuation coefficient at 850 nm	Attenuation coefficient at 1 300 nm	Performance codes
IEC 60793-2-10, A1a.1 type	3,5	1,5	OM1, OM2, OM3
IEC 60793-2-10, A1a.2 type	3,5	1,5	OM1, OM2, OM3
IEC 60793-2-10, A1b type	3,5	1,5	OM1, OM2, OM3

Table 2 – Single-mode maximum cable attenuation coefficient (dB/km)

Fibre category	Wavelengths (nm)	Maximum attenuation coefficient	Performance code
IEC 60793-2-50, B1.1 or B1.3	1310, 1550	1,0	OS1
IEC 60793-2-50, B1.3	1310, 1383, 1550	0.4	OS2

NOTE: It is true that the detailed specifications for MMF cables specify the bandwidth of the uncabled optical fibre but this is both because the test is applied to the optical fibre in production, and that bandwidth is not considered to be adversely affected during the cabling process.

Inset 2

OS2 is included in new IEC and EN cable standards (still in development and as shown in Inset 2) but only as a new outdoor cable specification in the new 60794-3-12 and 60794-3-21 standards. This is because OS2 was born in the industrial premises standard ISO/IEC 24702 to support 5 km and 10 km channels - which are by definition “outdoor”. More importantly, the low attenuation values of OS2 are only realistic in loose-tube cables in which the original optical fibre performance is almost unaltered by the cabling process (the same could be said of “blown fibre”).

There is a slight problem of guaranteed interoperability between OS1 and OS2. An OS1 cable is not simply an indoor version of an OS2 cable.

It has to be remembered that OS1 defines a very old specification. The original values for OS1 performance came from ISO/IEC 11801:1995 (and EN 50173:1995) and required the use of an optical fibre compliant with ITU-T G.652 (Type B1 in IEC 60793-2-50). Although the designation OS1 was only introduced in 2002 the performance requirements of 1995 did not change. As explained in the FIA White Paper entitled "An overview of singlemode optical fibre specifications", the G.652 specification covers four variants: G652a or b (both equivalent to Type B1.1) and G652 c or d (both equivalent to Type B1.3).

In comparison, OS2, introduced in 2006, requires the optical fibre to be compliant with ITU-T G.652c or d only (Type B1.3 in IEC 60793-2-50) which is specified for transmission at 1310 nm, 1550 nm and 1383 nm - i.e. a low water peak optical fibre suitable for CWDM operation. Therefore, the performance of OS1 cables is not directly compatible with OS2 cables and a new specification is required for "indoor" cables that use ITU-T G.652c/d optical fibres. As indoor cables tend to be of a buffered, tight construction, the low attenuation coefficients of an OS2 are unlikely to be maintained - hence the need for a new OS designation as shown in Table 3 below.

Table 3: Amendments to cabled singlemode optical fibre specifications

Wavelength nm	Maximum attenuation dB/km		
	OS1	OS new	OS2
1 310	1,0	>0,4 but <1,0	0,4
1 383	Not specified	>0,4 but <1,0	0,4
1 550	1,0	>0,4 but <1,0	0,4

It is worth pointing out that not only is the new designation not agreed - it may be that the new designation replaces OS1 and therefore becomes OS1:2009 for example. It is likely that marketing literature will contain the new designations quite soon. In terms of standardisation, it is unlikely that changes to the list of "OM"s and "OS"s will take place before 2009.

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