Trends in the International Standardization of Fiber Optic Interconnecting Devices and Passive Components

Ryo Nagase†

Abstract

This article describes recent trends in the international standardization of fiber optic interconnecting devices and passive components, which are mainly used for fiber optic telecommunication systems.

1. Introduction

Many fiber optic connectors and passive optical components are used throughout the world to construct photonic telecommunication networks. This makes it very important to standardize the interfaces, test and measurement procedures, and performance standards for these optical components. This article describes recent trends in the international standardization of fiber optic interconnecting devices and passive components mainly used for fiber optic telecommunication systems.

2. IEC

Fiber optic interconnecting device and passive component standardization activities are dealt with by the International Electrotechnical Commission (IEC). The IEC was founded in June 1906 in London, England, and is a leading global organization that prepares and publishes international standards for all electrical, electronic, and related technologies. These serve as a basis for national standardization and as references when international tenders and contracts are drafted. In 1948 the IEC Central Office moved from London to Geneva, Switzerland. 63 countries were registered as members or associate members of IEC in 2003.

Standards are discussed by the Technical Committee (TC) and Sub-Committees (SCs), which work under the supervision of the TC. TC86/SC86B members discuss standards related to fiber optic interconnecting devices and passive components. From 2003, the Japanese National Committee accepted the secretariat of subcommittee 86B. Dr. Etsuji Sugita of NTT Advanced Technology Corporation was appointed to serve as secretary.

IEC TC86/SC86B consists of four Working Groups (WGs): test and measurement procedures (WG4), reliability (WG5), fiber optic interconnecting devices (WG6), and fiber optic passive components (WG7).

Each WG consists of about 10 to 40 members. They include 14 members from Japan. WG meetings are normally held twice a year, one of these at the same time as the IEC General Meeting.

The Japanese National Committee is organized under The Institute of Electronics, Information and Communication Engineers (IEICE), which has a strong relationship with the Standardization Technical Committee of Japanese Industrial Standards (JIS), which is organized under the Optoelectronic Industry and Technology Development Association (OITDA). **Figure 1** shows the relationships among these committees.

3. Fiber optic interconnecting device and passive component standards

Standards for fiber optic interconnecting devices and passive components are classified into those for fiber optic interconnecting devices, passive components, and test and measurement procedures. **Table 1** shows the project number series and their contents, which are already established. Each project number series consists of general and detailed specifications.

† NTT Photonics Laboratories
Atsugi-shi, 243-0198 Japan
E-mail: r.nagase@aecl.ntt.co.jp

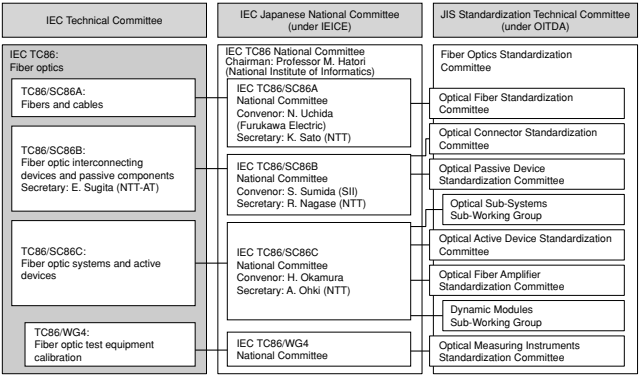

Fig. 1. Relationships among IEC Technical Committee, IEC Japanese National Committee, and JIS Standardization Technical Committee.

Table 1. IEC project no. series.

Project no.	Contents
IEC 60869	Fiber optic attenuators
IEC 60874	Connectors for optical fibers and cables
IEC 60875	Fiber optic branching devices
IEC 60876	Fiber optic switches
IEC 61073	Splices for optical fibers and cables
IEC 61202	Fiber optic isolators
IEC 61300	Basic test and measurement procedures
IEC 61314	Fiber optic fan-outs
IEC 61753	Fiber optic interconnecting devices and passive components performance standard
IEC 61754	Fiber optic connector interfaces
IEC 61977	Fiber optic filters
IEC 61978	Fiber optic passive dispersion compensators
IEC 62005	Reliability of fiber optic interconnecting devices and passive components
IEC 62077	Fiber optic circulators
IEC 62099	Fiber optic wavelength switches
IEC 62134	Fiber optic enclosures

3.1 Fiber optic interconnecting devices

Fiber optic interconnecting device specifications consist of those for fiber optic connectors, splices, fan-outs and enclosures. The first specification relating to fiber optic connectors was the sectional specification (60874 series). After that, new series, namely interface standard (61754), performance standard (61753), and test and measurement procedures (61300) were established and the constituent parts of series 60874 were successively deleted.

The optical interface (61755) series specifications are also discussed. They focus on fiber-to-fiber connection parameters when there are no fiber support mechanisms or ferrule-to-ferrule connection parameters where fiber support mechanisms are included, e.g., the effects of dome offset and fiber undercut.

Table 2 shows the interface standards for fiber optic connectors. Sixteen types of connector have already been standardized, and eight of these were developed in Japan (seven by NTT). Japanese technology is contributing greatly to the international field of fiber optic connectors.

Although these eight types of connector were previously standardized by JIS, SC type and MU type simplified receptacles (the latter is currently under discussion), to which another number has been given by JIS, are specified by IEC as Type-SC and Type-MU, respectively.

Currently, specifications for optical interfaces, enclosures and fiber management systems are being actively discussed.

Table 2. Fiber optic connector interface standards.

Project no.	Established	Title	JIS no.
IEC 61754-1	Dec-96	General and guidance	C 5970
IEC 61754-2	Dec-96	Type BFOC/2,5 connector family	
IEC 61754-3	Dec-96	Type LSA connector family	
IEC 61754-4	May-00	Type SC connector family	C 5973
IEC 61754-5	Dec-96	Type MT connector family	C 5981
IEC 61754-6	Aug-01	Type MU connector family	C 5983
IEC 61754-7	Nov-00	Type MPO connector family	C 5982
IEC 61754-8	Oct-96	Type CF08 connector family	
IEC 61754-9	Dec-96	Type DS connector family	C 5980
IEC 61754-10	Jul-00	Type Mini-MPO connector family	C 5984
IEC 61754-12	Aug-99	Type FS connector family	
IEC 61754-13	Mar-99	Type FC-PC connector family	C 5970
IEC 61754-15	Sep-99	Type LSH connector family	
IEC 61754-16	Oct-99	Type PN connector family	C 5976
IEC 61754-18	Dec-01	Type MT-RJ connector family	To be published
IEC 61754-19	Oct-01	Type SG connector family	
IEC 61754-19	Aug-02	Type LC connector family	

3.2 Fiber optic passive components

In the field of fiber optic passive components, eight 'general and guidance' standards (attenuators, branching devices, fiber optic switches, isolators, filters, passive dispersion compensators, circulators, and wavelength switches) and three performance standards (plug style fixed attenuators, pigtailed style fixed attenuators, and branching devices) have already been published.

In the performance standard field, environmental categories are specified depending on the environment in which the telecommunication equipment is installed. Seven types of category have already been specified and discussed as shown in **Table 3**. Categories A, G, and S are only used for enclosures (fiber optic interconnecting devices). Three performance standards have been published in the field of passive components, which includes categories U and O.

Currently, specifications for DWDM filters, fiber optic switches, and passive dispersion compensators are being actively discussed against the background of progress on DWDM and optical cross connect technologies.

3.3 Test and measurement procedures

Test and measurement procedures in the field of fiber optic interconnecting devices and passive components are specified in the IEC 61300 series. Forty-eight test procedures (61300-2 series) and forty measurement procedures (61300-3 series) have already been published. Some specifications that were published earlier are now entering their maintenance cycles, so the number of specifications is always fluid.

Table 3. Environmental categories.

Category	Definition
C	Controlled environment
U	Uncontrolled environment
E	Extreme environment
O	Outside plant
A	Aerial
G	Ground level
S	Subterranean

3.4 Reliability

The reliability of fiber optic interconnecting devices and passive components is specified in the IEC 62005 series. The structure of the reliability specifications consisting of ten items was fixed in the first stage, but discussions have been delayed because some key members have retired against the background of the depression in the telecommunications field.

Currently, specifications related to the reliability of fiber optic connectors and high power reliability are being discussed.

4. Future progress

JIS, the Japanese national standard, must harmonize with IEC specifications because of the WTO scheme. Initially, JIS published a large number of specifications because many products in the field of fiber optic interconnecting devices and passive components were developed in Japan. Subsequently, IEC standards were developed based on new concepts. This has resulted in differences between JIS and IEC standards.

Recently, harmonization with IEC is being actively discussed in the JIS Standardization Technical Committee. However, this is proving very difficult because the structures of the specifications differ and some content, not specified by IEC, is used in commercial transactions in Japan.

Many members of the Japanese standardization committee are pushing hard for Japanese technology to become the global standard.

Ryo Nagase
Group Leader, Senior Research Manager, Photonics Integration Project, NTT Photonics Laboratories.
He received the B.E., M.E., and Ph.D. degrees in precision engineering from Tohoku University, Miyagi, Japan, in 1983, 1985, and 1998, respectively. In 1985, he joined Musashino Electrical Communications Laboratories, NTT, Tokyo, Japan. He has been engaged in R&D of optical fiber connectors. From 1998 to 2000, he joined Global Business Division, NTT Communications Corporation. Since 2000 he joined Photonics Laboratories, NTT, and is currently involved in R&D of the fiber management on board technology. He is the chairman of JIS Optical Connector Standardization Committee and the secretary of IEC TC86/SC86B Japanese National Committee.