TIA 568 Standard for Fiber Optics

The TIA 568 standard for premises cabling is used by most manufacturers and users of premises cabling systems in the US. Internationally, IEC/ISO 11801 is very similar, although there are differences in various countries. TIA-568 has been under continual revision since its inception. The current version is "568 C". It includes some major changes from earlier versions for fiber optics as it adopts sections of IEC standards for international standardization.

Work is always ongoing in TIA 568. Several new issues have been addressed including passive optical LANs based on FTTH PONs and polarity of array fiber connection systems that now occupies half the standard itself, an indication of the complexity of the topic. The high component losses allowed, especially connector loss at 0.75dB, has not been addressed. There is widespread knowledge of this problem but manufacturers have been reluctant to change the standard due to the tighter controls on products they produce.

Since its beginnings in early 1990s, additions and changes To TIA 568 included:

- Add 50/125-micron fiber (OM2, OM3, OM4, OM5) as an alternative fiber type and specifies performance.
- Allows alternate connectors to the SC, esp. small form factor connectors like the LC and array connectors like the MPO.
- Adds performance standards for all connectors.
- Includes bend radius specifications for cables.
- Specifies requirements for connecting hardware.
- Adds OTDR testing to approved test methods.

Fiber Optic Cable Performance Standards

568 B3 added 50/125 fiber as an acceptable type and specifies the performance of cabled fiber as follows:

Fiber Type	Wavelength (nm)	Max Attenuation Coefficient (dB/km)	Bandwidth (MHz-km with overfilled launch)
50/125 (OM2, OM3, OM4)	850	3.5	500 (OM2), 2000 (OM3), 3500 (OM4)
	1300	1.5	500

62.5/125 (OM1)	850	3.5	160
	1300	1.5	500
Single mode (OS1, OS2) (Premises)	1310	1.0	NA
	1550	1.0	NA
Single mode (OS1, OS2) (Outside Plant)	1310	0.5	NA
	1550	0.5	NA

Note that these specs are quite conservative, compared to what is routinely available in the marketplace. The spec notes also that the cable manufacturer can use the fiber manufacturer's data on bandwidth, so they do not have to test it.

Hybrid Cables: The standard notes that hybrid cables are permitted, with markings per ANSI/EIA/TIA-598-A. (Hybrid cables contain both multimode and single mode fibers.)

Premises Cables: Horizontal cables with 2-4 fibers require a 25 mm bend radius after installation or 50 mm while being pulled with a tension of 50 pounds (222 N). Other premises cables require a bend radius of 10 times the cable outside diameter unloaded and 15 times the OD when under the maximum rated pulling tension for that cable.

Outside Plant Cables: The standard calls for water-blocked cables with a minimum pulling tension of 600 pounds (2670 N). Minimum bend radius is 20 times the cable diameter under max rated pulling tension and 10 times unloaded.

Connectors and Connecting Hardware

Any connector design is permitted as long as it has a FOCIS document (Fiber Optic Connector Intermate ability Standard). All small form factor connectors with FOCIS documents are acceptable. The latest versions of the document use LC connectors as the example, replacing SCs.

Color Codes: Multimode connectors are beige for 62.5/125 OM1 fiber, black for 50/125 OM2 fiber, aqua for laser-optimized 50/125 OM3 and OM4 fiber and lime green for wideband OM5 fiber. Single mode connectors are blue, angle-polished single mode are green, and outlets are also color coded accordingly. Cable color codes are the same as TIA-598.

Duplex connectors are keyed and are always crossover - that is Position A of one connector connects to Position B on the other end! Patch cords have this feature too, to permit correct connection of transmitters and receivers! Polarity for multipin connectors (MTP/MPO) are specified in several different versions and are very confusing, requiring about half the total number of pages in the document.

Outlet boxes must have provision for termination of at least 2 fibers.

Patch panels and outlets must provide unique identification for the connecting cabling.

Connector Mating Loss (Connection Loss):

Fiber Type	Wavelength (nm)	Loss (dB)	Optical Return Loss (dB)
Multimode	850	0.75	20
	1300	0.75	20
Single mode	1310	0.75	26 (CATV:55)
	1550	0.75	26 (CATV:55)

Notes:

These connection losses are for a fiber terminated in a connector mated to a known good reference connector per FOTP-34 or FOTP-171.

Remember these connector losses are maximum values. The loss is high to allow prepolished/splice connectors which have higher loss than adhesive/polish connectors because the connectors *include both a connection loss and a splice loss*.

The high loss also covers array connectors like MPOs which have higher loss due to the alignment of a large numbers of fibers. Users may specify lower loss for installations if agreed upon by all parties involved.

Loss is tested per FOTP-171, single cable reference.

Maximum loss spec holds over temperature (0-60C), humidity (95% @ 40C), impact, pull strength of coupling (7.4 lb./33N), durability (500 matings), cable retention (11 lbs./50 N straight, 4 lbs./19N at 90) flex and twist.

Recommendation: For design or loss budget purposes, single fiber adhesive/polish connectors as found on factory-made patch cords should be less than 0.3dB connection loss. Splice-on connectors using fusion splices or mechanical splices which include a splice loss in the connector loss should be less than 0.5dB. The highest loss is reserved for some mechanical splice-on connectors and array fiber connectors.

Splices

Fusion or mechanical splices shall not have a loss of more than 0.3 dB for either multimode or single mode fiber. Multimode splices must have a return loss of better than 20 dB. Single mode splices must be better than 26 dB ORL for general applications, 55 dB ORL for CATV broadband analog video.
