Optical Fiber Cables Glossary.

OPTCABLEGLOSSARY_GL_ENB01W

Optical Fiber Cables Glossary.

1 Armored Cable

Is a cable armored to protect against cable-seeking backhoes, posthole diggers, cable-loving rodents, and other adverse forces of man and nature. The armor may be in the form of aluminum or galvanized steel sheathing or interlocked aluminum or galvanized steel cladding.

2 B1.3 (G652D)

Fiber Element - (G.652.D) Single Mode			
Characteristics	**Conditions**	**Specified Values**	**Units**
Optical Character			
Attenuation	1310 nm 1383 nm (after H2-aging) 1550 nm 1625 nm	≤0.35 ≤0.35 ≤0.22 ≤0.24	[dB/km] [dB/km] [dB/km] [dB/km]
Attenuation vs. Wavelength Max. a difference	1285-1330 nm 1525-1575 nm	≤0.03 ≤0.02	[dB/km] [dB/km]
Dispersion coefficient	1285-1340 nm 1550 nm 1625 nm	≥-3.0 ≤3.0 ≤ 18 ≤ 22	[ps/(nm²·km)] [ps/(nm²·km)] [ps/(nm²·km)]
Zero dispersion wavelength		1312+/-10	[nm]
Zero dispersion slope Typical value PMD Maximum individual fibre Link design value (M=20,Q=0.01%) Typical value Cable cut-off wavelengthλcc Mode field diameter (MFD)	 1310 nm 1550 nm	≤0.090 0.086 ≤0.2 ≤0.1 0.04 ≤1260 9.2+/- 0.4 10.4+/- 0.5	[ps/(nm2·km)] [ps/(nm2·km)] [ps/ km] [ps/ km] [ps/ km] [nm] [µm] [µm]
Effective group index of refraction (Neff)	1310 nm 1550 nm	1.466 1.467	
Point discontinuities	1310 nm 1550 nm	≤0.05 ≤0.05	[dB] [dB]
Geometrical Characteristics			
Cladding diameter Cladding non-circularity Coating diameter Coating-cladding concentricity error Coating non-circularity Core-cladding concentricity error Curl (radius) Delivery length		124.8+/-0. 7 ≤0.7 245+/- 5 ≤12.0 ≤6.0 ≤0.5 ≤ 4 2.1 to 50.4	[µm] [%] [µm] [µm] [%] [µm] [m] [km/reel]

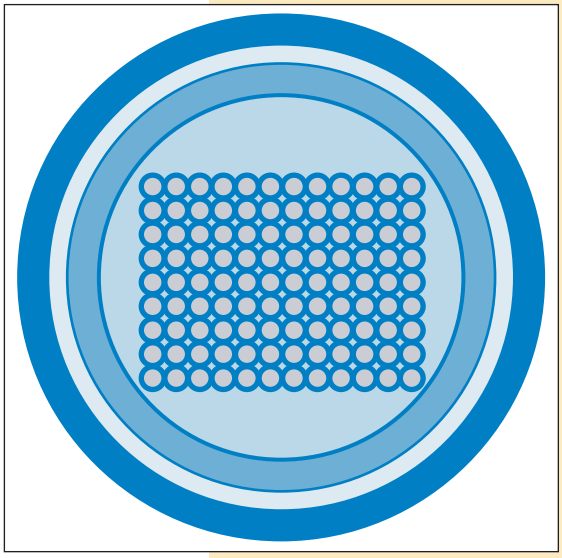
Fiber Element - (G.652.D) Single Mode			
Characteristics	**Conditions**	**Specified Values**	**Units**
Optical Character			
Environmental Characteristics (1310 nm, 1550 nm & 1625 nm)			
Temperature dependence Induced attenuation at	-60˚C to + 85˚C	≤0.05	[dB/km]
Temperature-humidity cycling Induced attenuation at	-10˚C to + 85˚C, 98%RH	≤0.05	[dB/km]
Watersoak dependence Induced attenuation at	23˚C, for 30 days	≤0.05	[dB/km]
Damp heat dependence Induced attenuation at	85˚C and 85% RH, for 30 days	≤0.05	[dB/km]
Dry heat aging at	85˚C	≤0.05	[dB/km]
Mechanical Specification			
Proof test	Off line	≥9.0 ≥1.0 ≥100	[N] [%] [kpsi]
Macro-bend induced attenuation I turn around a mandrel of 32 mm diameter 100 turns around a mandrel of 50 mm diameter 100 turns around a mandrel of 60 mm diameter	 1550 nm 1310 nm & 1550 nm 1625 nm	 ≤0.05 ≤0.05 ≤0.05	 [dB] [dB] [dB]
Coating strip force	Typical average force Peak force	1.7 ≥1.3	[N] [N]
Dynamic stress corrosion susceptibility parameter nd (typical) ≥		≥20	

3 Bar/Ribbon

Excerpt from:
http://www.tpub.com/neets/tm/107-8.htm

The ribbon cable design has the highest fiber capacity. Ribbon cables can hold 204 fibers in a 0.5-inch cable. However, ribbon cables have worse bend performance than OFCC and stranded cables. Ribbon cables also have the poorest waterblocking capabilities of the three cable designs. The bend performance is expected to worsen if manufacturers add appropriate compounds to increase water-blocking capabilities.

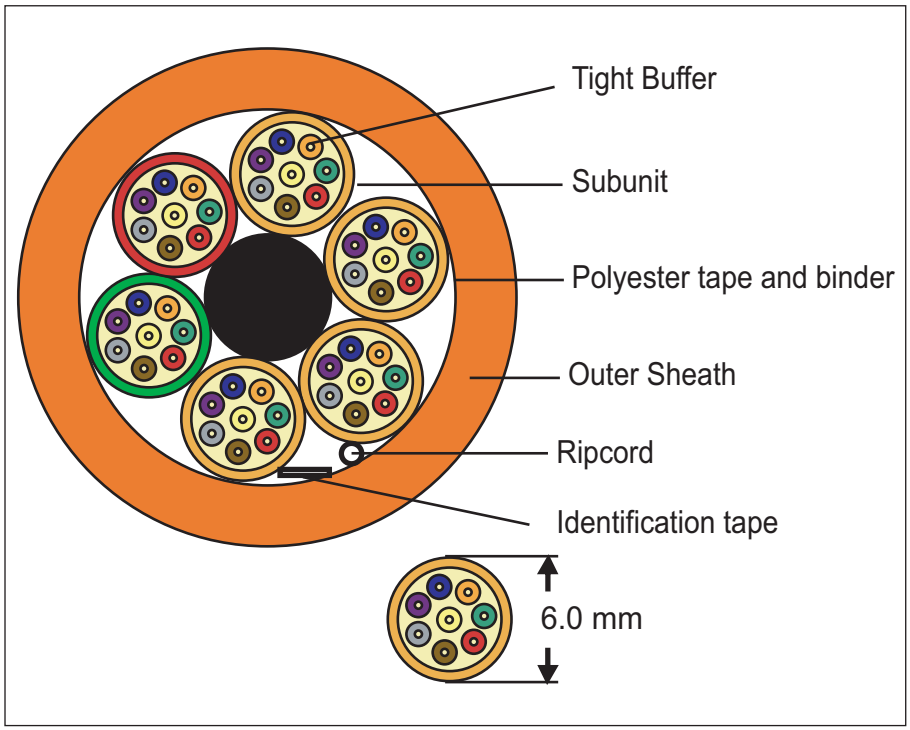
Ribbon cables are also hard to handle. Individual fibers are highly susceptible to damage when separated from the ribbon. This susceptibility to fiber damage during fiber breakout makes it necessary to perform multifiber connections. Multifiber connections can introduce single points of failure in multiple systems. The use of multifiber terminations also introduces maintenance, reconfiguration, and repair problems.



4 Break-Out Cables

Breakout optical fiber cables are used for indoor application. Breakout fiber optic cables are made of several simplex cables or subunits bundled together. Breakout design is strong and rugged, but it is bigger in size and more expensive than the distribution cables.

Optical fibers are protected by tight buffering materials. This is usually done with an over coating of 900 microns diameter. The material for tight buffering is decided by the application. If the cables are used for vertical runs, that is for riser application, the tight buffer material is polyester elastomer, such as Hytrel® and Arnitel®, which are popular materials used for riser grade tight buffers. PVC FR grade is used for plenum grade cables. PVC Apex is also a popular grade.



Tight buffers are put into the subunits or simplex tubes that are made of fire retardant PVC material. These subunits are colored for identification and are stranded around a central strength member. Aramid® yarns are put into the subunit for giving cushion to the tight buffers and for giving extra pulling strength.

The stranded core is protected by a Low smoke zero halogen material sheathing or Fire retardant PVC jacketing.

Breakout fiber optic cables are suitable for conduit runs, riser and plenum applications. Because each subunit is individually reinforced, this design allows for quick termination to connectors and does not require patch panels or boxes. Breakout cable can be more economic where fiber count isn't too large and distances too long, because is requires less labor for fiber optic termination work.

Mechanical connectors can be easily fit into the tight buffers of each subunit and thus Breakout fiber optic cables can be easily terminated in a mid-span branch box, or at the terminal equipment.

5 Buffer

In a fiber optic cable, a buffer is one type of component used to encapsulate one or more optical fibers for the purpose of providing such functions as mechanical isolation, protection from physical damage, and fiber identification.

The buffer may take the form of a miniature conduit, contained within the cable and called a "loose buffer", or "loose buffer tube". A loose buffer may contain more than one fiber, and sometimes contains a lubricating gel. A "tight buffer" consists of a polymer coating in intimate contact with the primary coating applied to the fiber during manufacture.

Buffer application methods include spraying, dipping, extrusion and electrostatic methods. Materials used to create buffers can include fluoropolymers such as polyvinylidene fluoride (Kynar), polytetraf luoroethylene(Teflon), or polyurethane.

Excerpt from: Wikipedia, the free encyclopedia.

6 Cable Type

In the code the cable morphology is denoted, which depends on the type of application the cable must operate in.

7 Central Strenght Member FRP

Optical cables structural characteristics are subjected to external elongation forces that might apply stress over the fiber cores that can damage or impair their physical characteristics. In order to avoid that stress on the cores, a strength central or lateral members are mandatory.

Some cables use a Fiber-Reinforced Plastic FRP strength member which is dielectric in nature, suited for those cables surrounded by large electric fields like those found near electric power lines.

8 Central Wire/Strand

Optical cables structural characteristics are subjected to external elongation forces that might impose stresses on the fiber cores that can damage or impair their physical characteristics. In order to avoid those stresses on the cores, a strength central or lateral member is mandatory.

When the cable does not need to withstand such high electric fields, a galvanized steel wire/stranded is used for strength.

9 Distribution

Distribution cables normally have an overall Kevlar wrapping, a ripcord, and a 900 micrometer buffer coating surrounding each fiber. These *fiber units* are commonly bundled with additional steel strength members, again with a helical twist to allow for stretching.

10 Double Jacket

A double jacketed cable refers to a cable with two layers of PE plastic, one external sheath with the purpose of overall protection of the fiber cores and an internal sheath to further protect the core subunits or loose tubes that carry the cores.

11 Dry Loose Tube

Dry Loose Tube cable design. This family of gel-free stranded loose tube cables uses all dry water blocking technology and reduced diameter buffer tubes. The design is completely gel-free, yet it provides full water blocking protection for outside plant applications. The Dry Loose Tube cables are an alternative to standard gel-filled loose tube cables, and meet the requirements of ANSI/ICEA S-87-640; Telcordia GR-20-CORE, issue 2; and EN 187105.

Benefits	
Dry Water Blocking Technology benefits	
▪	Decreases cable prep time.
▪	Eliminates need for potentially hazardous solvents.
▪	Less consumable materials required.
▪	Cleaner, improved work environment.
▪	Improved lifespan of equipment.
▪	Simplifies work site clean-up.
Lightweight Cable Design	
▪	Improves ease of handling.
Smaller Buffer tubes	
▪	Easier routing inside the enclosure.
Small Overall Cable Diameters	
▪	Maximizes conduit space and Improved reel capacity.

12 Dry Water Blocking Cable Core

The water blocking material is of a dry superabsorbent polymers SAP-type. The SAP particles are spherical in shape with an average particle size of 65 micron to minimize stress points when placed adjacent to optical fibers inside buffer tubes.

13 Dual Armor

When the cable is protected by two (2) armor layers with other layers of different materials in between.

14 Fiber Count

Relates to the total number of fiber cores in the cable. The cable might change morphology because, the larger the number of fibers, the larger the needs to protect them.

15 Fiber Type

In the LanPro´s Code used, it normally relates to the type or types of fiber used in the cable.

16 Fiber Optical Cable Jacket Material Ratings

Insulation/jacketing material types are almost the same for fiber optic cables as for metallic cables, but the rating codes are different. The ratings include plenum use, general purpose, and conductive cable types. You can refer to section 770 of NEC code for more information.

From the flame resistance point, the requirements for fiber optic cables are the same as for conventional cables. Only plenum rated fiber cables can be used in air plenums and only riser rated fiber cables can be used in vertical riser shafts.

Plenum rated fiber cables may be substituted for riser use or general purpose use. Likewise, riser rated fiber cables may be substituted for general purpose use. In addition to that, ports and pathways for fiber cables also must meet the appropriate flammability and fire-stop requirements as with metallic cables.

What is Plenum Area?

A plenum is a building space, compartment, duct or chamber used for air flow or to form part of an air distribution system. A plenum is a space used to move air to workspaces for the purpose of ventilation, heating or cooling. The informal words for plenums are "air duct" and "air return".

What is Riser Area?

A riser is a floor opening, shaft, or duct that runs vertically through one or more floors. Riser cable is intended for use in vertical shafts that run between floors. Many buildings have a series of equipment rooms that are placed vertically in a reinforced shaft for the purpose of enclosing power distribution equipment, HVAC units, telephone distribution and other utility services throughout the building.

What is General Purpose Area?

A general purpose area is all other area that is not plenum or riser, which is on the same floor.

Fire Rating Levels
Four levels of fire resistance are specified for both nonconductive and conductive fiber cables. These are outlined below from most stringent to least. The ratings are hierarchical, i.e., from a fire resistance standpoint, a higher rating can be substituted for any lower rating, but not vice versa.
A. OFNP and OFCP Fiber Cable
OFNP stands for Optical Fiber Nonconductive Plenum Cable and OFCP stands for Optical Fiber Conductive Plenum Cable. OFNP and OFCP cables must have resistance to flame spread and reduced smoke generating properties. These cables are approved for placement in air handling ducts and chambers without the use of fireproof conduit. The purpose of the rating is to lessen the transmission of fire and visible smoke to unaffected parts of the building. Toxic or corrosive elements of the smoke are not measured. The is the highest cable fire rating and no other cable types can be used as substitutes. This cable type can be marked as "FT-6" by Canadian Standards Association (CSA).

▪	**B. OFNR and OFCR Fiber Cable**

OFNR stands for Optical Fiber Nonconductive Riser Cable and OFCR stands for Optical Fiber Conductive Riser Cable. These cables must not transmit flame from one floor to another when placed vertically in a building shaft.

It cannot be installed in plenums. This cable has fire-resistance characteristics tested to UL-1666 "Standard Test for Flame Propagation Height of Electrical and Optical Fiber Cable Installed Vertically in Shafts". OFNP and OFCP cables can be used as substitutes for OFNR and OFCR cables respectively.

▪	**C. OFNG and OFCG Fiber Cable**

OFNG stands for Optical Fiber Nonconductive General-Purpose Cable and OFCG stands for Optical Fiber Conductive General-Purpose Cable. These cables may not transmit flame for more than 4 feet, 11 inches. They shall not penetrate floors or ceilings, i.e., may only be used within a single floor.

OFNG and OFCG cables can be installed in typical horizontal, single floor installations. They cannot be installed in plenums or risers. The equivalent in CSA standard is "FT-4' cable type. OFNP, OFNR, and OFCP cables can be used as substitutes for OFNG and OFCG respectively.

▪	**D. OFN and OFC Fiber Cable**

OFN stands for Optical Fiber Nonconductive and OFC stands for Optical Fiber Conductive. These cables may not transmit flame to the top of the tray. They shall not penetrate floors or ceilings, i.e., may only be used within a single floor.

OFN and OFC cables do not have equivalent in CSA rating.

Excerpted from: **http://www.fiberoptics4sale.com/wordpress/fiber-optic-cable-fire-rating/**

17 FRP (Fibre-reinforced plastic) (also fiber-reinforced polymer)

It is a composite material made of a polymer matrix reinforced with fibers. The fibers are usually fiberglass, carbon, or Aramid®, while the polymer is usually an epoxy, vinylester or polyester thermosetting plastic. FRPs are commonly used in the aerospace, automotive, marine, and construction industries.

18 Figure 8

As the name implies, the Figure 8 cables are two section cables that resemble an eight (8) number if viewed from a plane perpendicular to the axis of the cable. They are designed to hang between posts by use of a messenger type of steel wire/strand that holds the weight of the second section of the cable carrying the fibers and relieves the stress on the Fiber optic cable section. They can carry up to 144 fibers.

19 General Purpose (CM, CMG, CMX) Cable.

Complies with UL-1581 testing. It will burn and partially self extinguish. Not for use between build floors or in air plenum spaces. These cables are often used for workstation cables and patch cords.

Normally relates to a cable with two armor layers and other streght members included that make it extremely robust.

20 Heavy Armored

In fiber Optic Cables, it relates to cables with more than one armor made of interlocking steel tape.

21 IEC 60793-2-10 Type A1a, A1b

IEC 60793-2-10:2011 is applicable to optical fibre types A1a, A1b, and A1d. These fibres are used or can be incorporated in information transmission equipment and optical fibre cables. Other applications include, but are not restricted to, the following: - short reach, - high bit-rate systems in telephony, - distribution and local networks carrying data, - voice and/or video services; - on-premises intra-building and inter-building fibre installations including Data Centres, LANs, Storage Area Networks, PBXs, video, various multiplexing uses, outside telephone cable plant use, and miscellaneous related uses. The major changes with respect to the previous edition are: - addition of type A1a.3 fibre; - reduction of core diameter tolerance from 3,0 to 2,5 mum for A1a fibres.

22 Interlocked Armor

Interlocked Armor Optical Cables are inherently robust and have exceptional crush and impact resistance, making them suitable for harsh or hazardous environments. Before installing an armored fiber optic cable it is necessary to understand the construction of the product.

The cable is in fact a composite of two main elements:	
▪	1. A thermoplastic jacketed fiber optic cable.
▪	2. A flexible metal conduit (i.e. aluminum or galvanized steel interlocked armor) surrounded by a thermoplastic jacket.

It is important to note that no bonding exists between the cable and the armor. Thus, both elements require connection to a pulling medium to prevent separation. It is strongly recommended that a cable pulling grip be used to accomplish the installation.

23 Interlocked Armor Plenum Aluminum

This type of cable is mostly used for indoors Plenum installation, ideal for industrial and other installations requiring a metallic armor on their distribution cables, is easier to bend than the steel based. Constructed with interlocked aluminum and may eliminate the need for a conduit.

24 Interlocked Armor Plenum Steel

This type of cable is mostly used for indoors Plenum installation, ideal for industrial and other installations requiring a metallic armor on their distribution cables, is more difficult to bend than the aluminum based. Constructed with interlocked steel tape and may eliminate the need for a conduit.

25 Interlocked Armor Riser Aluminum

This type of cable is mostly used for indoors Riser installation, ideal for industrial and other installations requiring a metallic armor on their distribution cables. Is easier to bend than the steel based. Constructed with interlocked (corrugated) aluminum tape and may eliminate the need for a conduit.

26 Interlocked Armor Riser Steel

This type of cable is mostly used for indoors Riser installation, ideal for industrial and other installations requiring a metallic armor on their distribution cables. Is tougher to bend than the aluminum based. Constructed with interlocked (corrugated) steel tape and may eliminate the need for a conduit.

27 Jacket

A jacket refers to the extruded plastic/polymer more external layer that covers and protect the cable from the environment. Sometimes, another jacket is used to further protect the surface and the innards of the cable.

28 Laminated Aluminum Tape

This is a type of armor used to build cables of the Light Armor type, and consisting of a sheet of aluminum tape. A cable covered with this type of light armor is softer to bend than the ones made with steel tape.

29 Laminated Steel Tape

This is a type of armor used to build cables of the Light Armor type, and consisting of a sheet of treated steel tape added as one of the layers of the cable structure.

30 Layer of Galvanized Steel Wires

Used mainly as strength members when the architecture of the cable uses a central tube to carry the fibers. This layer actually covers the central loose tube structure and protects the fibers by relieving them from the longitudinal stresses imposed to the cable by the installation.

31 Light Armored

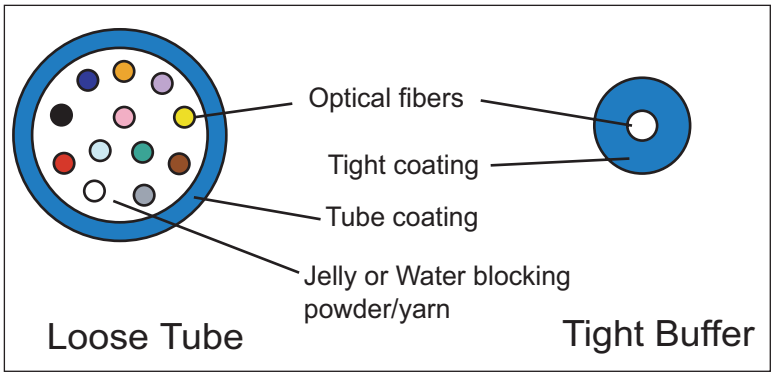
It relates to the cables that use aluminum or steel tapes to protect the cable from crushing forces.

32 Loose Buffer

Loose buffer fiber optic cables are mostly used for outdoor environment applications. The buffer is the tube that contains and protects the optical fibers. A Loose buffer means that the buffer tube inner diameter is much bigger than the outer diameter of the optical fibers inside it. There can be many optical fibers inside the same buffer tube.

A loose buffer can be filled with a water-blocking gel or dry superabsorbent polymer (SAP) to help make the cable waterproof. Another advantage of a loose buffer fiber due to the tube is larger diameter. Any stress subjected on the cable won't affect the fiber unles it becomes large enough. Because many fibers are fit inside the buffer tube, loose buffer structures can save cost. The disadvantage is that the loose buffer cable makes the termination of each fiber a more difficult task.

33 Loose Tube



In loose tube coating, the fibers are free to move inside the tube which is filled with jelly or water blocking powder or Aramid® yarn.

Loose tubes are made either filled with thixotropic gel compound or dry water blocking powder or yarn. Filled loose tubes are preferred choice for direct buried applications where the cable will have to stay long time with water during rainy season. When the presence of water is not significant, OSP installers can opt for a full dry design – meaning the optical fiber cable with dry loose tubes.

34 Low Water Peak Fiber (LWPF)

Excerpt from:
http://www.fiberopticmania.com/2009/02/g652d-low-water-peak-optical-fiber.html

G.652D – Low water peak Optical fiber characteristics and applications.

Low water peak fiber as called generally by the fiber optic industry, the ITU-T G.652D compliant optical fiber in the series of ITU-T G.652 recommendations has many different brands introduced by different optical fiber manufacturers. Each of them claims with sufficient reasons why their version is superior to others!.

Some of the brand names are *Zero water peak fiber, Allwave® fiber, and low water peak fiber* all pointing to the same optical fiber mentioned in the ITU-T G.652D recommendations.

Putting in a layman's language, low water peak fibers are different from ITU-T G.652B fibers in two respects. The first and foremost difference is in the use of water peak region for transmission in ITU-T G.652D fibers. For a conventional fiber complying to G.652B recommendations, it is not possible to transmit in the 1360 nm to 1480 nm region of the light spectrum as the attenuation is quite high compared to the attenuation at 1310 nm or 1550 nm.

The water peak in a G.652B fiber occurs at 1383 +/- 3 nm nominally. Some manufacturers roughly specify it as 1383 nm. G.652B fibers, drawn from the preforms made by using MCVD process, shows comparatively high attenuation at water peak region. VAD process or Vapor axial deposition preform manufacturing method to a great extent eliminates the presence of hydroxyl ions and hence the attenuation of optical fibers made out of preforms manufactured by VAD is low. Usually this low value of attenuation comes near to 0.5 dB/Km. For MCVD process, the attenuation at water peak region is higher than 1 dB/Km and many times near to 2 dB/Km.

So, attenuation at the water peak region has reduced to less than or equal to the attenuation at 1310 nm for an ITU-T G.652D compliant optical fiber. This is the first difference from G.652B fiber. Since the attenuation is low at 1383 nm region, the whole spectrum ranging from 1310 nm to 1625 nm can be used for transmission if a G.652D fiber is used in an telecommunication network. This opens up a huge window for transmission.

G.652D fibers are treated in deuterium environment in order to fill all the voids in the glass material with the Deuterium atoms so that in the future also, there is no provision or space available for the hydroxyl ions to sit inside glass after getting in contact with the hydrogen generating environment like water or other cable components.

The application of G.652D fiber is mainly in long haul terrestrial application, Backbone, metro access and now recently from the Central office to the splitter point. Virtually the positions of G.652B fibers were almost replaced by the G.652D fibers. OFS says they have zero water peak fiber. There is an interesting technical debate between the Zero water peak fiber and the Low water peak fiber. Draka finds it an investment waste to invent a zero water peak fiber, when the fiber optic industry and the ITU do not specifically requires such a fiber.

The second difference between the G.652B fiber and G.652D fiber is in the polarization mode dispersion coefficient. ITU-T requirement for PMD on a G.652B fiber is less than or equal to 0.5 ps/sqrt.Km. For G.652D fibers the value of PMD as per ITU-T recommendation is less than or equal to 0.2 ps/sqrt.Km. Thus G.652D fibers can be used for high speed transmission like 40 Gbps and more. With the small PMD value, more number of signals can be transmitted over G.652D fiber for long distances. This makes it suitable for long haul terrestrial applications, Metro access and backbone services.

Other transmission parameters like chromatic dispersion at 1550 nm, 1285 nm-1340 nm range, zero dispersion wavelength, cut-off wavelength etc are almost same like the conventional G.652B fibers.

Geometrical parameters of G.652D fibers of many of the manufactures have improved performance than G.652B fibers. They offer superior characteristics for cladding non-circularity, core concentricity error etc which have influence on the splicing too.

G.652D fibers have the major share in the optical fiber market. G.652D fiber dominates the fiber optic market. The demand will still be going on in the coming years as many economies are now opening up for fiber optic backbone infrastructure development. The price of G.652D fiber is almost near to the price of a G.652B fiber. The cost of G.652D fiber is in the range of US $9.0 to 11 depending on the region and the manufacturer.

35 LSZH (Low smoke zero halogen)

Excerpt from: Wikipedia, **http://en.wikipedia.org/wiki/Low_smoke_zero_halogen**

Low smoke zero halogen or low smoke free of halogen (LSZH or LSOH or LS0H or LSFH or OHLS) is a material classification typically used for cable jacketing in the wire and cable industry. LSZH cable jacketing is composed of thermoplastic or thermoset compounds that emit limited smoke and no halogen when exposed to high sources of heat, e.g. flame.

Most network cables are insulated with polyethylene, PVC or Thermoplastic Urethane (TPU). In a fire, a halogen-containing plastic material releases, e.g. hydrogen chloride, a poisonous gas that forms hydrochloric acid when it comes in contact with water. Designated Halogen-free cables, on the other hand, do not produce a dangerous gas/acid combination or toxic smoke when exposed to flame.

Low smoke zero halogen cable reduces the amount of toxic and corrosive gas emitted during combustion. This type of material is typically used in poorly ventilated areas such as aircraft or rail cars. Low smoke zero halogen is becoming very popular and, in some cases, a requirement where the protection of people and equipment from toxic and corrosive gas is critical.

Other benefits of halogen free cable include:	
▪	It is often lighter, so overall cable network system weights can be reduced.
▪	The environmental impact of halogen free cabling can be lower if there are fewer toxic chemicals.

Used in shipboard applications and computer networking rooms where toxic or acidic smoke and fumes can injure people and/or equipment. Examples of Halogens include Fluorine, Chlorine, Bromine, and Iodine. These materials when burned produce acidic smoke that can harm people and computer equipment. Low Smoke means the cable does not produce the heavy black soot and smoke common with PVC cables. These cables will self extinguish but cannot pass UL-910 or UL-1666 for a plenum or riser rating.

36 Metallic Central Strengt Member.

The meaning of "Strenght member", applied to Optical cables relates to how the cable is protected against axial stresses applied when installing or in normal operation of the fiber optic cables.

The purpose of any kind of "Strenght Member" is to relieve the optical fiber cores of any axial stress.

The constructs used as Metallic strength members are in most of the cases Galvanized Steel Wires, in a simple arrangement or in a stranded manner.

It is normally located in the center of the cable, and sometimes is covered with some kind of plastic.

37 Mini Figure 8

Is a figure 8 cable with up to 12 fibers.

38 Multi-Mode

Excerpt from: **http://en.wikipedia.org/wiki/Multi-mode_optical_fiber**

Multi-mode optical fiber (multimode fiber or **MM fiber** or **fiber**) is a type of optical fiber mostly used for communication over short distances, such as within a building or on a campus. Typical multimode links have data rates of 10 Mbit/s to 10 Gbit/s over link lengths of up to 600 meters—more than sufficient for the majority of premises.

39 Multi-Fiber Cables Color Coding

Individual fibers in a multi-fiber cable are often distinguished from one another by color-coded jackets or buffers on each fiber. The identification scheme is based on EIA/TIA-598, **"Optical Fiber Cable Color Coding".** EIA/TIA-598 defines identification schemes for fibers, buffered fibers, fiber units, and groups of fiber units within outside plant and premises optical fiber cables. This standard allows for fiber units to be identified by means of a printed legend. This method can be used for identification of fiber ribbons and fiber subunits. The legend will contain a corresponding printed numerical position number and/or color for use in identification.

EIA 598-A Fiber Color Chart	
Position	**Jacket color**
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Rose
12	Aqua

EIA 598-A Fiber Color Chart	
Position	**Jacket color**
13	Blue with black tracer
14	Orange with black tracer
15	Green with black tracer
16	Brown with black tracer
17	Slate with black tracer
18	White with black tracer
19	Red with black tracer
20	Black with yellow tracer
21	Yellow with black tracer
22	Violet with black tracer
23	Rose with black tracer
24	Aqua with black tracer

Color coding of Premise Fiber Cable		
Fiber Type / Class	**Diameter (µm)**	**Jacket Color**
Multimode 1a	50/125	Orange
Multimode 1a	62.5/125	Slate
Multimode 1a	85/125	Blue
Multimode 1a	100/140	Green
Singlemode IVa	All	Yellow
Single		Red

40 Multi-Fiber Loose Tube(Gel-Filled).

It relates to a Loose (Buffer) Tube in which multiple fibers are incorporated by the cable manufacturer and filled with water blocking gel substance.

41 Non-Armored

It relates to a cable that has little or minimal crushing protection.

42 OM1, OM2, OM3, OM4 (ISO standards)

Excerpt from Wikipedia: **http://en.wikipedia.org/wiki/Multi-mode_optical_fiber**

Multi-mode fibers are described by their core and cladding diameters. Thus, 62.5/125 µm multi-mode fiber has a core size of 62.5 micrometers (µm) and a cladding diameter of 125 µm. The transition between the core and cladding can be sharp, which is called a step-index profile, or a gradual transition, which is called a graded-index profile. The two types have different dispersion characteristics and thus different effective propagation distance.

In addition, multi-mode fibers are described using a system of classification determined by the ISO 11801 standard — OM1, OM2, and OM3 — which is based on the modal bandwidth of the multi-mode fiber. OM4 (defined in TIA-492-AAAD) was finalized in August 2009, and was published by the end of 2009 by the TIA. OM4 cable will support 125 m links at 40 and 100 Gbit/s.

For many years 62.5/125 µm (OM1) and conventional 50/125 µm multi-mode fiber (OM2) were widely deployed in premises applications. These fibers easily support applications ranging from Ethernet (10 Mbit/s) to Gigabit Ethernet (1 Gbit/s) and, because of their relatively large core size, were ideal for use with LED transmitters. Newer deployments often use laser-optimized 50/125 µm multi-mode fiber (OM3). Fibers that meet this designation provide sufficient bandwidth to support 10 Gigabit Ethernet up to 300 meters. Optical fiber manufacturers have greatly refined their manufacturing process since that standard was issued and cables can be made to support 10 GbE up to 550 meters. Laser optimized multi-mode fiber (LOMMF) is designed for use with 850 nm VCSELs.

The migration to LOMMF/OM3 has occurred as users upgrade to higher speed networks. LEDs have a maximum modulation rate of 622 Mbit/s because they cannot be turned on/off fast enough to support higher bandwidth applications. VCSELs are capable of modulation over 10 Gbit/s and are used in many high speed networks.

VCSEL power profiles, along with variations in fiber uniformity, can cause modal dispersion which is measured by differential mode delay (DMD). Modal dispersion is an effect caused by the different speeds of the individual modes in a light pulse. The net effect causes the light pulse to separate or spread over distance, making it difficult for receivers to identify the individual 1's and 0's (this is called intersymbol interference). The greater the length, the greater the modal dispersion. To combat modal dispersion, LOMMF is manufactured in a way that eliminates variations in the fiber which could affect the speed that a light pulse can travel. The refractive index profile is enhanced for VCSEL transmission and to prevent pulse spreading. As a result the fibers maintain signal integrity over longer distances, thereby maximizing the bandwidth.

43 PE Jacket with Bonded Steel Tape

It relates to a light-armored cable in which the PE jacket is extruded over the steel tape and makes a metal to plastic bond in the process of being manufactured.

44 Plenum Cable

Is a cable able to perform under the NEC specifications used for operation in a Plenum area of a premise.

What is Plenum Area?

A plenum is a building space, compartment, duct, or chamber used for air flow or to form part of an air distribution system. A plenum is a space used to move air to workspaces for the purpose of ventilation, heating or cooling. The informal words for plenums are "air duct" and "air return". Please read: **Fiber Optical Cable Jacket Material Ratings.**

45 Ripcord

Of an optical cable, is a parallel cord of strong yarn that is situated under the jacket(s) of the cable for the purpose of facilitating Jacket removal preparatory to splicing or breaking out.

The ripcord is exposed by carefully removing or severing a portion of the jacket near the end of the cable. It is then grasped with the fingers, or usually, with a tool such as a pair of pliers, and pulled to sever the jacket for the remainder of the desired distance.

46 Riser Cable, Riser (CMR) Rated Cable

Complies with UL-1666. Defined for usage in vertical tray applications such as cable runs between floors through cable risers or in elevator shafts. These spaces cannot be used for environmental air. These cables must self extinguish and must also prevent the flame from traveling up the cable in a vertical burn test.

47 Riser-Chemical Resistant

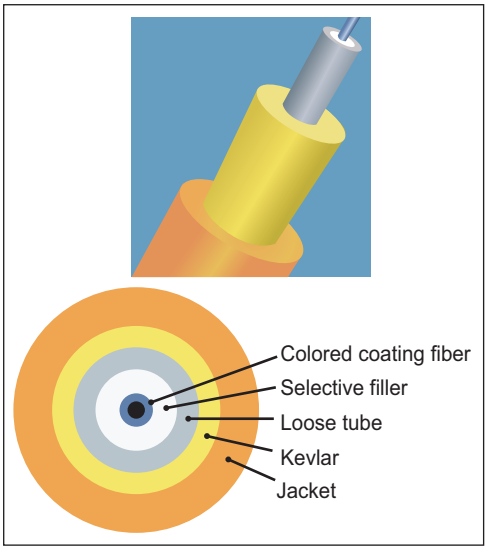
Besides being for riser applications, this type of optical cable is built with a Chemical-resistant outer jacket for harsh industrial or outdoor environments.

48 Self- Supporting

The high-capacity self-supporting cable eliminates the need for a support messenger made of steel/FRP.

49 Single Core Round Loose Tube Indoor Fiber Optic Cable

It provides good protection to the fiber. The mechanical and physical characteristics of the outer jacket meet the requirement of relevant standards. This cable is soft, flexible, and easy to do stripping, splicing, and cabling.



Loose tube material is usually poly butylenes terephthalate (PBT).

Color of jacket and fiber meets the requirements of relevant standards, or customized color. Cable dimension: the nominal diameters, or customized dimension.

▪	Single Core Round Loose Tube Indoor Fiber Optic Cable Applications.
▪	Used in patch cords and pigtails.
▪	Interconnection of fiber optic equipments.
▪	Indoor cabling.

50 Single Mode

Excerpt from Wikipedia: **http://en.wikipedia.org/wiki/Single-mode_optical_fiber**

In fiber-optic communication, a single-mode optical fiber (SMF) (monomode optical fiber, single-mode optical waveguide, or unimode fiber) is an optical fiber designed to carry only a single ray of light (mode). Modes are the possible solutions of Helmholtz equation for waves, which is obtained by combining Maxwell's equations and the boundary conditions. These modes define the way the wave travels through space, i.e. how the wave is distributed in space. Waves can have the same mode but have different frequencies. This is the case in single-mode fibers, where we can have waves with different frequencies, but of the same mode, which means that they are distributed in space in the same way, and that gives us a single ray of light. Although the ray travels parallel to the length of the fiber, it is often called transverse mode since its electromagnetic vibrations occur perpendicular (transverse) to the length of the fiber. The 2009 Nobel Prize in Physics was awarded to Charles K. Kao for his theoretical work on the single-mode optical fiber.

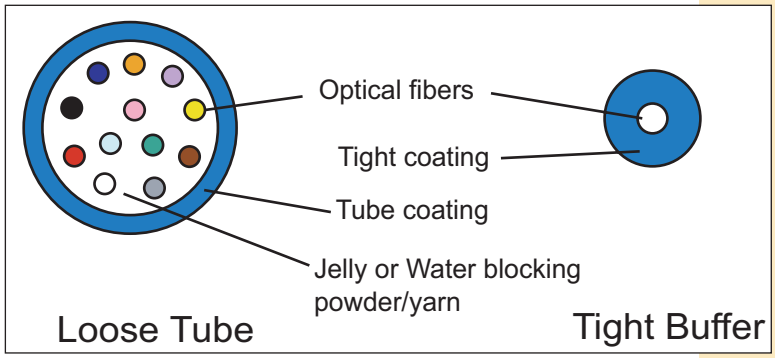
51 Steel Wire

Relates to a single galvanized steel wire used for giving longitudinal strenght to a fiber optic cable.

52 Steel Wire/Strand

Relates to a single or a strand of galvanized steel wires used for giving longitudinal strenght to a fiber optic cable.

53 Tight Buffer



54 Types of cables as per the NEC (National Electrical Code of USA)

▪	**OFC:** Optical fiber, conductive.
▪	**OFN:** Optical fiber, non-conductive.
▪	**OFCG:** Optical fiber, conductive, general use.
▪	**OFNG:** Optical fiber, non-conductive, general use.
▪	**OFCP:** Optical fiber, conductive, plenum.
▪	**OFNP:** Optical fiber, non-conductive, plenum.
▪	**OFCR:** Optical fiber, conductive, riser.
▪	**OFNR:** Optical fiber, non-conductive, riser.
▪	**OPGW:** Optical fiber composite overhead ground wire.
▪	**ADSS:** All-Dielectric Self-Supporting.

55 Water-Blocked Cables

An industry standard was developed (in GR-20-CORE) requiring loose-tube gel-filled cables to block water with no leakage for at least 24 hours from a 1-meter sample length of open-end cable, when exposed to 1-meter water head pressure. The test method is detailed in TIA-455-82B.

Several loose-tube cable manufacturers later introduced "dry water-blocked". Most of these loose-tube cables have water swellable yarns and tapes around the loose tubes, but still use gel to fill the large voids inside the tubes. Some designs have a dry powder compound within the tube as well.

- **What does "water-blocked" mean?**

  It means that the "dry" loose-tube cables will retard the rate of water flow in the cable for about one hour. Manufacturer specifications for some well-known brands rate these cables for only one hour exposure to one-meter water head pressure, when tested to TIA-455-82B.

56 With Subunits

Subunits are defined as groups of fibers inside a buffer container like a loose tube.