FOLAN

DATA & TELECOM INFRASTRUCTURE

FIBER OPTIC

PRACTICAL GUIDE

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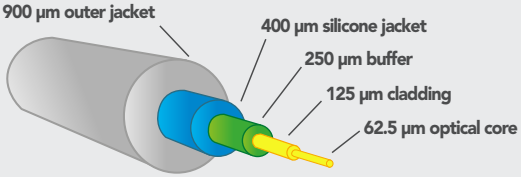
CABLES AND THEIR STRUCTURE



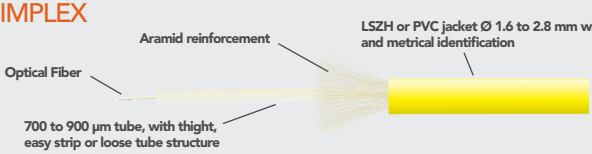
THE 3 COMPONENTS OF FIBER OPTIC ARE:

1. The core: in silica, melt quartz or plastic where the fibers spread. Diameter: 50 or 62.5 µm for multimode fibers, 9 µm for singlemode fibers.

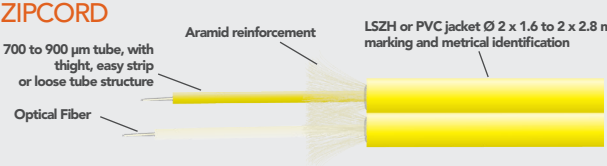
2. The optical coating (cladding): usually it is the same components as the core but with additives (that gather all the optical waves inside the core of the fiber).

3. The protection cover (primary sheath): generally it is plastic, it gives mechanical protection to the fiber.

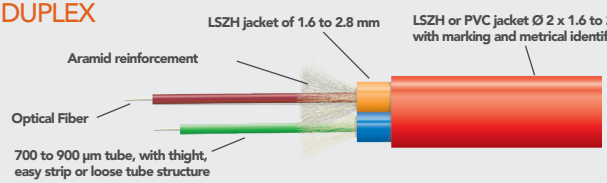
SIMPLEX



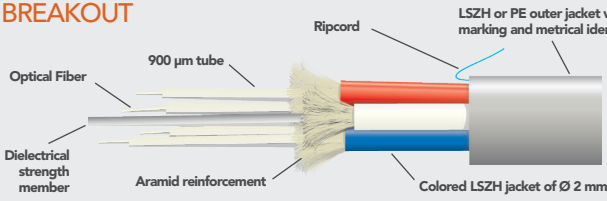
ZIPCORD



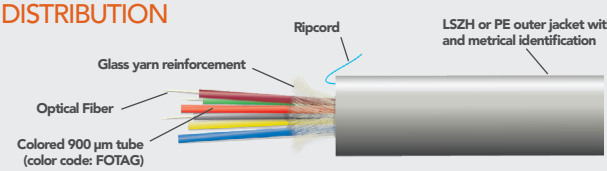
DUPLEX



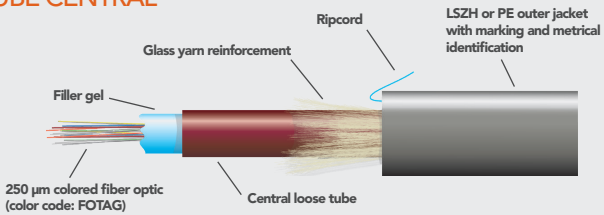
BREAKOUT



DISTRIBUTION

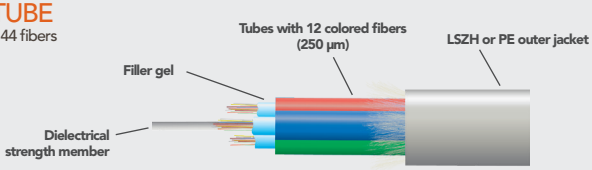


TUBÉ CENTRAL



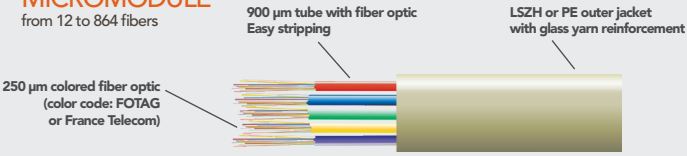
MULTITUBE

from 36 to 144 fibers



MICROMODULE

from 12 to 864 fibers



THE COLORS OF CABLES

Mainly concerns cables : Simplex, Zipcord, Duplex, Breakout, Distribution & Central loose tube.

Multimode 62.5/125 µm	Multimode 50/125 µm OM2	Multimode 50/125 µm OM3	Multimode 50/125 µm OM4	Monomode 9/125 µm

TIGHT STRUCTURE

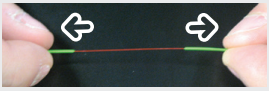
The plastic buffer surrounds the cladding. This type of structure mechanically strenghens the fiber and gives it the flexibility necessary to do patchcords or cables inside buildings.

LOOSE STRUCTURE

One or various fibers are placed «loose» inside a tube. This type of structure is particulary recommended for links between buildings.

Fiber tube in tight structure

Fiber tube in loose structure



INTERIOR CABLES

Generally made of a round LSZH outer jacket, this cable can bear from 2 to 24 fibers, in tight or loose structure, for direct patching (breakout or distribution cables). It is necessary to retube or to splice pigtails when using central loose tube or multitube cables.

EXTERIOR CABLES

Usually in loose tubes types, this cable is made of a PE outer jacket and it is designed to link building. It is possible to add special reinfrcements on the outer jacket to use it outside. 250 µm fibers are in a loose tube or in multitube or microbundle cables with a PE jacket.

COLOR CODES

	1	2	3	4	5	6	7	8	9	10	11	12
FRANCE TÉLÉCOM												
FOTAG IEEE 802.8												

CONNECTORS


singlemode SC-PC


singlemode SC-APC


multimode SC-PC


E2000


FC


FC-APC


ST


SMA


singlemode LC-PC


monomode LC-APC


multimode LC-PC


MU


MTP®/MPO


MTRJ


VFO

ADAPTORS


Self-protected SC-APC


Simplex SC-APC


Duplex SC-PC


E2000


FC

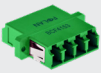

FC


ST


SMA


Simplex LC-PC


Duplex LC-PC


Quadruplex LC-APC


MU


MTP®/MPO


MTRJ


VFO

THEORY & NORMS

MAIN ADVANTAGES OF FIBER OPTIC:

- High data flow
- Low attenuation, high information-carrying capacity
- No problem of earth wiring
- Insensitive to electromagnetic disturbances
- No cross talk
- No risk of spark
- Resistant link
- Reliable installations

Use of optical fibers is recommended by the ISO and EIA/TIA standards for bypasses in cabling systems. Its immunity to electromagnetic disturbances makes it the perfect medium for very high bandwidths: for links between buildings or to patch desks («Fiber To The Desk»).

MAIN STANDARDS:

		MM62,5	MM50			SM
	APPLICATIONS	OM1	OM2	OM3	OM4	-
850 nm	1GIGABIT	275 M	550 M	1000 M	1100 M	-
	10 GIGABIT	33 M	82 M	300 M	550 M	NA
1300 nm	GIGABIT ETHERNET	550 M	550 M	550 M	550 M	5,000 M
	10 GIGABIT ETHERNET	300 M	300 M	300 M	300 M	10,000 M

G.652: Standard for dispersion unshifted singlemode optical fiber.

G.653: Standard for dispersion shifted singlemode optical fiber, including submarine cables.

G.655: Standard for NZDF (Non Zero Dispersion Fiber) optical fiber, mainly used for submarine and group-long range infrastructures.

G.657 A: Standard for low bending radius optical fiber (SM). Can support very low bending radius, especially for cabling inside buildings. Compliant with G652 standard.

G.657 B: Standard for low bending radius optical liber with low «OH» peak. Use for WDM.

FTTX (VERY HIGH SPEED TECHNOLOGY USING OPTICAL FIBERS):

FTTH (Fiber To The Home): Optical fiber reaching directly the customer housing. It is a fiber optic network that comes very close to the customer: his housing.

FTTA (Fiber To The Antenna): Optical fiber reaching directly the GSM antenna. It is a fiber optic network that comes up to the GSM / 3G / 3G+ / 4G / LTE... antennas.

FTTB (Fiber To The Building): Optical fiber reaching directly the building. It is a fiber optic network where the termination comes to the building.

FTTO (FTTD/O: Fiber To The Desk/Office): Optical fiber reaching directly the office. It is a fiber optic network where the termination comes to the desks.

PON (Passive Optical Network): FTTH architecture that uses a passive coupler system in access network: up to 128 users can be managed in only 1 fiber that comes to Optical Connection Node.

P2P (Point To Point): Passive Point to Point. FTTH architecture where there is at least one continuous fiber, unshared between the user and the Optical Connection Node.

AON (Active Optical Network): Active Point to Multipoint. Point to Multipoint architecture that uses an active equipment installed in the access network (LAN).

GLOSSARY

Fiber attenuation: Attenuation of a fiber measured in dB/km.

Birefringent: Property of transmitting the light in 2 directions unequally.

Cleaver: Tool used to cut the fiber (cleave) and prepare the splicing.

Patchcord: Cable used to link connection points, terminals, desks... It is a set made of 1 or 2 connectors on each side of a simplex, zipcord or duplex patch cable.

Splicing: Used to link permanently 2 libers. The splicing can be done by fusion (with a splicer) or mechanically (with mechanical splicing).

Ferule: Connector end in which is the fiber.

Singlemode fiber: Optical fiber which only enables one single ray of light (the fundamental mode) to spread through the fiber.

Multimode fiber: Optical fiber which enables different wavelengths (modes) to spread through the fiber.

Connector: Termination and mechanical element made of a ferule (zirconia, metallic or glass).

P.O.F: Plastic Optical Fiber.

Index of refraction: Equals to the light speed in the void divided by the light speed in the considered medium.

LAN (Local Area Network): Limited network (from hundred meters to few kilometers).

Wavelength: Oscillation measurement of a wave. It is defined by the speed of the wave divided by its frequency. It is represented by the symbol λ, and it is measured in µm or nm.

MAN (Metropolitan Area Network): Network where the distance between two points is up to ten or so kilometers. It is used to link equipments and big company networks or campus. It is usally built with optical fibers.

Modes: Ways followed by the different light rays (at different wavelengths) inside the optical fiber.

OCN: Opical Connection Node. Building where all the optical fibers of an area are stored.

Numerical Aperture: Characterizes the range of angles over which the optical fiber can accept or emit light, It is equal to the sine of the half-angle of the acceptance cone times the refraction index.

Pigtail: 900 µm fiber of several meters, connectorized at only one side. The other side will be terminated by a splicing.

Adaptor: Mechanical component used to connect two connectors.

Bending radius: It is the minimum radius of a curve that can support a fiber / a cable without damaging it.

Reflectometer or OTDR (Optical Time Domain Reflectometer): Measurement equipment used to check the properties of a transmission line (length, optical budget, return loss, etc.).

Optical repeater: Interconnection device used to amplify an optical signal between two points.

Sleeve: Central part of an adaptor, used to align the two ferules.

Switch: Equipment fitted with various ports (4, 8, 16, 24) to connect machines. It is used to connect two segments of local network.

VDI : Voice-Data-Images.

WAN (Wide Area Network): Wide network (no distance limitation).