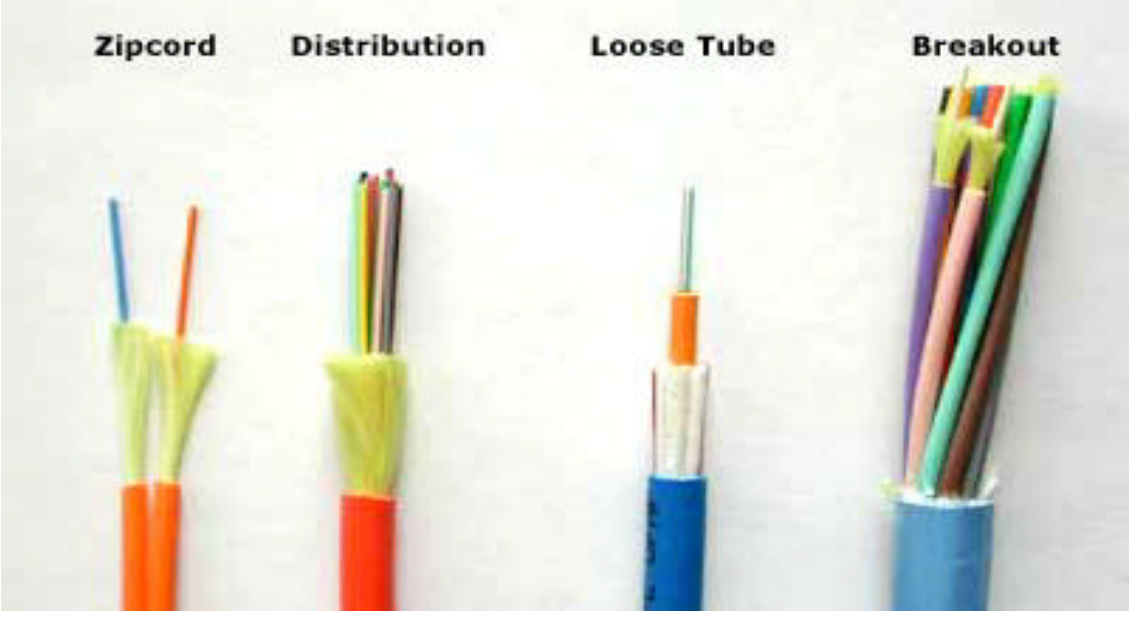
Fiber Optic Cable Selection

Fiber optic "cable" refers to the complete assembly of fibers, strength members and jacket. Fiber optic cables come in lots of different types, depending on the number of fibers and how and where it will be installed. Choose cable carefully as the choice will affect how easy it is to install, splice or terminate and, most important, what it will cost!

Choosing a cable - what hazards will it face?

Cable's job is to protect the fibers from the hazards encountered in an installation. Will the cables be exposed to chemicals or have to withstand a wide temperature range? What about being gnawed on by a woodchuck or prairie dog? Inside buildings, cables don't have to be so strong to protect the fibers, but they have to meet all fire code provisions. Outside the building, it depends on whether the cable is buried directly, pulled in conduit, strung aerially or whatever.
You should contact several cable manufacturers (two minimum, three preferred) and give them the specs. They will want to know where the cable is going, how many fibers you need and what kind (single-mode or multimode or both in what we call "hybrid" cables.) You can also have a "composite" cable that includes copper conductors for signals or power. The cable companies will evaluate your requirements and make suggestions. Then you can get competitive bids.
Since the plan will call for a certain number of fibers, consider adding spare fibers to the cable - fibers are cheap! That way, you won't be in trouble if you break a fiber or two when splicing, breaking-out or terminating fibers. And request the end user consider their future expansion needs. Most users install lots more fibers than needed, especially adding single-mode fiber to multimode fiber cables for campus or backbone applications.

Cable Types:



Simplex and zip cord: Simplex cables are one fiber, tight-buffered (coated with a 900 micron buffer over the primary buffer coating) with Kevlar (aramid fiber) strength members and jacketed for indoor use. The jacket is usually 3mm (1/8 in.) diameter. Zipcord is simply two of these joined with a thin web. It's used mostly for patch cord and backplane applications, but zipcord can also be used for desktop connections.

Distribution cables: They contain several tight-buffered fibers bundled under the same jacket with Kevlar strength members and sometimes fiberglass rod reinforcement to stiffen the cable and prevent kinking. These cables are small in size, and used for short, dry conduit runs, riser and plenum applications. The fibers are double buffered and can be directly terminated, but because their fibers are not individually reinforced, these cables need to be broken out with a "breakout box" or terminated inside a patch panel or junction box.

Breakout cables: They are made of several simplex cables bundled together. This is a strong, rugged design, but is larger and more expensive than the distribution cables. It is suitable for conduit runs, riser and plenum applications. Because each fiber 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 so much less labor to terminate.

Loose tube cables: These cables are composed of several fibers together inside a small plastic tube, which are in turn wound around a central strength member and jacketed, providing a small, high fiber count cable. This type of cable is ideal for outside plant trunking applications, as it can be made with the loose tubes filled with gel or water absorbent powder to prevent harm to the fibers from water. It can be used in conduits, strung overhead or buried directly into the ground. Since the fibers have only a thin buffer coating, they must be carefully handled and protected to prevent damage.

Ribbon Cable: This cable offers the highest packing density, since all the fibers are laid out in rows, typically of 12 fibers, and laid on top of each other. This way 144 fibers only has a cross section of about 1/4 inch or 6 mm! Some cable designs use a "slotted core" with up to 6 of these 144 fiber ribbon assemblies for 864 fibers in one cable! Since it's outside plant cable, it's gel-filled for water blocking.

Armored Cable: Cable installed by direct burial in areas where rodents are a problem usually have metal armoring between two jackets to prevent rodent penetration. This means the cable is conductive, so it must be grounded properly.

Aerial cable: Aerial cables are for outside installation on poles. They can be lashed to a messenger or another cable (common in CATV) or have metal or aramid strength members to make them self supporting. Even More Types Are Available: Every manufacturer has it's own favorites, so it's a good idea to get literature from as many cable makers as possible. And check out the little guys; often they can save you a bundle by making special cable just for you, even in relative small quantities.

Cable Design Criteria

Pulling Strength: Some cable is simply laid into cable trays or ditches, so pull strength is not too important. But other cable may be pulled thorough 2 km or more of conduit. Even with lots of cable lubricant, pulling tension can be high. Most cables get their strength from an aramid fiber (Kevlar is the duPont trade name), a unique polymer fiber that is very strong but does not stretch - so pulling on it will not stress the other components in the cable. The simplest simplex cable has a pull strength of 100-200 pounds, while outside plant cable may have a specification of over 800 pounds.

Water Protection: Outdoors, every cable must be protected from water or moisture. It starts with a moisture resistant jacket, usually PE (polyethylene), and a filling of water-blocking material. The usual way is to flood the cable with a water-blocking gel. It's effective but messy - requiring a gel remover (use the commercial stuff - it's best- -but bottled lemon juice works in a pinch!). A newer alternative is dry water blocking using a miracle powder - the stuff developed to absorb moisture in disposable diapers. Check with your cable supplier to see if they offer it.

Fire Code Ratings: Every cable installed indoors must meet fire codes. That means the jacket must be rated for fire resistance, with ratings for general use, riser (a vertical cable feeds flames more than horizontal) and plenum (for installation in air-handling areas. Most indoor cables us PVC (polyvinyl chloride) jacketing for fire retardance. In the United States, all premises cables must carry identification and flammability ratings per the NEC (National Electrical Code) paragraph 770. These ratings are:

NEC Rating	Description
OFN	Optical fiber non-conductive
OFC	Optical fiber conductive
OFNG or OFCG	General purpose
OFNR or OFCR	Riser rated cable for vertical runs
OFNP or OFCP	Plenum rated cables for use in air-handling plenums
OFN-LS	Low smoke density

Cables without markings should never be installed as they will not pass inspections! Outdoor cables are not fire-rated and can only be used up to 50 feet indoors. If you need to bring an outdoor cable indoors, consider a double-jacketed cable with PE jacket over a PVC UL-rated indoor jacket. Simply remove the outdoor jacket when you come indoors and you will not have to terminate at the entry point.

Choosing a Cable

With so much choice in cables, it is hard to find the right one. The table below summarizes the choices, applications and advantages of each.

Cable Type	Application	Advantages
Tight Buffer	Premises	Makes rugged patch cords
Distribution	Premises	Small size for lots of fibers, inexpensive
Breakout	Premises	Rugged, easy to terminate, no hardware needed
Loose Tube	Outside Plant	Rugged, gel or dry water-blocking
Armored	Outside Plant	Prevents rodent damage
Ribbon	Outside Plant	Highest fiber count for small size