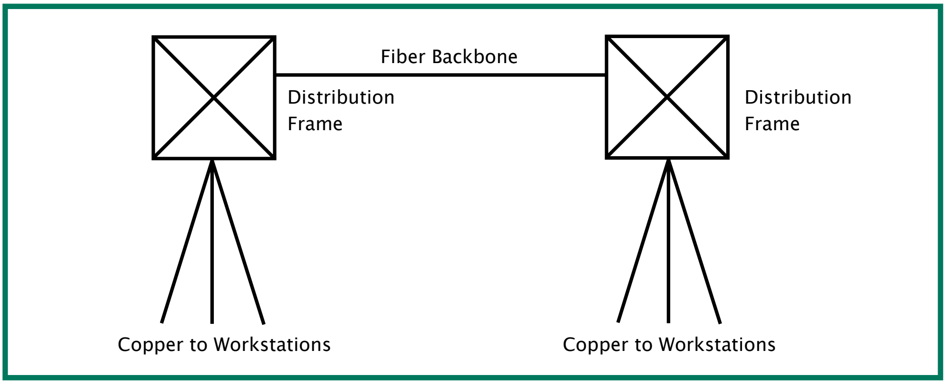
FIBER IN LOCAL NETWORKS

Fiber in Local Area Networks

Today, when local area networks are being built, quite a lot of fiber is laid out. Most of the fiber is laid out between racks, either in the same building or in different buildings.

In other words, fiber is used between racks, and copper is laid out to the workstations. In that way, you avoid to replace anything at each individual user.

Figure 1



Typically, a fiber backbone connects two racks. You will also find a number of media converters, converting optical signals into electrical signals.

Previously, it was common to lay out 2 or 4 fibers, but today it is standard practice to lay out 12 or 24 fibers. Regarding indoor installations, it is very important not to use fiber cables containing PE or PA as these substances are extremely flammable. According to a danish departmental order for electrical installations it is prohibited to use copper cables containing PE/PA in indoor installations. Even though this departmental order does not incorporate fiber cables, it will be sensible not to use fiber cables containing PE/PA indoors, considering insurance conditions.

Regarding fiber, there are two main groups of enclosures, loose tube cables and tight buffer cables.

Loose Tube Cables

Figure 2

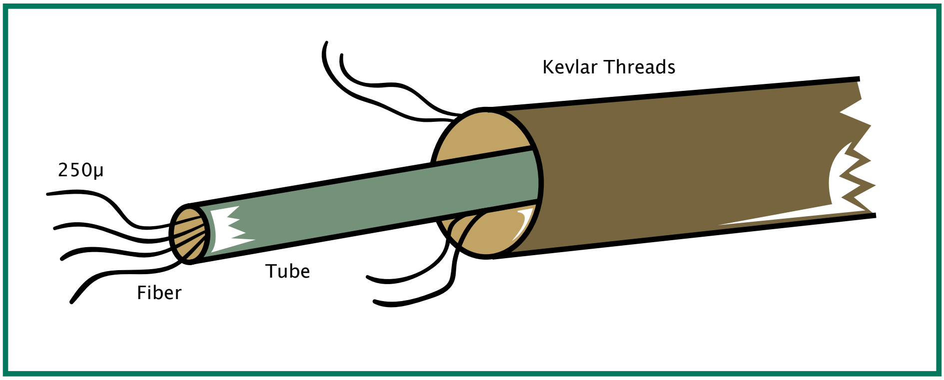
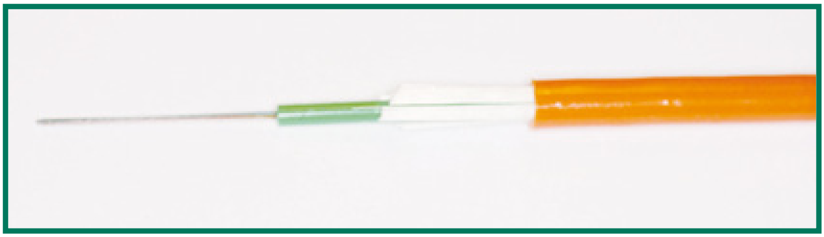


Figure 2 shows the design of a loose tube cable. Commonly, the tube has a diameter between 2,8 and 3,2mm. However, tubes with a diameter as small as 1,2mm have been developed. In spite of the reduced diameter, the tube has still room for 12 fibers.

Loose tube cables protect the fibers well, and the tube itself may be filled with gel to protect the fibers against moisture. Normally, each tube contains up to 12 fibers, sometimes up to 24 fibers. If the cable contains one single tube, it is called a uni tube and if it contains several tubes, it is called a loose tube cable. Draka produces cables with up to 46 tubes with 24 fibers pr. tube, which gives a total of 1104 fibers.

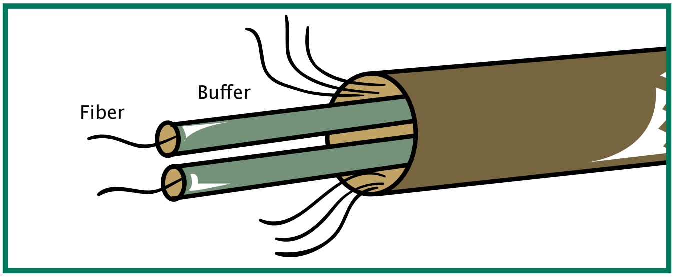
Figure 3



Loose tube label

Tight Buffer Cables

Figure 4



This is a tight buffer cable. Notice, that each fiber is covered by a buffer (900μm). Tight buffer cables are usually used as "break out cables" (a branch from cables in a duct tube ending in a wall outlet). Patch cables are also examples of tight buffer cables. Commonly used are sizes from one single fiber up to 24 fibers.

Figure 5

Tight buffer cable

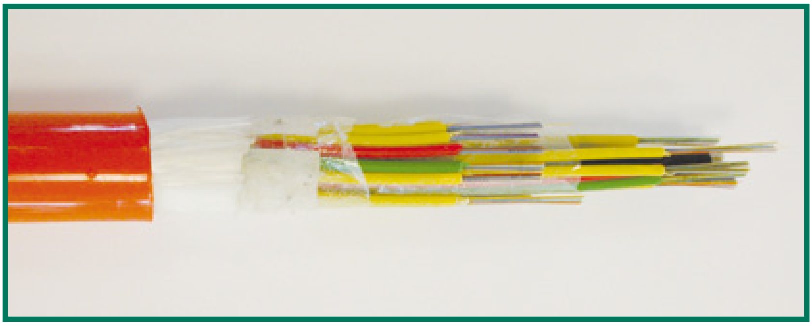
The Choice Between Tight Buffer and Loose Tube Cables

Tight buffer cables have an additional protection covering the fiber, which makes it easier to terminate the cables. They are suitable for terminating directly into a connector, that is, in wall outlets or patchpanels. The kevlar in the cable gives it strength, but cables do not withstand getting pulled or jammed, and fastening the cable with a cable tie is not good, either. But the cable is well protected at the point, where the connector is attached.

In return, however, loose tube cables are cheaper and they take up less room. They consist of tubes, each containing 12 or 24 fibers, so with regard to cable installations, the lay out is easier, due to the smaller size. But now the problem appears. The cable must be terminated. It must be terminated with either a breakout kit or a splice cassette.

Contrary to tight buffer cables, loose tube cables are not suitable for termination directly into a connector. Unfortunately, many installers do so anyway and as a result of this, the expected life of the installation, presumably, will get shortened. Doing it right takes a little longer and requires maybe a splice cassette and a splicer. The extra consumption of time is of course a disadvantage.

Figure 6



Loose tube cable from Draka, with 1104 fib-ers, quite impressive

Other Types of Cable

These days, new types of cable are on their way, including the so called micro cables. The coating thickness of these cables has been reduced considerably and, as a result of this, the coating is not so protective against tensile stress, thrust, blows, bends, etc. Micro cables are meant for laying into tubes, to give them the necessary strength.

At the beginning of 2009, 96 fibers in one tube is the most common number, but 144 fibers are on their way. The crucial question concerning a micro cable is, can it be blown through a 10mm tube? If you are dealing with a 144 fiber cable, it may be rather difficult to blow the cable all the way. Micro cables are usually used in FTTH (Fiber To The Home) installations, not so much in LAN (Local Area Network) installations.

Figure 7

Micro cable

The photo above shows a micro cable. It is hard to see on the photo, but the cable contains 72 fibers, the six coloured mini tubes contain 12 fibers each.

Connecting Fibers

There are two ways to connect fibers. It applies to fiber as well as to copper, either spliced (permanently), or with opportunity for changeover, using a connector.

Splicing

Splicing can be done, either mechanically, or by using a fusion technique.

A fusion splicer, that fuses or melts the fibers together, produces a very low loss. Furthermore, this method of splicing is cheap to carry out. However, this technique requires a fusion splicer. A splicer costs from appr. 7000 USD and up. A splicer of very high quality may cost threefold that amount.

Figure 8

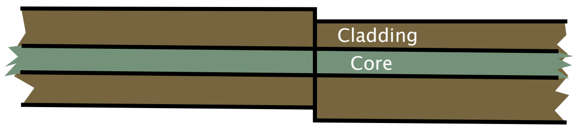
Core fusion splicer from Sumitomo

Figure 9

V-groove fusion splicer from Sumitomo

The photos above show two different types of fusion splicers. Even though they function in the same way, like all other fusion splicers, they represent the two main types, namely core and cladding splicers. The difference between these two types is the way, in which the fibers are brought together. The core splicer aligns the two pieces of fiber relative to the core, whereas the cladding splicer aligns relative to the cladding.

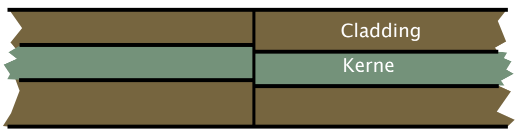
Figure 10



Core Splicer

Figure 10 illustrates the principle of a core splicer. The two pieces of fiber are brought together after which the cores are aligned.

Figure 11

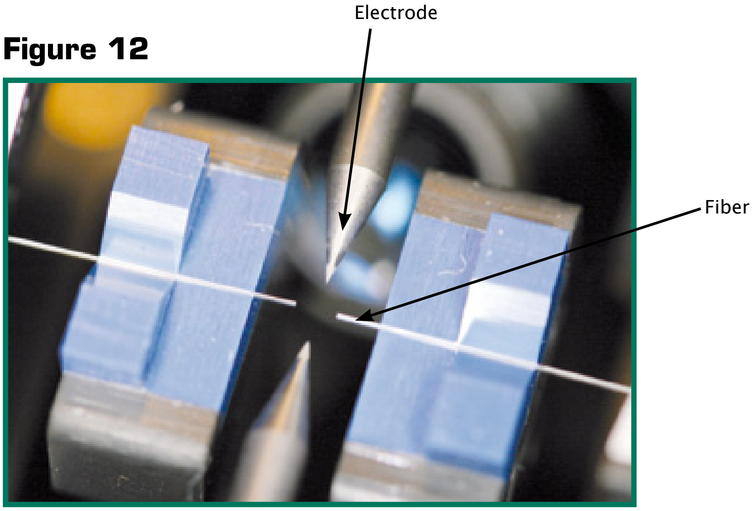


Cladding splidser

The cladding splicer, as shown in figure 11, aligns the claddings. Notice, that the cores do not match. This type of splicer is also called a V groove splicer.

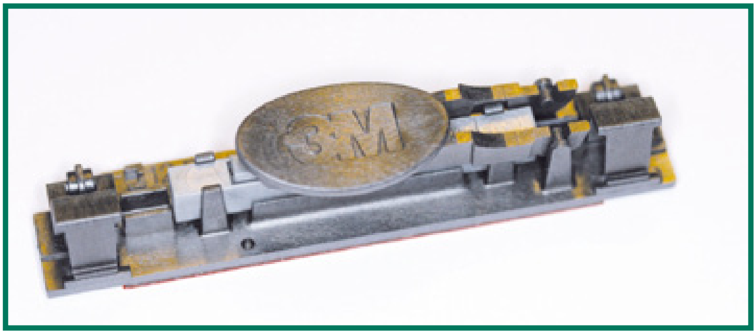
The best result is obtained using a core splicer, but the relatively cheaper cladding splicers are usable in many situations. Concerning losses, the core splicing method causes a loss between 0,01 and 0,03dB and a little higher as to a cladding splicer.

Figure 12



On figure 12 you see two pieces of fiber, placed in the splicer, ready to being spliced.It is also possible to connect fibers mechanically. This method is some-what more expensive, but cheaper with regard to equipment, on the other hand. Mechanical splicings take up more space than fused splicings.

Figure 13

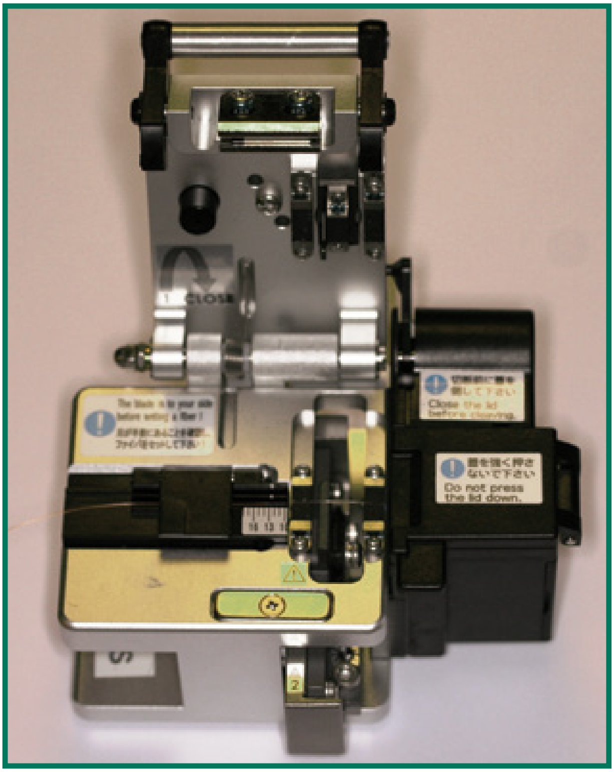


Mechanical splicing from 3m.

Cleavning

Before splicing, you must cleave. The fiber must be cut clean in an angle of 90 degrees. It is very important to be precise, as deviation of 0,1 degree only, will produce a poorer result.

Figure 14



Cleaver