

Compact Fiber Optic Cables with Central Strength Element for FTTH Applications

White Paper¹

1. Introduction

Fiber optic cables using solid, rod-like central strength element have two major advantages: (i) they are robust and have high mechanical strength; (ii) they possess a very low thermal expansion rate and can withstand extreme weather conditions. The disadvantage is that these cables are rigid and their size is relatively large. The applications of such cables are mainly for high fiber-count outdoor installations and they are not economical for low fiber-count installations. As a result, low fiber-count cables are normally without a central strength element. Especially in Europe, low fiber-count cables without a central strength element are widely deployed for FTTH indoor applications with the corresponding shortcomings.

In recent years, a few inventions of low fiber-count cables using at least two parallel metallic or non-metallic solid, rod-like strength elements with anti-buckling strength are published (1, 2). Especially in the US and in Asia, such cables are widely installed as FTTH drop cables. However, this flat cable that contains two strength elements is relatively rigid and large for in-house installations where existing cable channels are usually small. Another disadvantage of these flat drop cables is the asymmetric bending behavior, which means that the cables could only be bent in one direction during installations. In addition, the fiber counts of this type of cables are limited.

Novobit has developed a new compact fiber optic cable with a **central strength element from FRP** that overcomes the disadvantages mentioned above by applying a novel concept of cable construction. This new cable under the trademark "**BrightCore**[®]" is suitable for both FTTH indoor and outdoor installations.²

2. Cable Construction

2.1 FTTH BrightCore[®] Indoor Cables

Figure 1 shows the structure of the FTTH BrightCore[®] indoor cables:

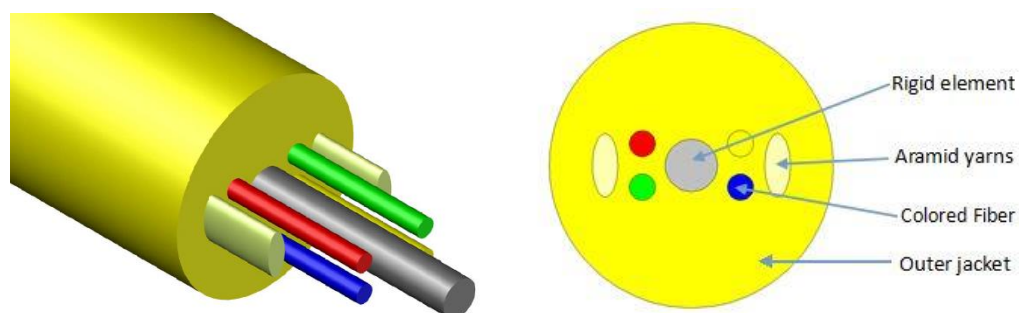


Figure 1. FTTH BrightCore[®] Indoor Cables

¹ Version: 1.1, Date: December 2015

² © BrightCore is a registered trademark of Novobit AG. For a description of Novobit AG please see the section "Company" below

A **rigid element from FRP** is situated in the center of the cable (**central strength element**). It is tightly coated by thermoplastic material that performs the function as the cable jacket in the same time.

Two optical fibers are embedded longitudinally along each side of the central strength element inside the thermoplastic layer. The optical fibers are of no preferences, they can be single-mode as well as multi-mode.

Two sections of tensile strength elements made from **aramid yarns** are also embedded longitudinally alongside the fibers. The cable's outer jacket is made from flame retardant LSZH.

2.2 FTTH BrightCore® Outdoor Cables

Figure 2 shows the structure of the FTTH BrightCore® outdoor cables:

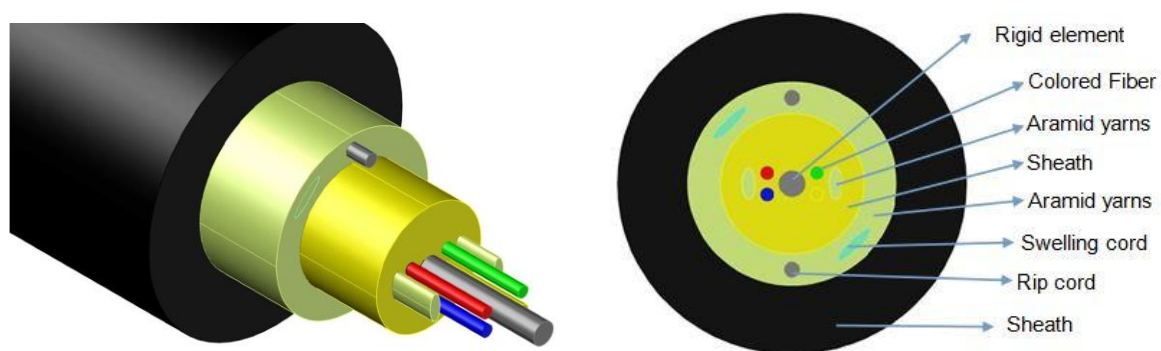


Figure 2. FTTH BrightCore® Outdoor Cables

In the case of FTTH outdoor cables an outer sheath made from HDPE is additionally used. This robust sheath makes the cable also suitable as **aerial drop cables**. The inner cable with LSZH jacket material is the same as the FTTH indoor cables described in 2.1. The only distinction here is that up to 24 fibers can be embedded in this outdoor cable. Between the outer sheath and the inner cable there are aramid yarns as well as water blocking cords (swelling cords) and rip cords. After an easy stripping of the outer sheath using rip cords, the inner cable can be deployed for indoor installations.

3. Product Benefits

The BrightCore® cable is a composite of thermoplastic and FRP. The relatively large shrinkage and expansion of thermoplastic is compensated by the FRP. The resulting advantage is the very good thermal performance of the cable. The working temperature can be extended to a range of -40°C and +80°C.

Another advantage is the high anti-buckling strength provided by the central strength element from FRP. Using non-metallic FRP as central strength element also makes the (outdoor) cable safe to the environment / network in the course of lightning strikes. Beside non-metallic FRPs, the central strength element of the BrightCore® Cables can also use metallic material such as steel wire. The benefit of using thin steel wire as central strength element is that the cable will become more flexible.

Due to the compact design, the BrightCore® indoor cables' size and mass are greatly reduced: 2.0 mm cable diameter and 3.5 kg per km. The cables have a low friction rate and can be easily installed (both push and pull) in channels with tight turns. Because of a unique construction, the cables are easy to strip and the fibers are easily accessible which enables fast and economical installations. Moreover, the cables are very soft, flexible and can be bent in any direction.

The FTTH BrightCore® indoor cables can be configured either with aramid yarns or without aramid yarns. Holding the strength of the central element constant, the cables will get a higher tensile strength with aramid yarns than without aramid yarns. However, we can also achieve a high tensile strength without aramid yarns by strengthening the central strength element. This also leads to higher anti-buckling strength as well as higher thermal performance of the entire cable.

In the case of BrightCore® outdoor cables, we can construct the cables to have an outer diameter between 4.8 mm and 6.0 mm for different tensile strengths. Up to 24 optical fibers can thus be embedded in just one outdoor cable. This makes it possible to produce small-sized and robust cables with only one FRP element suitable for outdoor / aerial installations under harsh environmental conditions.

In addition, the cable manufacturing process can get rid of one extrusion step, leading overall to only one extrusion iteration for indoor cables and two for outdoor cables. This makes the cable production highly economical and efficient. Moreover, less cable material is consumed during the production process.

For both indoor and outdoor cables there are two versions available: (i) non-connectorized (bulk) cables, and (ii) pre-connectorized cables. The first cable is not pre-connected on both ends of the cable. The second cable is pre-connected on one end of the cable and with an outlet. Both non-connectorized and pre-connectorized cables are packed in environmental friendly cartons that are optimized for on-site installations. The following figure illustrates the two packaging systems:



Figure 3. Packaging of the FTTH BrightCore® cable systems

References

1. United States Patent 6714710, Inventors: Gimblet, Michael J. (Hickory, NC), Application Number: 10/294136, Publication Date: 03/30/2004, Filing Date: 11/14/2002, Fiber optic cables with strength members

2. WIPO Patent Application WO/2004/038474, Inventors: Honjyou, Takeshi c/o FUJIKURA LTD. SAKURA WORKS (1440 Mutsuzak, Sakura-shi Chiba, 285-8550, JP) Kobayashi, Kazunaga c/o FUJIKURA LTD. SAKURA WORKS (1440 Mutsuzak, Sakura-shi Chiba, 285-8550, JP) Kusakari, Masahiro c/o FUJIKURA LTD. SAKURA WORKS (1440 Mutsuzak, Sakura-shi Chiba, 285-8550, JP) Koyasu, Osamu c/o FUJIKURA LTD. SAKURA WORKS (1440 Mutsuzak, Sakura-shi Chiba, 285-8550, JP) Shiobara, Satoru c/o FUJIKURA LTD. SAKURA WORKS (1440 Mutsuzak, Sakura-shi Chiba, 285-8550, JP) Osato, Ken c/o FUJIKURA LTD. SAKURA WORKS (1440 Mutsuzak, Sakura-shi Chiba, 285-8550, JP) Hara, Masashi c/o FUJIKURA LTD. SAKURA WORKS (1440 Mutsuzak, Sakura-shi Chiba, 285-8550, JP) Tanaka, Shimei c/o FUJIKURA LTD. SAKURA WORKS (1440 Mutsuzak, Sakura-shi Chiba, 285-8550, JP) Ohashi, Keiji c/o FUJIKURA LTD. SAKURA WORKS (1440 Mutsuzak, Sakura-shi Chiba, 285-8550, JP), Application Number: PCT/JP2003/013637, Publication Date: 05/06/2004, Filing Date: 10/24/2003 , OPTICAL DROP CABLE

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Company

Novobit AG is a well-established and fully independent company that develops and manufactures a wide range of fiber optic products for the global market. Our engagement in the field started back in 2000 and our company was officially founded in 2002 in Winterthur, Switzerland where its headquarters are. Our customers can count on our comprehensive knowledge of the market and decades of experience. Today, we employ nearly 300 employees who are the driving force behind our performance.

Novobit's vision is a fiber-connected world. Our mission is to help public and private network operators and cloud and data center service providers all over the world to build up or modernize their networks and infrastructure with fiber optic technology. We achieve this by delivering technology innovations as well as the highest quality standards in fiber optic connectivity, making connections faster, more reliable, and more economical.