



**Draka's success story of Bend-Insensitive fibers**  
**BendBright-XS and BendBright-Elite:**  
**from FTTH to component and specialty applications**



Value Innovation is a way of looking at the world. How can we help our customers do more, make more, save more, achieve more.

This attitude is in particularly applicable for Draka's continuous efforts in the field of bend-insensitive (single-mode) fibers (BIF). Draka has a long history in improving the bending characteristics of its single-mode fibers (SMF), long before main

competitors took up this issue. Draka - rightly positioned as the "bending company" - has developed two BIF products:

**BendBright-XS**, a BIF suitable for all access and FTTH cable applications, including in-building networks

**BendBright-Elite**, an ultra-BIF, especially suitable for component intraconnection and specialty applications

## Introduction

Both application areas (FTTH and component intraconnection) require tighter bendable fibers in order to reduce the component size and volume, minimizing the cost of ownership. Another advantage of BIF is the easier installation techniques which can be applied, reducing the cost of installation. For ultra-BIF, one key advantage is to also facilitate handling thus reduce assembly time - hence

production costs - of optimized footprint components and specialty sub-systems. BIF and ultra-BIF offer reduced CAPEX for the end-users in both application areas. Draka started its activities on optimizing the bending characteristics of SMF at the start of this century, in preparation of the FTTH development. In 2002 Draka's BendBright SMF was launched, with bending optimization by means of

selected mode-field diameter (MFD) and fiber cut-off wavelength. This fiber has successfully been used in the USA market (OSP drop-cable), recognized with the 2005 AT&T award for outstanding technical innovations.

Draka continued its progress in this area with the development of its optimized BIF product, **BendBright-XS**, launched in September 2006. Here a new technique was applied of a trench-assisted core structure, improving the confinement of the light to the core. This fiber type fully complies with ITU-T Rec. G.657B as well as Rec. G.652D.

**BendBright-XS** has proven to be very successful: since its introduction well over one third million fiber kilometers have been sold worldwide, in a large number of different FTTH projects, different cable types and different (indoor) installation techniques. This leading position offers Draka a large knowledge base of different

FTTH installations, showing the perfect performance of this fiber type for indoor cable installations. Not once a complaint was returned about too high bending losses after installation.

Following the knowledge on trench-assisted core structures, Draka developed recently another kind of BIF-product, which due to further tightened bend loss specifications can be introduced as ultra-BIF. This product is launched in January 2009 under the name of **BendBright-Elite** and is introduced as a new product in Draka's specialty fiber family:



in particular for component intraconnection applications. This market segment is another example where tighter bend radii are required.

## Performances

BIF needed adequate standardization. With **BendBright-XS** Draka played a major and leading role in ITU-T in developing the present G.657 recommendation, which was approved in 2006.

This standard contains two versions: class A with moderately improved bend loss characteristics and class B with major improvement compared to traditional G.652 fibers, see Figure 1.

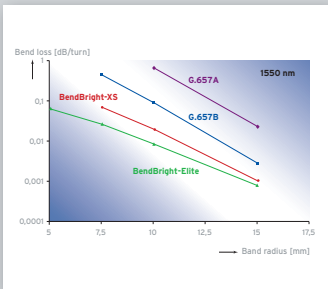


Fig. 1. G.657A + G.657B bend loss specifications (1550 nm) and typical bend loss values for **BendBright-XS** and **BendBright-Elite**.

## FTTH cable bend loss behavior

From a technical background it can be stated that the cabled bend loss behavior of BIF's is determined by the glass fiber design as well as the cable construction in which it is used. Where bare fiber bend loss is linear with bending length, Draka showed that cabled fiber bending is not linear. For example, four separate 90-degree cabled fiber bends

(encountered in FTTH roll-outs) show four to more than ten times lower bend loss than one 360-degree cabled fiber bend depending on the cable type, see Table 1. This clearly shows that bare fiber bend loss models for calculating the total FTTH indoor installation loss are overestimating cabled fiber bend loss and therefore do not reflect real installation loss. Based on its cabled

fiber bend loss behavior Draka's **BendBright-XS** has shown to be THE fiber for FTTH installations. The use of a very tight *bare fiber* bend loss specification (e.g.  $\leq 0.1$  dB @1550nm at a radius of 5 mm), in combination with inappropriate cable constructions or installation procedures could to some extent be dangerous as the fiber does not ring any loss alarm if subjected to very low radii (2 - 3 mm), impacting

the fiber life time expectation. That is why such ultra-bending performance should always be used in combination with either an appropriate in factory procedure (for components) or appropriate cable construction and installation procedures (for FTTH). Consequently, for this latter FTTH field, Draka is supporting standardization of more pragmatic approaches in the form of *cabled fiber* bend loss specification.

90 degree cable testing R=5mm at 1550nm using <b>BendBright-XS</b>	One continuous 360 degree loop	One 90 degree bend	Four 90 degree bends in series	Reduction factor bending loss 1*360 degrees versus 4*90 degrees
Standard duty cable (3 mm in diam.)	0.24 dB	0.016 dB	0.064 dB	4
Ruggedized cable(4.8 mm in diam.)	0.11 dB	0.002 dB	0.008 dB	13.75

Table 1. Disproportional behavior of 90 degree cabled fiber bend loss compared to 360 degree bend loss

## BendBright-XS for FTTH

In Draka's view G.657B-based BIF (and still compliant to G.652D like the **BendBright-XS**) is excellently suited for all FTTH access cable applications including indoor cabling. Draka's impressive sales figures of, and experience with, **BendBright-XS**, bear this view. In addition, **BendBright-XS** is supporting this application by a sharply price positioning, as close

as can be to the one of widely-deployed G.652D single-mode fiber. Such price-point is another excellent feature for end-users' CAPEX and of utmost importance as decision factor in realizing new FTTH projects. **BendBright-XS** is the best overall optimized (bend loss and price) BIF available in the market nowadays.

## BendBright-Elite for component and specialties

The new **BendBright-Elite** has been optimized for component level applications which require precise geometrical control with tight core/clad concentricity and cladding diameter tolerances. In addition Draka's **BendBright-Elite**, in its commercial standard version, is proof tested to twice the normal value ( $> 1.4$  GPa or 200 kpsi) to ensure the highest reliability, hence lifetime, even in bends as small as 5 mm.

It is worth underlining that the performance premium for such new ultra- BIF (e.g. **BendBright-Elite** but similarly competitor fiber) has, de-facto, a price premium impact. These fibers are sub-optimized to bend loss only and can be used in market/applications where such optimization is required; the associated price premium is acceptable, as induced-benefits in terms of better footprint and handle-ability are off-setting such premium.

Examples of such applications are for instance component-intraconnection, military cable, tactical cable, aerospace applications, sensors, etc.

However, for larger volume FTTH indoor cabling, ultra-BIF's higher price point may significantly impact the CAPEX and Return on Investment plans for many end-users projects. Customers of course still could make a choice to apply ultra-BIF (like **BendBright-Elite**) for FTTH indoor cable installations. In that case Draka will certainly serve these customers and offer the necessary relevant cable design, based on Draka's large experience in FTTH applications.

In general, however, Draka recommends the flagship **BendBright-XS** BIF as the fiber of choice for FTTH, which supports most indoor cable applications.

### Further information

Interested how Draka can support your Value Innovation?

For Draka's **BendBright-XS** BIF and **BendBright-Elite** ultra-BIF datasheets, please contact us at one of our locations, for which full details are provided below or check our website.

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