Draka

UC^{FIBRE} Optical Fibre Cable

CABLE SOLUTIONS FOR NETWORKS TO LAST

A brand of the

Prysmian Group

Prysmian Group – a leading player in the cable industry

2011 will go down in the history of the cable industry as the founding year of a successful merger.

With 22,000 employees across 50 countries, sales of some € 7 billion and 98 plants, the new Prysmian Group is the world leading manufacturer of cables and accessories for the energy and telecommunications industry. In the energy sector, the Prysmian Group portfolio ranges from high voltage and extra high voltage underground and submarine power transmission cables, medium and low voltage cables for the construction and infrastructure industry to special cables for applications in these industries. The telecommunications portfolio includes cables and accessories for the voice, video and data transmission industry as well as optical fibre cables for almost all communication applications. The Prysmian Group has a strong position in high-tech markets and in the production of optical fibre cables. With its know-how, first-class products, services and technologies, the Prysmian Group provides solutions for all market segments. Innovation, customer satisfaction and outstanding service make the Prysmian Group with its global presence the leader in the cable industry. More information here: www.prysmiangroup.com

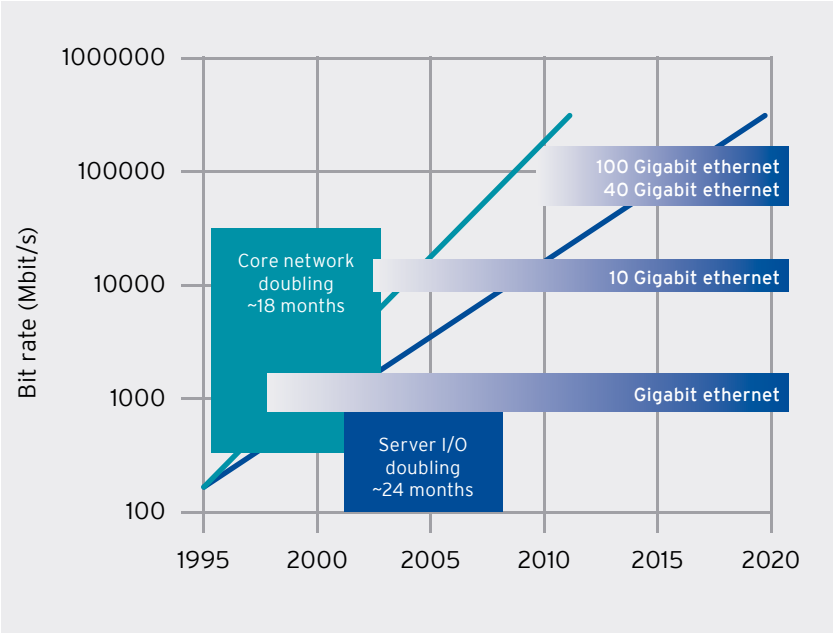
Application of UC^{FIBRE}: LAN

When it comes to data transmission cables, more and more users decide for fibre technology. It is the undisputed number one in today's Local Area Networks (LAN) – structured cabling in campus and riser networks.

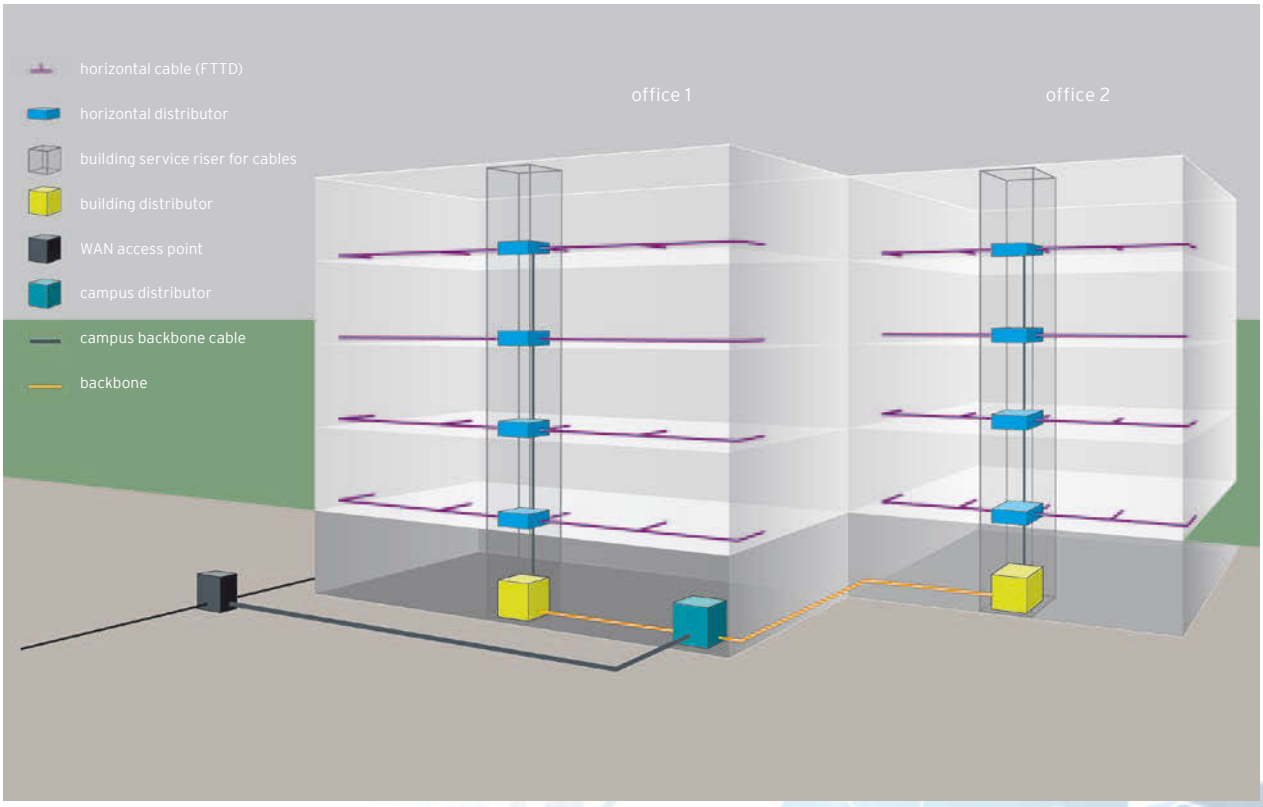
The decision to use either fibre optic or copper data cables as an ideal solution for horizontal networks depends on many factors like application environment, previous network basis and future needs.

Whatever you decide for, with fibre optic data cables of the UC^{FIBRE} series – specifically designed to meet the requirements of all structural levels of local networks – you are on the safe side for the future.

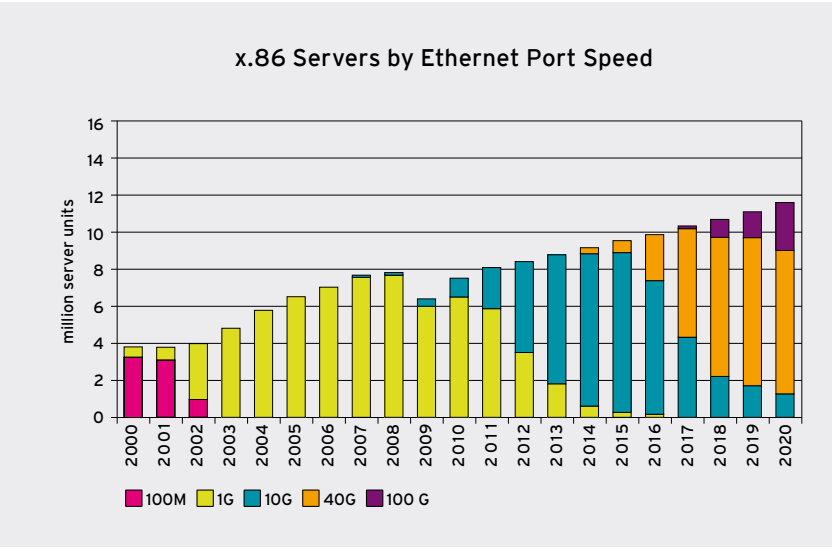
Transmission rates are developing exponentially. New transmission protocols follow in ever shorter periods of time. 10 years ago 1 Gb/s was state of the art and only foreseen for communication between switches, servers and storage systems. 5 years ago the 10 Gb/s protocol was developed and is becoming mainstream.



Next generation 40 Gb/s and 100 Gb/s are already here. Using MaxCap advanced optical fibres from Draka insures that your network can be upgraded to the coming generations of network in all cases where the protocols are compliant.



Application of UC^{FIBRE}: Data Centre



Every data centre is a unique structure. There are various segments of different requirements which need to be understood before creating any solution.

Data centre backbones are already equipped with optical fibre technology. Optical fibre technology offers lowest attenuation, highest bandwidth and longer link lengths. Thus supporting the highest data rates which is a prerequisite for backbone data links. Within data centres it forms one of the most critical components due to the highly aggregated data traffic there.

As soon as 10 Gigabit Ethernet comes to the agenda at client level, a data centre backbone capable of 10GbE to link between access and distribution level turns into a real bottleneck. Despite the fact that copper data cables are capable of covering a distance of up to 100m at 10Gbit/s, the preference in this place should be laser optimized multimode fibre according to the OM4 specification. Today's recommendation is clearly to take this future proof solution which is the only short-link technology that is also part of the 40 Gigabit Ethernet and likewise 100GbE Ethernet. It is based on multi-lane structures of OM4 or OM3 channel links. A data centre backbone in OM4 can therefore be easily expanded to the Next Generation Ethernet and secures investments for a longer pack-off time.

Draka's patented PCVD fibre manufacturing technology enables high-precision refractive index profiles which are the key to laser launched high-speed links. This makes the difference between MaxCap-BB-OM4 or MaxCap-BB-OM3 and traditional multimode fibres like OM1 and OM2.

This fibre technology is available in all Draka cable designs to meet any specific needs.

Specific for the protected, yet demanding environment of data centres are requirements for small dimensions and easy installation. Thus Draka are presenting new and innovative cables directed for these high fibre count applications. The advanced cables are developed to work together with the most advanced optical connectors on the market like the MPO/MTP® connector families. The cables come in different styles and with different fibre types, thus satisfying any need for high fibre count data centre cabling.

Application of UC^{FIBRE}: Industry

Ethernet – the classic office application – is increasingly accepted also in industrial automation. In addition to bus solutions still to be encountered, Ethernet makes it possible to manage communication. It is possible to selectively access every single point in the network which makes adjustments and modifications much easier and in the end leads to a reduction of idle times and an increase in productivity.

Fibre optic cables of the series UC^{FIBRE} are the first choice for Ethernet in a rough industrial environment. Here the cables prove their superiority as to mechanical, chemical and climatic capacity - and, of course, you don't have to care about electromagnetic interferences.

Relevant Ethernet standards:

International Standards

ISO/IEC 11801 (2002)
Information technology
- Generic cabling for customer premises
ISO/IEC 24702 (2006)
Information technology
– Generic cabling – Industrial premises
ISO/IEC 24764 (2010)
Information technology
- Generic cabling for data centres
ISO/IEC 15018 (2004)
Information technology
– Generic cabling for homes

European Standards

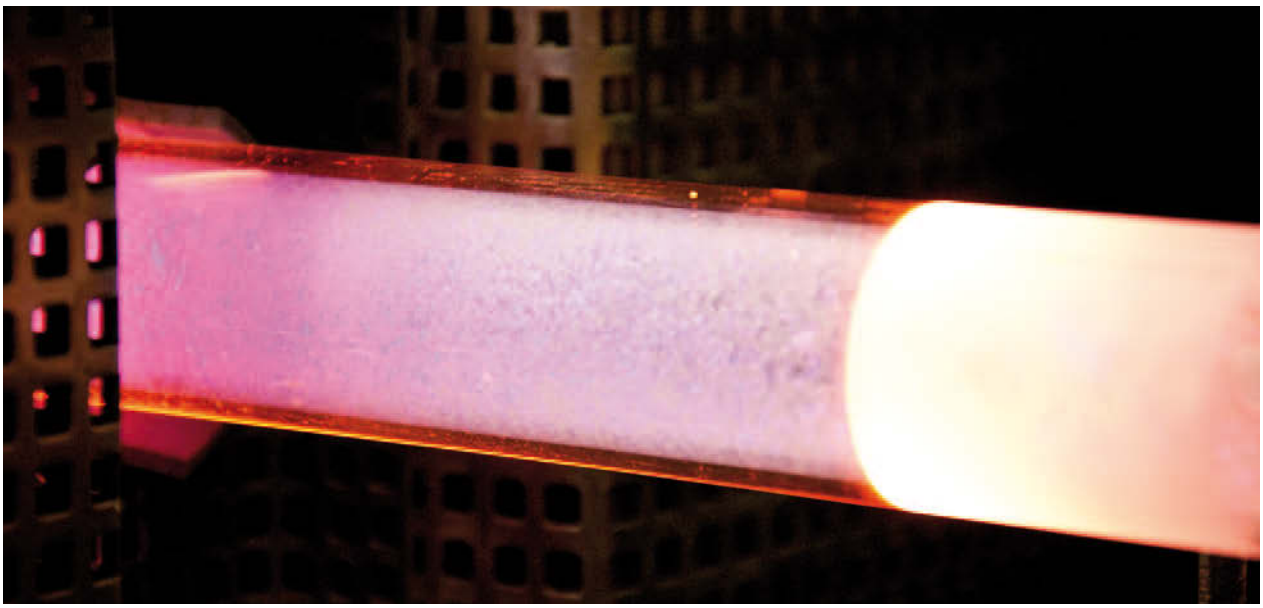
EN 50173-1 (2007) Information technology
- Generic cabling systems
- Part 1: General requirements
EN 50173-2 (2007) Information technology
- Generic cabling systems
- Part 2: - Office premises
EN 50173-3 (2007) Information technology
- Generic cabling systems
- Part 3: - Industrial premises
EN 50173-4 (2007) Information technology
- Generic cabling systems
- Part 4: - Homes
EN 50173-5 (2007) Information technology
- Generic cabling systems
- Part 5: - Data centres

	Class		
Mechanical	M_1	M_2	M_3
Ingress	I_1	I_2	I_3
Climatic	C_1	C_2	C_3
Electromagnetic	E_1	E_2	E_3

Mice Matrix

MICE is the heading under which the demands for wiring is covered in a standardized way. A set of requirements is defined which consists of mechanical (M), ingress (I), climatic (C) and electromagnetic (E) components. A difference is made between three categories (1, 2 and 3): office (1), light industry (2) and heavy industry (3). The crucial factor: a newly designed product, built up from experience must demonstrate the right combination of properties for its envisaged purpose.

How do we make optical fibre?



Optical fibres used for Telecom or Datacom applications are thin threads of glass – 0.125mm in diameter – and surrounded with a polymer protection coating, in total 0.242mm diameter (Roughly the size of a human hair). They are drawn from a 15cm diameter glass rod, which is called a Preform. This preform already contains the light-guiding area of the final fibre – the core – built up in many layers. After all, an optical fibre is composed of different areas of glass and polymers.

The essence is a core of very high quality glass with a 0.009mm diameter (single mode fibre if you are a specialist). A multimode fibre – used in Datacom - has a larger core diameter of e.g. 0.05mm. The core is where the light and thus communication signals passes through. The core is surrounded by a different type of glass (the cladding), followed by a double layer polymer coating. The process of manufacturing an optical fibre may vary from one manufacturer to the other. Here is an explanation of how Draka produces optical fibres.

How to make a preform

In Eindhoven (NL) and elsewhere within Draka, the PCVD process (Plasma Chemical Vapour Deposition) is being used for the production of a glass preform. The basis of the preform is a high-grade quartz hollow tube. This tube is placed in a PCVD-lathe, allowing a special gas mixture to pass through, which is ionized into plasma by using high power microwaves. This microwave power is created in a magnetron (similar to that in your kitchen, only more powerful) and is connected to a resonator. This assembly moves up and down the length of the tube, coupling power into the gasses passing through the tube. The high power creates plasma (ionized gases, similar as in a fluorescent lamp). The plasma causes the gases, to react, depositing thin glass layers onto the inside of the tube. PCVD is a unique highly efficient process developed by Philips, now owned by Draka.

Collapsing: transforming a tube into a solid rod

In the PCVD deposition process, the wall thickness of the tube is increased because of the newly deposited glass layers. To render this tube into a solid rod, this hollow space needs to be removed and for that the preform is placed into a so-called 'Collapsing' lathe. Here, an induction furnace at about 2000°C moves up and down the quartz tube and the heat causes the tube to 'collapse' into a solid glass core rod, due to surface tension. The beauty of this method is that it doesn't change the qualities of the final preform, maintaining the core-to-cladding ratio.

Over-Cladding Process

The collapsed core rod now requires a glass over-cladding. Silica (very clean sand) is heated and de-

posited as extra glass layers over the core rod using a plasma torch until the required diameter of the final preform is met. This process is called APVD (Advanced Plasma and Vapour Deposition)

From Preform to Fibre

Next fibre is drawn from the final preform in tall drawing towers. Such a tower is erected in a vibration-free setup as the slightest trembling could disturb the process. The preform is slowly lowered into a furnace fixed at the top of the tower where the preform end is heated above 2000°C. A thin 0.125mm diameter fibre is drawn from the preform in this extreme hot area. Subsequently the fibre is cooled down and a double layer of polymer coating is added, for protecting the glass thread. The polymer coatings are achieved by passing the fibre a cell filled with liquid acrylate polymer, which are cured using UV-lamps.

Finally this dual-layer coated fibre is wound onto a take-up drum (see drawing). At the same time, special equipment monitors the fibre's diameter. By modifying the drawing speed, the glass diameter can be maintained at a diameter of 0.125 +/- 0.001mm over several hundreds of kilometres.

Cutting and testing

Because the fibre on the take-up drum is too long for most applications after drawing, it is re-spooled on to shorter, more manageable lengths. During this process, the fibre is checked by performing a 'Tensile strength test', by introducing a tension which elongates the fibre up to 1%, which the fibre is expected to survive.

Quality control

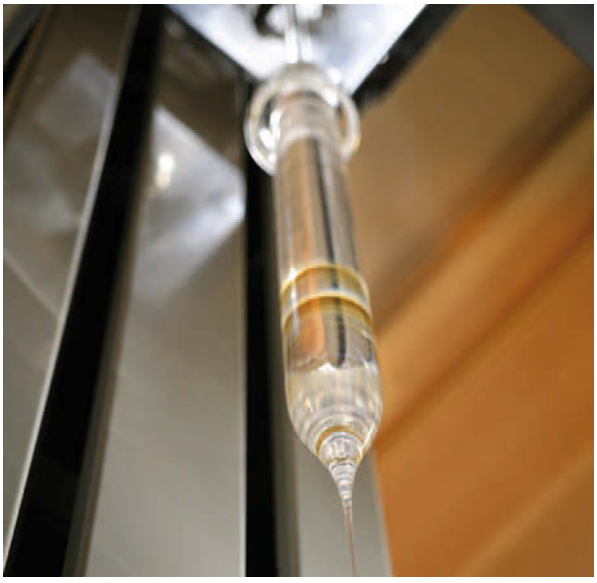
To guarantee perfect quality, each fibre is checked using dedicated measuring equipment. For instance, fibres are tested for geometry, attenuation (loss of light) and fibre capacity (bandwidth or dispersion limitations). Products that do not meet the requirements are moved to quarantine and root cause analysis done.

Optional colouring

A last, yet optional step can be the fibre's colouring. By customer's request, a fibre can be supplied in twelve different colours. Sometimes an additional black ring marking is applied to easily differentiate between coloured fibres, within a high fibre count cable. Similar to the operation during the drawing process, the fibre runs through a bath of acrylate coloured polymer. This extra thin coloured coating layer is cured immediately by means of UV light.

Conclusion

Finally, the fibres are transported to a warehouse when the production is complete and all test reports are positive. At a later stage and depending on the final use, fibres can be selected against customer order requirements and shipped to cable customers. Here the fibres are assembled to form a cable, sometimes even in combination with copper cable. Manufacturing of optical fibre cables does not happen in Eindhoven, but elsewhere within Draka. Ultimately optical cables are transported to their final installation location, where all fibres are spliced either to fibres in next cable segments or connectorised.



BendBright® and MaxCap® fibres: Standards compliant fibres with extraordinary features.

BendBright fibres.

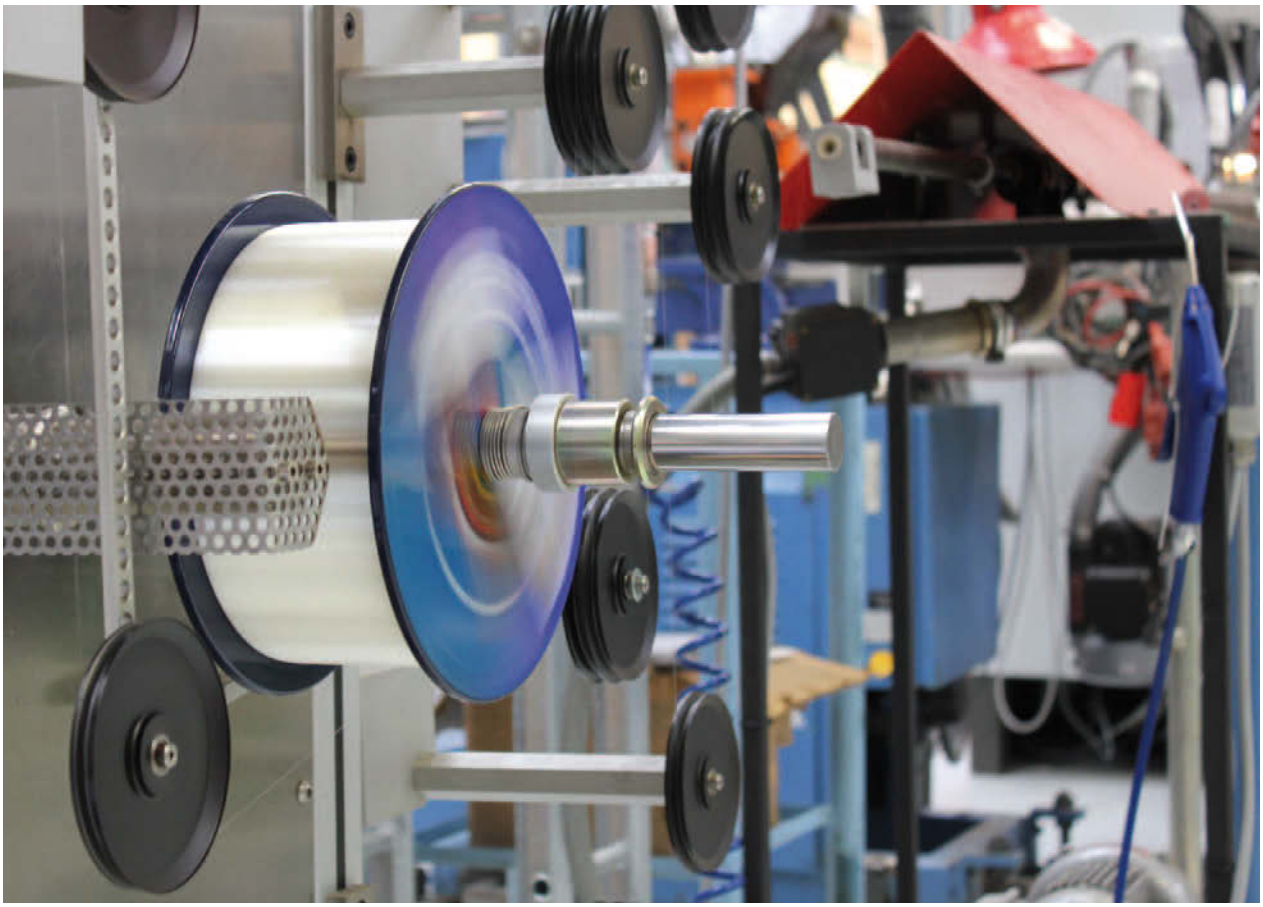
The very first bend insensitive Single Mode fibres were introduced by Draka in 2002. These fibres featured a 10x improvements in attenuation at narrow bends over the ITU-T requirements for a single mode fibre. The original BendBright fibre was characterised by the right relationship between mode field diameter and cut-off wavelength value. While, 10x improvements in itself was good, we at Draka embraced the concept of continuous improvement, which resulted in the introduction of BendBright-XS fibre in 2006. This fibre shows 100x lower attenuation at narrow bends compared to what is required for a standard G.652.D single mode fibre. The BendBright-XS fibre features a minimum bending radius of 7.5mm with only limited attenuation increase.

Not only should the bending performance be improved; but in addition the fibre should be compliant to the traditional single mode fibre G.652.D. A special technology was needed for achieving this outstanding feature.

The solution is the introduction of a trench in the refractive index profile of the fibre. As the trench is just outside the core of the fibre it improves the confinement of the light to the core, preventing it from being lost under tight bending and without impairing the transmission properties of the fibre. The trench is designed as an area of circular cross section with lower refractive index than the cladding. As the trench is outside of the core, the fibre is 100 % compliant with a traditional fibre; both with regard to insertion loss and splice loss.

The next step was taken in 2008 when Draka introduced the BendBright-Elite fibre. This fibre, build on the technology platform of BendBright-XS, features a minimum bending radius of 5.0mm, thus improving the performance even further.

For making the trench Draka takes advantage of its unique technology platform of the PCVD (Plasma Chemical Vapour Deposition) fabrication process for the fibres. The PCVD process is able to make many thin layers for the inner part of the fibre, thus giving a correct index profile of the core and more importantly, the precise position and size of the trench.



G657 version 2				
	Category A		Category B	
Fibre type	G.652.D compliant		Not G.653.D compliant	
Application	Outside plant and in-building cabling All bands: (O, E, S, C, L) utilization No distance limitation		In-building cabling Limited bands: 1310, 1550 and 1625 nm Restricted distances	
	Sub-category A.1 (= former A)	Sub-category A.2	Sub-category B.2 (= former B)	Sub-category B.3
Bending performance	≈ x 10 improvement vs. G652	≈ x 10 improvement vs. G657.A1	≈ x 10 improvement vs. G657.A1	≈ x 3 improvement vs. G657.B2 at 10 mm
	Radius: 15 and 10 mm	Radius: 15, 10 and 7.5 mm	Radius: 15, 10 and 7.5 mm	Radius: 10, 7.5 and 5 mm
Draka Fibre Compliance	BendBright-XS BendBright-Elite	BendBright-XS BendBright-Elite	BendBright-XS BendBright-Elite	BendBright-Elite

MaxCap Fibres

The MaxCap multimode fibres of Draka are high bandwidth fibres with extraordinary features. Draka started the development of high capacity multimode fibres directly following the establishment of the 1 gigabit Ethernet standard in 1998.

The MaxCap300 (now MaxCap-OM3) fibre was introduced in 2002. It was the first fibre compliant to the 10G Ethernet transmission protocol of IEEE for 10GBASE-SR. The protocol specifies a 300m minimum link length for transmission at 850nm using a VCSEL laser. The OM3 fibre was born.

Further to this introduction, Draka drove the evolution forward and introduced the MaxCap550 (now MaxCap-OM4) in 2003, with a possible link length of a stunning 550m at 850nm.

The MaxCap fibres have a core diameter of 50µm optimized for transmission at 850 nm. The conventional bandwidth need to be very high and in addition one needs to carefully address the additional challenges of using a VCSEL laser at the high speed of 10 gigabit per second or even higher in the future. The interaction of VCSEL laser and fibre DMD (Differential Mode Delay) results in EMB (Effective Modal Bandwidth). High EMB values are needed for reliable 10Gb/s transmission over 300m and even more over 550m. In order to make a perfect MaxCap fibre, the core profile should be a near perfect match to the ideal graded-index profile . The PCVD process offers just that, as this process is able to build the core out of several thousands of ultra thin layers compared to conventional processes which use much less and thicker layers.

The quality of the transmission parameters are insured by measuring the DMD (Differential Mode Delay) of each fibre and check this to tight specifications.

Macrobend loss: 2 turns	850 nm	1300 nm
R = 7.5 mm	≤ 0.2 dB	≤ 0.5 dB
R = 15 mm	≤ 0.1 dB	≤ 0.3 dB

Macro bend loss for a MaxCap-BB-OMx fibre.
Up to 10x improvement compared to the ITU-T G651.1 (2007) of 1 dB per 2 turns for both 850 nm and 1300 nm

MaxCap-BB-OM3 / OM4 fibre compared in practical bend testing to regular OM3 / OM4 multimode fibre:

2mm indoor cable tested in sharp 90 degree angel

Regular OM3: 2.75dB

MaxCap-BB-OM3: 0.01dB

The combination: Bend-insensitive multimode fibres

By combining the technologies for making the Bend-Bright single mode fibres and the MaxCap high band-width laser optimized fibres, new unique products were born: the MaxCap-BB-OMx fibres. These fibres are made by combining the trench-assisted Bend-Bright technology with the special features of the MaxCap fibres: The MaxCap-BB-OM3 and MaxCap-BB-OM4. In addition, a MaxCap-BB-OM2 fibre is also offered. The Max-Cap-BB-OMx fibres feature up to 10x improvement in bending loss up to a bend radius of 7.5mm compared to ITU-T G651.1 (2007) require-ments.

This ensures an error free transmission even for installation in difficult environments. Making a bend-insensitive multimode fibre is actually a much more complicated task than making a single mode fibre. A multimode fibre guides, as the name indicates, many modes of the light. The fibres behave differently when they are put through a few bends.: The higher order modes (travelling in the outer region of the core) are more bend-sensitive than the lower order modes (travelling in the central part of the core).

The trench-assisted MaxCap-BB-OMx fibre concept improves the macro-bend losses through a better confinement of the higher order guided modes. Care-ful designs are required for a significant improvement of the bend sensitivity and at the same time ensure full backward compatibility (including absence of splice issues), OM4 grade capability, etc.

The unique and patented PCVD fibre manufactur-ing process of Draka is the ideal platform for making fibres meet these and other challenges. The MaxCap-BB-OMX fibres are thus the optimized combination of the BendBright technology and the MaxCap high bandwidth features.

Ethernet Applications at 850 nm

Ethernet applications and permissible channel lengths with MaxCap multimode fibre

	MaxCap-BB-OM4	MaxCap-BB-OM3	MaxCap-BB-OM2
1 Gb/s (1000BASE-SX)	1100 m	1000 m	550 m
10 Gb/s (10GBASE-SR)	550 m	300 m	82 m
40 Gb/s (40GBASE-SR4)	150 m	100 m	-
100 Gb/s (100GBASE-SR10)	150 m	100 m	-

Optical properties

Cabled multimode fibres

Draka brand name			MaxCap-BB-OM2	MaxCap-BB-OM3	MaxCap-BB-OM4
ISO/IEC 11801 / EN 50173	OM1	OM2	OM2	OM3	OM4
IEC 60793-2-10/ EN 60793-2-10	A1.b	A1.a.1	A1.a.1	A1.a.2	A1.a.3
TIA/ANSI-492	AAAA	AAAB	AAAB	AAAC	AAAD
Bandwidth OFL @ 850 nm [MHz · km] ≥	200	500	500	1500	3500
Bandwidth EMB @ 850 nm [MHz · km] ≥	-	-	-	2000	4700
Bandwidth OFL @ 1300 nm [MHz · km] ≥	600	500	500	500	500
Attenuation @ 850 nm [dB/km] ≤	3.2	2.7	2.7	3.0	3.0
Attenuation @ 1310 nm [dB/km] ≤	1.0	0.8	0.8	1.0	1.0
Bending loss R= 7.5 mm @ 850/1300 nm ≤ [db/2 turns]			0.2 / 0.5	0.2 / 0.5	0.2 / 0.5
Bending loss R= 15 mm @ 850/1300 nm ≤ [db/2 turns]			0.1 / 0.3	0.1 / 0.3	0.1 / 0.3
Bending loss R= 75 mm @ 850/1300 nm ≤ [db/100 turns]	0.5	0.5			
Group index of refraction @850 nm	1.496	1.482	1.482	1.482	1.482
Group index of refraction @1300 nm	1.491	1.477	1.477	1.477	1.477
Numerical aperture	0.275	0.200	0.200	0.200	0.200
Link length 100BASE FX [m]	2000	2000	2000	2000	2000
Link length 1000BASE SX [m]	275	550	550	1000	1100
Link length 1000BASE LX [m]	550	550	550	550	550
Link length 10GBASE SW/SR [m]	33	82	82	300	550**
Link length 10GBASE LX4 [m]	300	300	300	300	300
Link length 40GBASE SR4 [m]				100	150
Link length 100GBASE SR10 [m]				100	150
For more information see data sheet	C02	C23	C34	C31	C32

Cabled single mode fibres

Draka brand name	ESMF	BendBright-XS
ISO/IEC 11801 / EN 50173	OS2	OS2
ITU	G652.D	G657.A2
IEC 60793-2-10/ EN 60793-2-10	B.1.3	B.6_b
Attenuation 1310 nm - 1625 nm [dB/km] ≤	0.39 / 0.36*)	0.38
Attenuation @1550 nm [dB/km] ≤	0.25 / 0.23*)	0.23
Bending loss R= 7.5 mm @ 1550 nm ≤ [db/turn]		0.5
Bending loss R= 15 mm @ 1550 nm ≤ [db/10 turns]		0.03
Bending loss R= 25 mm @ 1310/1550/1625 nm ≤ [db/100 turns]	0.05	<0.01
Group index of refraction @1310 nm	1.467	1.467
Group index of refraction @1550 nm	1.468	1.467
Link length 1000BASE LX	5000	5000
Link length 10GBASE L	10000	10000
Link length 10GBASE EW/ER	30000/40000*)	40000
Link length 40GBASE LR4	10000	10000
Link length 100GBASE ER4	10000	10000
For more information see data sheet	C03e/C06e*)	C24

Note: *Values applicable for stranded loose tube cable; data sheet C06e

** For properly engineered links

Cable description

Code	Meaning	Explanation
1st position: Brand		
UC FIBRE	Universal cable FIBRE	Cables for general data communication use
UC FUTURE FO	Universal cable FUTURE Fibre Optic	Cables specially developed for data centre applications
2nd position: Installation environment		
I	Indoor	
I/O	Indoor/Outdoor	
O	Outdoor	
3rd position: Build		
S	Single fibre cable	
T	Twin fibre cable	Figure-8 cable or zipcord cable
FL	Flat cable	Cable build with single cable units and common sheath
DI	Distribution cable	Also called mini breakout cable
B	Break-out cable	Also called full breakout cable
CT	Central tube cable	Also called unitube cable
ST	Stranded loose tube cable	
3rd position for UC FUTURE FO cables:		
RIP	Ribbon in parallel	Cable build with 12 fibre Ribbon
LBP	Loose bundle in parallel	Cable build with a number of fibres arranged without any structure
B3S	Bundle 3 mm stranded	Cable build like a breakout cable with a number of stranded units, ø3 mm
FS	Flextube stranded	Stranded cable build with a number of flextubes
4th position: Water blocking		
D	Dry waterblocked	
N	No water blocking	
5th position: Armouring		
DA	Dielectric armouring	Other additional protection
MA	Metallic armouring	Steel tape armouring
6th position: Sheathing materials		
LSHF-FR	Low smoke halogen free, fire retardant	
LSHF	Low smoke halogen free	
PE	Polyethylene	
PUR	Polyurethane	
PA	Polyamide	
7th position: Tensile strength, dimension and fibre count		
X kN	The tensile strength, applicable for CT and LT types	
n.n mm	Diameter of cable or cable units in mm, applicable for S, T, FL and B types	
X x n	X = number of elements N number of fibres	In case of one element or no grouping, only the fibre count.
8th position: Fibre type		
MM61	OM1 62.5/125µm	According to data sheet C02
OM2B	MaxCap-BB-OM2 fibre	According to data sheet C34
OM3B	MaxCap-BB-OM3 fibre	According to data sheet C31
OM4B	MaxCap-BB-OM4 fibre	According to data sheet C32
MM51	OM2 50/125 µm 500/500	According to data sheet C23
MM52	OM2 50/125 µm 600/1200	According to data sheet C01a
SM2D	Single mode 9/125 G652.D	According to data sheets C03e/C06e
SM2D.P	Single mode 9/125 G652.D	patch cords According to data sheet C18e for
SM7B	BendBright XS single mode G657.A2	According to data sheet C24

Indoor cables

The Draka range of indoor cables is designed with detailed consideration to the safety of the end user and the ease of installation in mind.

All cables are made with LSHF-FR sheathing fulfilling the strict requirements of EN 50290-2-27. As an added benefit, all cable sheaths are UV stabilized, so they can stand to be exposed to direct sunlight. Typical installations cover hospitals, airports, and hotels. All these places generally have a high density of working or resident human population, where a great deal of precautionary and safety measures need to be put in place for the cabling systems to ensure the wellbeing of people. Other important installation conditions are buildings where a breakdown would involve high expenses (e.g. industrial plants, electric power stations, EDP centres, banks, power plants) as well as in alarm, signal and control systems.

The indoor cables are either grey or colour coded to show the fibre type used in the cable. The cable colours follow the ISO/IEC and the TIA recommendations and are listed below:

Single mode OS1 and OS2	Yellow	RAL 1021
Multimode OM1 62.5/125	Grey	RAL 7037
Multimode OM2 50/125	Orange	RAL 2003
Multimode OM3 and OM4	Aqua	RAL 6027

Note: The RAL numbers indicate the nearest RAL colour as per DIN/VDE 60304

Improved fire protection characteristics

IEC 60332-3-24: No spread of fire (fire propagation)
IEC 60754-1: No halogen content, which may lead to emission of poisonous and corrosive gases
IEC 60754-2: No emission of corrosive gases, which can cause acid with extinguishing water
IEC 61034-2: Very low smoke development

Considerably low toxicology of fire gases

UC^{FIBRE} I DI N LSHF-FR ES9 D02b

Selected properties

Number of fibres	2	4	6	8	12	24
Cable diameter (mm)	4.5	5	5.5	6	6.5	8
Weight (kg/km)	21	26	30	35	45	65
Installation tensile strength (N)	1000	1000	1000	1000	1200	1500
Minimum bending radius (mm)	50	50	50	50	75	115
Compressive strength (N)	3000					
Operational temperature range (°C)	-20 to 70					

Construction

Mini-breakout or distribution cable build with ES9 easy strippable fire retardant and halogen free buffer. Aramid yarn as strength members, outer LSHF-FR sheath in colour indicating the fibre type. Buffer diameter is 900 µm.

Application

Typical application areas include indoor medium range connections, often in cases where field installable connectors are preferred.

UC^{FIBRE} I B LSHF-FR ES9 2.0 D03b

Selected properties

Number of fibres	2, 4	6	8	12	24
Cable diameter (mm)	7.5	8.5	10	12.5	14.5
Weight (kg/km)	60	75	100	160	210
Installation tensile strength (N)	1300	1800	2400	3500	4500
Minimum bending radius (mm)	75	100	100	150	175
Compressive strength (N)	1500				
Operational temperature range (°C)	-20 to 70				

Construction
A full breakout cable having ø2.0 fibre units and a LSHF-FR sheath with colour indicating the fibre type completes. The ø2.0 mm fibre units have an ES9 easy strippable fire retardant and halogen free tight buffer.

Application
The application includes short to medium range connections. The breakout cable is well suited for making assemblies factory fitted with connectors. The single fibre units' fits small form factor connectors.

UC^{FIBRE} I B N LSHF-FR ES9 D06b

Selected properties

Number of fibres	36	48	60	72	96
12.5 (mm)	12.5	14,5	17	20	19
Weight (kg/km)	165	230	300	375	325
Installation tensile strength (N)	3600	4200	4800	5400	6600
Minimum bending radius (mm)	150	150	200	200	200
Compressive strength (N)	3000				
Operational temperature range (°C)	-40 to 70				

Construction
Distribution cable with up to 96 fibres featuring ES9 easy strippable LSHF-FR sheathing, build with multiple 6-fibre sub units stranded around a central strength member

Application
Applications include high fibre count indoor medium range connections, often in cases where field installable connectors are preferred.

UC^{FIBRE} I ST D LSHF-FR 1.8 kN N06a

Selected properties

Number of fibres	up to 72	96	144
Cable diameter (mm)	10.5	12	15
Weight (kg/km)	140	180	260
Installation tensile strength (N)	1800	1800	1800
Minimum bending radius (mm)	160	180	225
Compressive strength (N)	3000		
Operational temperature range (°C)	-40 to 70		

Construction
Stranded loose tube cable with LSHF-FR sheath. A combination of loose tubes and fillers are stranded around a FRP central strength member. The tubes are colour coded with a pilot-marker system.

Application
The application includes long range connections where medium to high fibre counts are employed. This cable is intended for installation in ducts and on cable trays. It may be blown for shorter distances.

UC^{FIBRE} I B LSHF-FR ES9 2.1 D23/D24

Selected properties

Number of fibres	2	4
Cable diameter (mm)	5.5	6.5
Weight (kg/km)	30	30
Installation tensile strength (N)	500	850
Minimum bending radius (mm)	15	20
Compressive strength (N)	3000	
Operational temperature range (°C)	-20 to 60	

Note: The cables are not completely round

Construction
These two cables are designed as flexible full breakout cables with 2 or 4 fibre units ø2.1 mm. A thin LSHF-FR sheath completes the cable. The sheath colour indicates the fibre type.

Application
The application is point to point connections in server rooms and data centres. Fits most types of connectors, is well suited both for making preassembled cable sets as well as fitting of connectors in the field.

Universal cables

Draka universal cables or indoor / outdoor cables are cables designed for combined indoor and outdoor use. The cables are designed with a LSHF sheathing making them perfectly suitable for indoor installation, where the requirements to flame spread are limited.

The universal cables in our portfolio use the FireBur™ fire retardant sheathing material. The FireBur™ sheathing material offers outstanding properties for outdoor use and at the same time fulfils EN 50290-2-27. The characteristic colour of the universal cables is blue (RAL 5015).

Improved fire protection characteristics

IEC 60332-1-2: limited vertical flame propagation
IEC 60754-1: No halogen content, which may lead to emission of poisonous and corrosive gases
IEC 60754-2: No emission of corrosive gases, possibly creating acid with extinguishing water
IEC 61034-2: Very low smoke development

Considerably low toxicology of fire gases

UC^{FIBRE} I/O CT D DA LSHF 1.0kN E14a

Selected properties

Number of fibres	4, 6, 8, 12	24
Cable diameter mm	6.0	6.5
Weight kg/km	40	45
Installation tensile strength N	1000	
Minimum bending radius mm	60	
Compressive strength N	1500	
Operational temperature range °C	-30 to 60	

Construction

Uni-tube cables build with a central loose tube. Coated glass yarns ensure sufficient high tensile strength (1.0 kN). A blue FireBur™ LSHF sheath completes the cable. The cable is longitudinal water blocked

Application

The application is medium to long LAN backbones where the requirement is to have a compact cable and easy to install cable. The cable can be installed in cable trays, in ducts and tunnels.

UC^{FIBRE} I/O CT D DA LSHF 1.5kN E10a

Selected properties

Number of fibres	4, 6, 8, 12	24
Cable diameter mm	7.5	8.0
Weight kg/km	55	60
Installation tensile strength N	1500	
Minimum bending radius mm	60	
Compressive strength N	2000	
Operational temperature range °C	-30 to 70	

Construction

A uni-tube cable build with coated glass yarns ensure sufficient high tensile strength (1.5kN) and a nominal rodent resistance. A blue FireBur™ LSHF sheath completes the cable. The cable is longitudinal water blocked

Application

The application is medium to long LAN backbones where the requirement is to have a robust medium strength and still compact cable. The cable can be installed in cable trays, in ducts and tunnels.

UC^{FIBRE} I/O CT N MA LSHF 1.0kN E07a

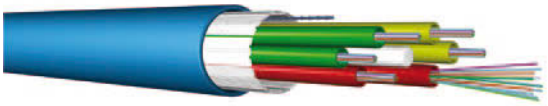
Selected properties

Number of fibres	4, 6, 8, 12	24
Cable diameter mm	8.5	8.5
Weight kg/km	75	85
Installation tensile strength N	1000	
Minimum bending radius mm	55	
Compressive strength N	2000	
Operational temperature range °C	-40 to 70	

Construction
Uni-tube cables build with a central loose tube. Coated glass yarns ensure sufficient high tensile strength. A corrugated steel tape armouring makes the cable rodent proof. A blue FireBur™ LSHF sheath completes the cable.

Application
The application is medium to long LAN backbones, and SCADA systems, where the main requirement is for having a tough, robust and rodent proof cable. The cable can be installed on trays, in ducts and tunnels.

UC^{FIBRE} I/O ST D DA LSHF 5.0kN N05a



Selected properties

Number of fibres	Up to 72	96	120	144 - 216
Cable diameter mm	11	13	14	15.5
Weight kg/km	130	165	200	240
Installation tensile strength N	5000			
Minimum bending radius mm	150	180	200	220
Compressive strength N	3000			
Operational temperature range °C	-40 to 70			

Construction
Stranded loose tube cable with LSHF sheath. The tubes are colour coded with a pilot-marker system. A layer of coated glass yarns gives the cable a high tensile strength and some rodent resistance. A blue FireBur™ flame retardant sheathing completes the cable. The cable is longitudinal water blocked.

Application
The application is medium to long distance LAN backbones where there is a need for higher fibre count. The cable can be installed in cable trays, ducts and tunnels.

UC^{FIBRE} I/O DI N LSHF ES9 D12b

Selected properties

Number of fibres	2	4	6	8	12	24
Cable diameter mm	6	6.5	6.5	7	7	8.5
Weight kg/km	32	34	36	39	43	63
Installation tensile strength N	1500	1500	1500	1500	1500	2400
Minimum bending radius mm	50	50	50	50	75	115
Compressive strength N	3000					
Operational temperature range °C	-20 to 70 °C					

Construction
Cable build with up to 24 fibres. The buffer is the ES9 LSHF easily strippable buffer. A layer of glass yarns gives the cable sufficient tensile strength. A FireBur™ LSHF sheath completes the cable.

Application
Typical application areas include indoor medium range connections, often in cases where field installable connectors are preferred.

UC^{FIBRE} I/O DI N LSHF-FR ES9 D15a

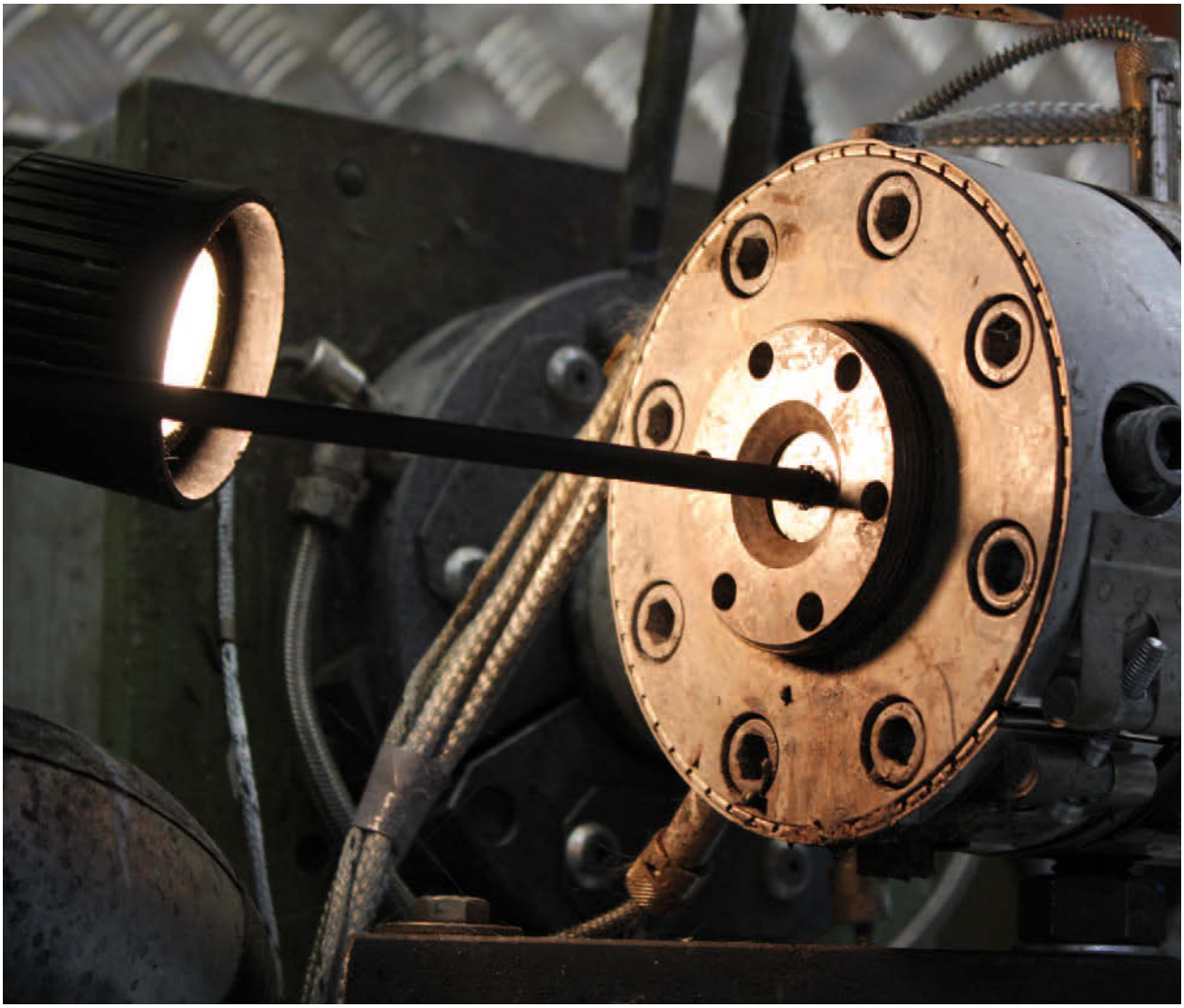
Selected properties

Number of fibres	2	4	6	8	12	24
Cable diameter mm	5	5	5.5	6	6.5	8
Weight kg/km	21	26	27	35	45	65
Installation tensile strength N	325	440	440	680	900	1400
Minimum bending radius mm	50	50	50	50	50	60
Compressive strength N	2000					
Operational temperature range °C	-40 to 70					

Construction
The buffer is the ES9 LSHF easily strippable buffer. A watertight layer of coated glass yarns gives the cable sufficient tensile strength. A LSHF-FR sheath with the colour following the fibre type as for indoor cables completes the cable.

Application
The application of this cable is LAN backbones, horizontal cabling and any kind of cabling where there is a need for a robust and easy to terminate cable. Installation includes cable trays, ducts and tunnels.

Outdoor cables



The UC[FIBRE] cables for outdoor installation consist of central tube cables and stranded loose tube. The cables are intended for installation in ducts and/or for direct burial. The cables are UV-resistant, armoured (metallic and non-metallic), resistant to rodents, longitudinal watertight and have a very high tensile strength. The cable sheathing is of black polyethylene PE, which ensures a superior stability in an outdoor environment. The cables are designed for 25 years of operation being directly in the sun or buried in the ground.

The central tube cables have a capacity of up to 24 fibres, and the stranded loose tube cables have a capacity of up to 216 fibres or more. For special applications, engineered versions with up to 864 fibres are possible.

UC^{FIBRE} O CT D DA PE 1.0kN E16a

Selected properties

Number of fibres	4, 6, 8, 12	24
Cable diameter mm	6.0	6.5
Weight kg/km	40	45
Installation tensile strength N	1000	
Minimum bending radius mm	60	
Compressive strength N	1500	
Operational temperature range °C	-20 to 60	

Construction
A central loose tube ø2,8 or 3,5 mm with up to 24 fibres. Coated glass yarns ensure a sufficient tensile strength and a nominal rodent resistance. A black PE sheath completes the cable.

Application
The application is medium to long distance LAN backbones where the requirement is for having a small and compact cable. The cable can be installed in ducts and tunnels.

UC^{FIBRE} O CT N MA PE 1.0kN E06a

Selected properties

Number of fibres	4, 6, 8, 12	24
Cable diameter mm	8.5	8.5
Weight kg/km	75	80
Installation tensile strength N	1000	
Minimum bending radius mm	55	
Compressive strength N	2000	
Operational temperature range °C	-40 to 70	

Construction
A Uni-tube cable build with a capacity of up to 24 fibres. A corrugated steel tape armouring make the cable rodent proof. A black PE sheathing completes the cable.

Application
The application is medium to long distance LAN backbones, as well as surveillance and SCADA systems, where the main requirement is for having a tough and robust rodent proof cable.

UC^{FIBRE} O CT D DA PE 1.5kN E08a

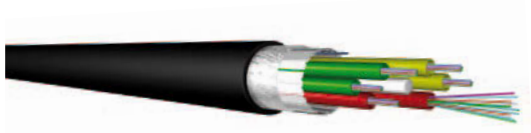
Selected properties

Number of fibres	4, 6, 8, 12	24
Cable diameter mm	6.5	7,0
Weight kg/km	40	45
Installation tensile strength N	1500	
Minimum bending radius mm	60	
Compressive strength N	2000	
Operational temperature range °C	-30 to 60	

Construction
A central loose tube ø2,8 or 3,5 mm with up to 24 fibres. Coated glass yarns ensure a sufficient tensile strength and a nominal rodent resistance. A black PE sheath completes the cable.

Application
The application is medium to long distance LAN backbones where the requirement is for having a robust medium strength and still compact cable. The cable can be installed in ducts and tunnels

UC^{FIBRE} O ST D DA PE 5.0kN H08a



Selected properties

Number of fibres	Up to 72	96	120	144 - 216
Cable diameter mm	11	13	14	16
Weight kg/km	105	140	170	200
Installation tensile strength N	5000			
Minimum bending radius mm	150	175	190	220
Compressive strength N	3000			
Operational temperature range °C	-40 to 70			

Construction
A stranded loose tube cable, each loose tube contains 12 fibres, The core is surrounded by a layer of coated glass yarns giving the cable a high tensile strength and some rodent resistance.

Application
The application is medium to long distance LAN backbones where there is a need for higher fibre count as can be obtained with the central tube constructions. The cable can be installed in ducts and tunnels.

Data centre cables

Under this heading we are introducing a series of dedicated cables use inside a data centre. The cables are a subset of the UC^{FUTURE} portfolio of cables for data centres.

UC^{FUTURE}

The future is here now in the form of the newly published IEEE 802.3 standards for 40 GbE and 100 GbE Ethernet transmission standards. The UC^{FUTURE} line of products is highly specialised copper and fibre products for use inside data centres. They are compact multi-way cables for high density cabling. The ever increasing demand for transmission of data inside a data centre requires more cable and more fibre. Space is always in limited supply so the cables need to be compact and easy to install.

The fibre cables in the UC^{FUTURE} product line are dedicated for this environment.

The UC^{FUTURE} cables come, in a colour showing the fibre type inside the cable as follows

Single mode OS1 and OS2	Yellow	RAL 1021
Multimode OM1 62.5/125	Grey	RAL 7037
Multimode OM2 50/125	Orange	RAL 2003
Multimode OM3 and OM4	Aqua	RAL 6027

Note: The RAL numbers indicate the nearest RAL color as per DIN/VDE 60304

UC^{FUTURE} FO I RIP DI N LSHF-FR 12 M01

Selected properties

Number of fibres	12
Cable diameter mm	2.0 x 4.5 mm
Weight kg/km	9
Installation tensile strength N	200
Minimum bending radius mm	7.5
Compressive strength N	1000
Operational temperature range °C	0 to 50

Construction

The cable core is an encapsulated ribbon 0.3 mm x 3.1 mm. The core is surrounded by aramid yarns and a LSHF-FR sheath.

Application

The application is as patch cord in data centres for fitting of MPO/MPT style connectors.

UC^{FUTURE} FO I LBP DI N LSHF-FR 12 M02

Selected properties

Number of fibres	12
Cable diameter mm	3.0
Weight kg/km	9
Installation tensile strength N	220
Minimum bending radius mm	15
Compressive strength N	500
Operational temperature range °C	0 to 50

Construction

The core of the cable consists of 12 optical fibres and a number of aramid yarns as strain relief. The core is surrounded by a LSHF-FR sheath.

Application

The application is as patch cord in data centres for fitting of a MPO/MPT style 12 fibres connector.

UC^{FUTURE} FO I LBP DI N LSHF-FR 24 M03

Selected properties

Number of fibres	24
Cable diameter mm	3.6
Weight kg/km	11
Installation tensile strength N	220
Minimum bending radius mm	15
Compressive strength N	500
Operational temperature range °C	0 to 60

Construction
The core of the cable consists of 24 optical fibres arranged in two bundles of 12 fibres each. A number of aramid yarns and a LSHF-FR sheath complete the cable.

Application
The application is as patch cord in data centres for fitting of a MPO/MPT style 24 fibres connector.

UC^{FUTURE} FO I LBP DI N LSHF-FR 2 x 12 M04

Selected properties

Number of fibres	12
Cable diameter mm	3.0 x 6.2
Weight kg/km	18
Installation tensile strength N	440
Minimum bending radius mm	20
Compressive strength N	400
Operational temperature range °C	0 to 50

Construction
This is a zip-cord design with two legs, each consisting of 12 optical fibres and a layer of aramid yarns as strain relief. The core is surrounded by a LSHF-FR sheath.

Application
The application is as patch cord in data centres for fitting of 2 MPO/MPT style 12 fibres connectors.

UC^{FUTURE} FO I FS LSHF-FR M05

Selected properties

Number of fibres	36	48, 72	96, 108	144
Cable diameter mm	7.5	8.0	8.5	9.0
Weight kg/km	45	55	60	70
Installation tensile strength N	1000			
Minimum bending radius mm	50	50	50	60
Compressive strength N	2000			
Operational temperature range °C	0 to 70			

Construction
This cable has a core with a number of 12 fibre dry Flextubes®, each containing 12 optical fibres. A number of aramid yarns and a LSHF-FR sheath complete the cable.

Application
The application is as distribution cable inside data centres and central offices of telecommunication systems. With an appropriate fan-out design, this cable fits 12 fibre MPO/MTP connectors.

UC^{FUTURE} FO I B3S LSHF-FR M06

Selected properties

Number of fibres	24	36	48	72	96
Cable diameter mm	10	10	10	11.5	13.5
Weight kg/km	103	100	95	110	160
Installation tensile strength N	600	600	600	1100	1100
Minimum bending radius mm	125	125	125	150	175
Compressive strength N	2000				
Operational temperature range °C	-10 to 70				

Construction
This cable has a core with a number of 12 fibre, ø3.0 mm dry fibre units. Multiple sub-units are stranded together with a central strength member. A LSHF-FR sheath completes the cable.

Application
The application is as distribution cable inside data centres and central offices of telecommunication systems. Each of the fibre units fits a 12 fibre MPO/MTP connector.

Optical fibre data assembly cables

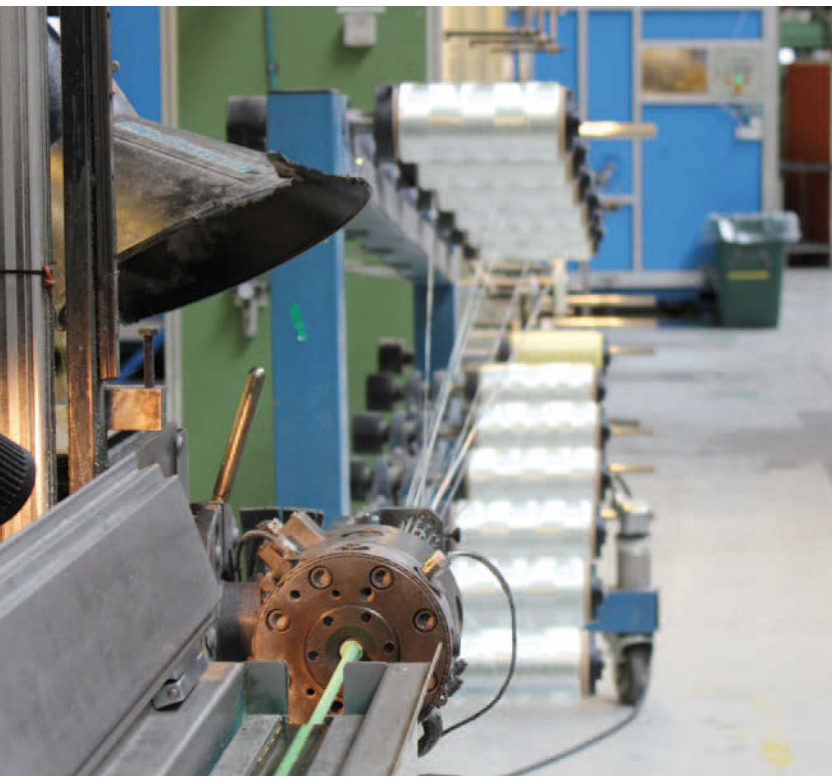
Single- and two fibre cables for patch cords, jumpers and pigtails.

The cables are as standard made with 900 micron buffered fibres, aramid yarns are used as strength member, and the sheath is LSHF-FR material. The cables may also be used for indoor subscriber connections for FTTH systems.

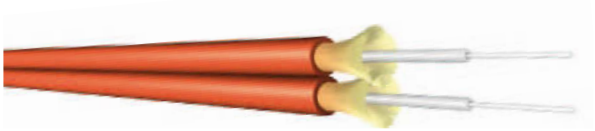
The cables are halogen free, low smoke and features an IEC 60332-3-24 fire rating. The single and two fibre cables come in several dimensions and with two main buffer types: With Draka's ES9 easily strippable tight buffer for general application. The ES9 easily strippable tight buffer is indented for general use and is ideal for field mountable connectors.

The LS9 dry semi-tight buffer is for applications where the exposure of a long length of the primary coated fibre is essential. The LS9 buffer may be stripped 1 meter to the coating, and is ideal for pigtails.

Presented here is single fibre cable and zip-cord style two fibre cable, but also flat (figure 0) and round two fibre cables are available. Dimensions range from 1.2 mm to 3.0 mm



UC^{FIBRE} I S LSHF-FR ES9 2.0 D10d/D10e



Selected properties

Number of fibres	1	2
Cable diameter mm	2.0	2.0 x 4.2
Weight kg/km	4.5	9.0
Installation tensile strength N	120	240
Minimum bending radius mm	7.5	7.5
Compressive strength N	2000	2000
Operational temperature range °C	-40 to 70	-40 to 70

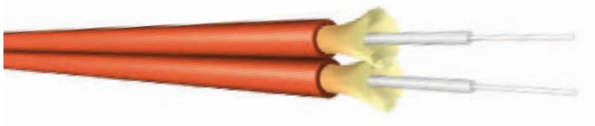
Construction

The cables are build with 1 or 2 ES9 dry tight buffered fibres, armid strain relief and an outer FireRes™ sheathing.

Application

Patch cords and jumpers, especially such with connectors using small form factor 1.25 mm ferules like LC connectors.

UC^{FIBRE} I S LSHF-FR ES9 2.8 D04c/D01c



Selected properties

Number of fibres	1	2
Cable diameter mm	2.8	2.8 x 5.7
Weight kg/km	9	16
Installation tensile strength N	300	600
Minimum bending radius mm	7.5	7.5
Compressive strength N	3000	3000
Operational temperature range °C	-40 to 70	-40 to 70

Construction

The cables are build with 1 or 2 ES9 dry tight buffered fibres, armid strain relief and an outer FireRes™ sheathing.

Application

Patch cords and jumpers, especially such with connectors using ø2.5 mm ferules, like SC, St or FC/PC. Can also be used for indoor fixed point-to-point connections.

Special optical cables

Special cables for special applications

Fire resistant cable for use in security systems, railway systems or car tunnels is one of our offerings. Others are cables for heavy industrial applications, for studio and broadcast systems and for military tactical use. Many other applications can be served.

We supply cables for the world's tallest buildings, for wind turbine towers, for the offshore industry, geophysical research and many more applications.

We present but 2 cables: A Firetuf^{FIBRE} fire resistant cable fulfilling IEC 60331 and EN 50200 and a cable for heavy industrial applications.

Firetuf^{FIBRE} I/O ST MA LSHF-FR 1.8 kN I10b

Selected properties

Number of fibres	Up to 96
Cable diameter mm	15.5
Weight kg/km	290
Installation tensile strength N	1800
Minimum bending radius mm	290
Compressive strength N	3000
Operational temperature range °C	-60 to 70

Construction

The core is with stranded loose tubes and with swellable tapes. Steel tape armoring and two FireRes™ LSHF-FR sheaths complete the cable.

Application

Security and railway systems, where there is a need for a fire resistant cable passing IEC 60331 or EN 50200. The cable can be installed on trays, in ducts and in tunnels.

UCFIBRE I/O B D DA LSHF LS9 2.7 D22a

Selected properties

Number of fibres	Up 6	8
Cable diameter mm	12	14
Weight kg/km	120	225
Installation tensile strength N	4500	
Minimum bending radius mm	75	
Compressive strength N	3000	
Operational temperature range °C	-20 to 70	

Construction

This is a full breakout cable with ø2.7 mm single fibre units and LS9 dry semi-tight buffer. A yarn layer and a heavy FireBur™ LSHF sheath completes the cable.

Application

The application includes industrial automation and LAN connections for industrial sites. Intended termination is by splicing of pigtails. The cable may be installed by most methods including direct burial.

We make communication technology work, by serving you in every way to realize your leading edge network solution

We have our offices and production facilities all over the world. To get in touch with us and find out how we can help you build your network, visit our website at www.draka.com/communications or contact us.

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