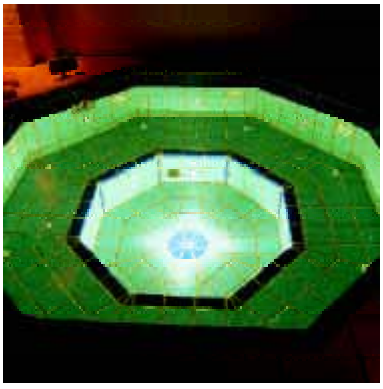
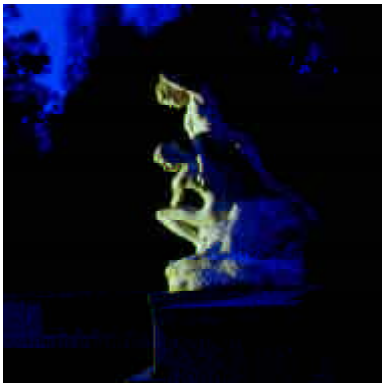





Fiber Optics Guide

ROBLON
Fiber Optics

Welcome to Roblon Fiber Optics' World of Fiber Light

Fiber light, or fiber optics, is a way of lighting that becomes more and more popular due to the numerous applications related to this light.

Nobody can really predict tomorrow's applications of fiber light - new areas appear all along.

The big difference
Basically, the difference between fiber light and traditional light is the separation of the light source from the light, a difference that offers two important advantages:

- The light is cold light (no IR-rays).
- The light source can be placed where it is easily accessible for maintenance.

The many ways of application
Fiber light has meant a revolution in many areas so far dominated by halogen lighting, places that are not lit at all, or maybe lit by expensive special solutions:

- Showcases and vitrines.
- Installations where UV and IR radiation are unwanted.
- Areas exposed to danger of explosion or vandalism.
- Inaccessible and elevated areas where maintenance is difficult, expensive, or even impossible.
- Special projects for which a unique effect is required; many light points, colour shift, sparkling, or light directing.

With this brochure *Roblon Fiber Optics* hopes to inspire and throw new light over the wonderful and fascinating world of fiber optics.

Enjoy yourself !

1. Eclipse fitting.

Contents:

Inspiration:

Technical Information:

2. Water-proof special fitting.

Roblon Fiber Light Terminology

A fiber light system consists of 2 or 3 components:

- Light generator
- Fiber harness
- Fittings on the fiber ends (can be omitted)

The light generator is the “engine” of the system. The special light source placed inside the generator concentrates the highest possible amount of light into the fiber harness, which is connected to the **light port.** Halogen and metal halide lamps are the light sources applied.

The light generator can be placed indoors or outdoors and is available in several strengths. The stronger the generator, the higher the requirements to its placing, cooling etc. Most light generators require cooling, and this is done by means of a built-in fan cooling the vital parts.

The fiber harness is the unique part of the fiber light system. By means of the fiber harness, the light from the generator is led and spread. The joint ends of the fiber harness, called the **polyconnector or the common end,** are connected to the generator. Here the fibers are collected, smoothed and polished into a homogeneous surface that allows a maximum of light to pass through.

Roblon Fiber Optics manufactures **plastic fiber (PMMA) –** as well as **glass fiber cables**. A fiber harness is either uniform or different fiber dimensions, either in uniform or different lengths, according to requirements. The light emits from the fiber end **(endlight**) or through the side of the fibercable (**sidelight, PMMA only).**

The fiber can be without termination (“raw fiber end”), or it can be terminated with a glued-on, polished aluminium-bushing, a **fiber termination**. The latter improves the light utilisation by approx. 30-50 % ! The light leaves the fiber end at an angle of 60°.

The fitting is the visible part of a fiber light system with endlight fiber cables. Fiber optical fittings are small and discreet compared to traditional light fittings. *Roblon Fiber Optics* manufactures fittings with and without optics, as well as crystal fittings and custom design fittings.

Fittings are mounted on the fiber ends for 4 primary reasons: for aesthetics, for concentration of the light, to control the light, and to protect the fiber end, for instance against UV-radiation or water.

Fittings with optics reduce the light angle from 60° to for instance 9°, resulting in an increased light intensity.

3. Fiber light system: 75 W light generator (01500178) + PMMA Ø 3 mm fiber harness (24006000)+ fittings: 03101223, 03101224, 03101205, 03101230, 03101251, 03101242, 03101255, 03101247 and termination for fittings (99030001).

Outdoor Lighting

Outdoor application of fiber light may include economical, environmental and aesthetic advantages.

For illuminating facades on buildings, fiber light is most suitable, as all maintenance of the light is concentrated to one place. Contrary to traditional light fittings, fiber light fittings need not be taken apart to replace a light source. Disassembling always leaves a risk of leaks. No corrosion takes place inside the fitting because no heat is generated. *Roblon Fiber Optics´* corrosion and acid resistant fittings are in principle 100% maintenance free. If fittings are installed high up on a facade, it is an advantage that all main-tenance can safely take place inside the building, rendering ladders and crane lift unnecessary.

Energy and environmental advantages are gained by using fiber light:

- the light from one light generator can be evenly spread on the facade and can be led precisely to the desired area - it is not “spilt” into space
- light dimming may not be needed
- the fittings will last a lifetime, as there is no corrosion caused by temperature differences
- no change of light source in the fittings - long life of the light source inside the light generator
- placed inside, the heat from the light generator supplements the heating system of the building

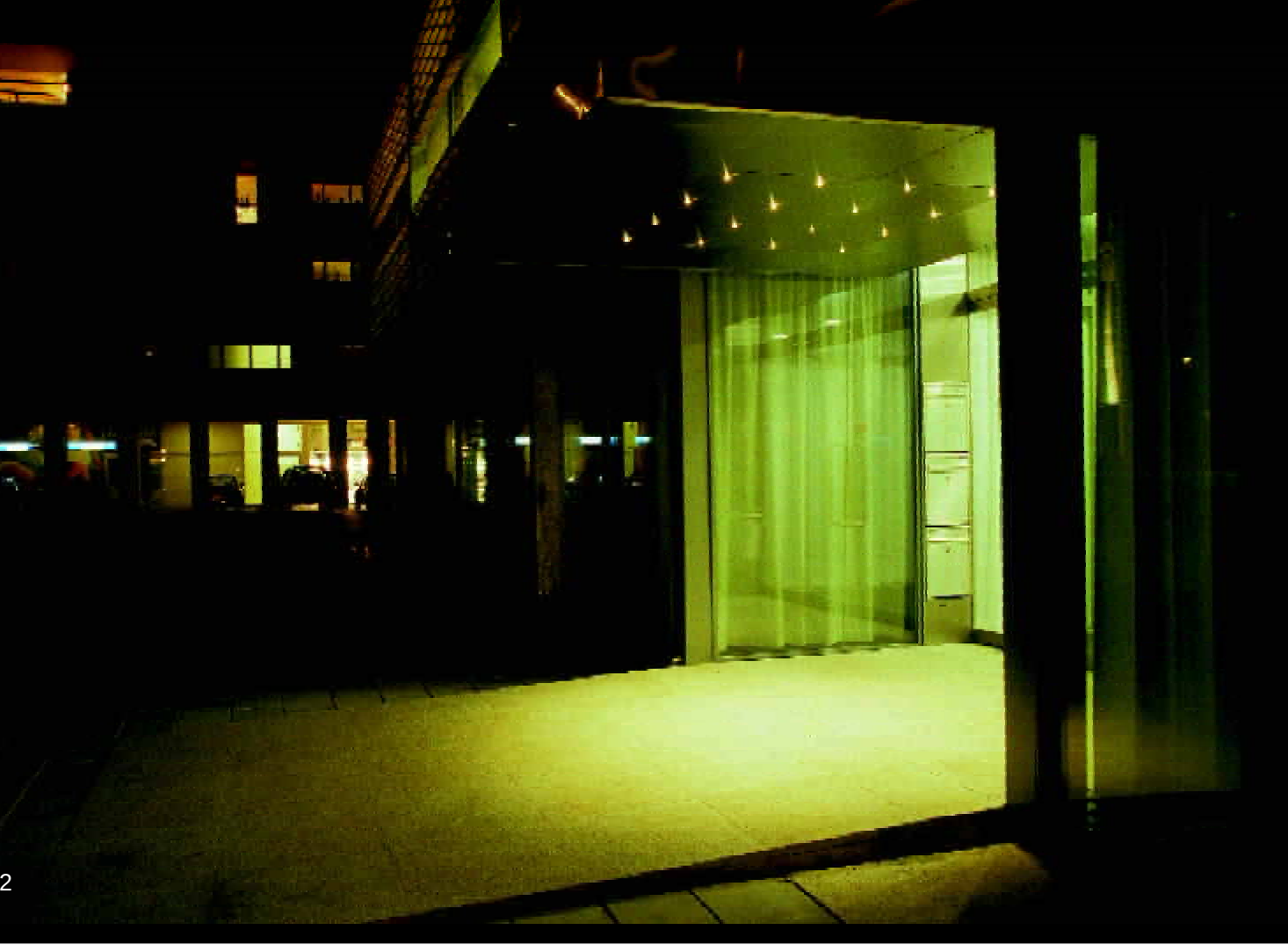
If fiber light is used for decorating trees, or as an alternative to the traditional Christmas tree lighting, one 75 Watt generator can “feed” up to 575 light points (PMMA Ø 1 mm). This equals 0.13 Watt per light point. The fibers remain on the tree from year to year, while the generator is taken down when the light is not in use. As fiber light carries no current, it is extremely suitable for integrating into fountains and pools.

With *Roblon Fiber Optics’* light generators (4.200 Kelvin) and a wide range of corrosion-proof outdoor fittings, a fascinating white and clear light can be integrated in public and private parks and gardens.

4. Beespot Focus. **5.** Ceiling: Fixed fittings with Ø 12 mm optics. Flower bed: Circle H. **6.** Eclipse. **Next page: 7.** Compas Wide. **8.** Circle H. **9.** Compas Angle.


Frederiksberg Rådhus
Åbent
Mandag-onsdag 10-15
Torsdag 10-18
Fredag 10-13
Adgang fra Frederiksberg Runddel
Dog må hverhunde gerne

1



2

Functional Lighting

Our strongest sense impressions are obtained through our eyesight, and the light figures prominently in our apprehension of the surrounding world and our wellbeing. Therefore it is important that the light meets a few basic requirements: it must not blind, the lightcolour (Kelvin) and the ability to reproduce colours (CRI) must be satisfactory, and the life of the light source must be economically justified.

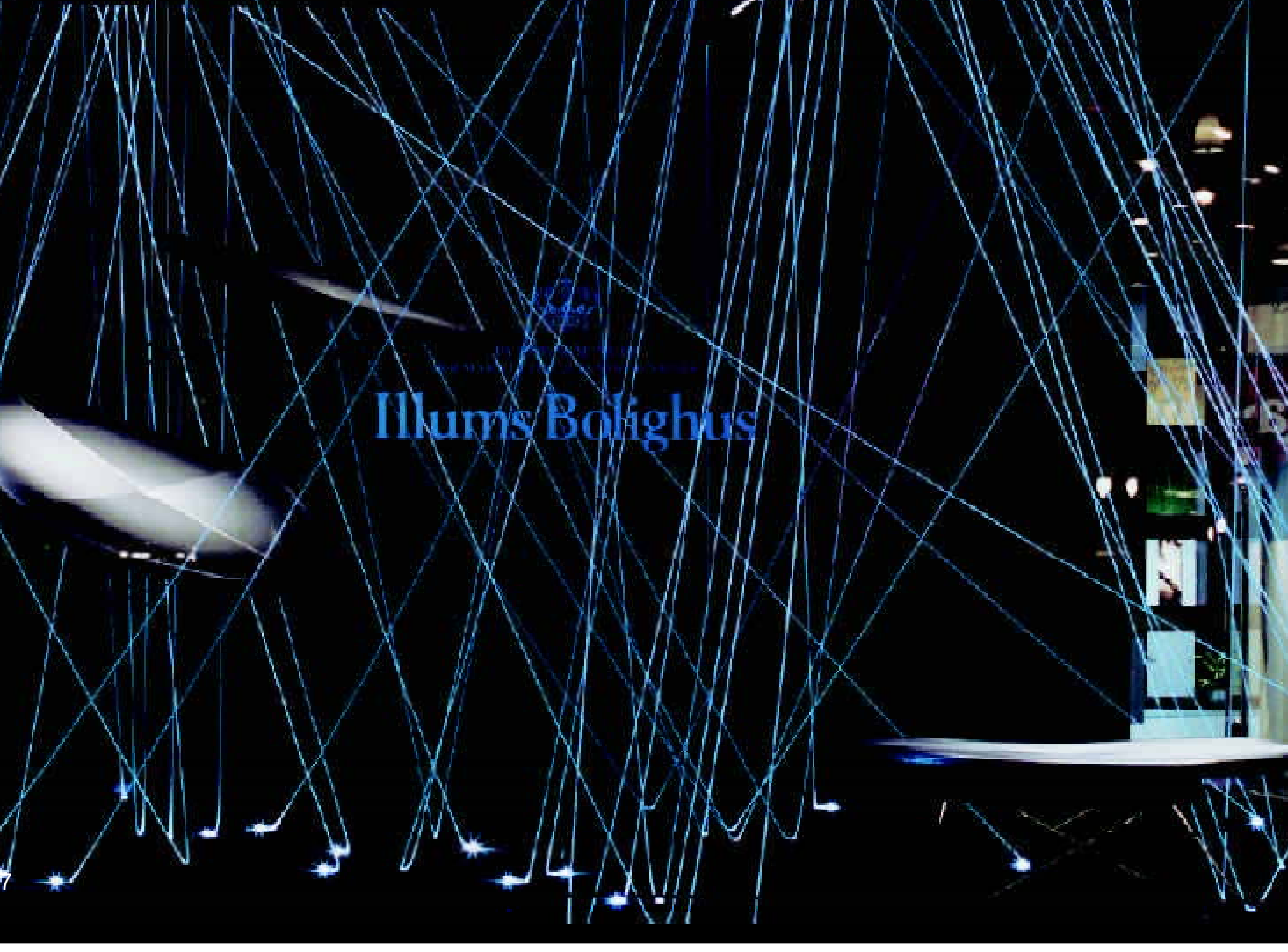
Fiber light will fully meet these basic requirements, and by using fiber light as complete or partial lighting, a unique, aesthetic dimension is added to the room.

By using several fiber ends, an even spread of the light is obtained, in principle the more fiber ends the better. If extra light is wanted in one particular part of the room, the fibers can be mounted tighter, or stronger fibers can be used in that area. This is also the way to light for instance pictures and paintings on the wall. Because of a fairly narrow light cone, max. 60°, fiber light fitted in the ceiling does not blind unless you look directly into the fiber. This is an obvious advantage when you open your eyes after a good night's sleep. As fiber light is less diffuse than that of halogen spotlights with parabola, the fiber cables must be placed closer to the walls.

PMMA fibers conduct more light than glass fibers; however, the light from glass fibers is "warmer" in its colour, more yellowish. With "cool" and "warm" light in the same room, a fascinating combination is obtained between light and space.

Roblon Fiber Optics constructs the fiber harnesses in a special way, so called randomising, which ensures that to the eye the light is uniform from all fiber ends. This method is recommendable for all lighting tasks including room lighting. If on/off function and dimming is wanted, a generator with halogen light source is required.

10. Fittings with Ø 12 mm optics. **11.** Ceiling: Fixed fittings with Ø 12 mm optics. Sign letters: Tiltable fitting with Ø 12 mm optics. **12.** Fittings w. Ø 12 mm optics. **Next pages: 13.** Special staircase fitting. **14.** Fittings without optics. **15.** No fittings – terminations only.



Decorative Lighting

Realising the significance of the surroundings to the wellbeing of human beings and their efficiency in their daily work, architects and light designers more than ever before integrate light, sounds, colours and fragrances in their work.

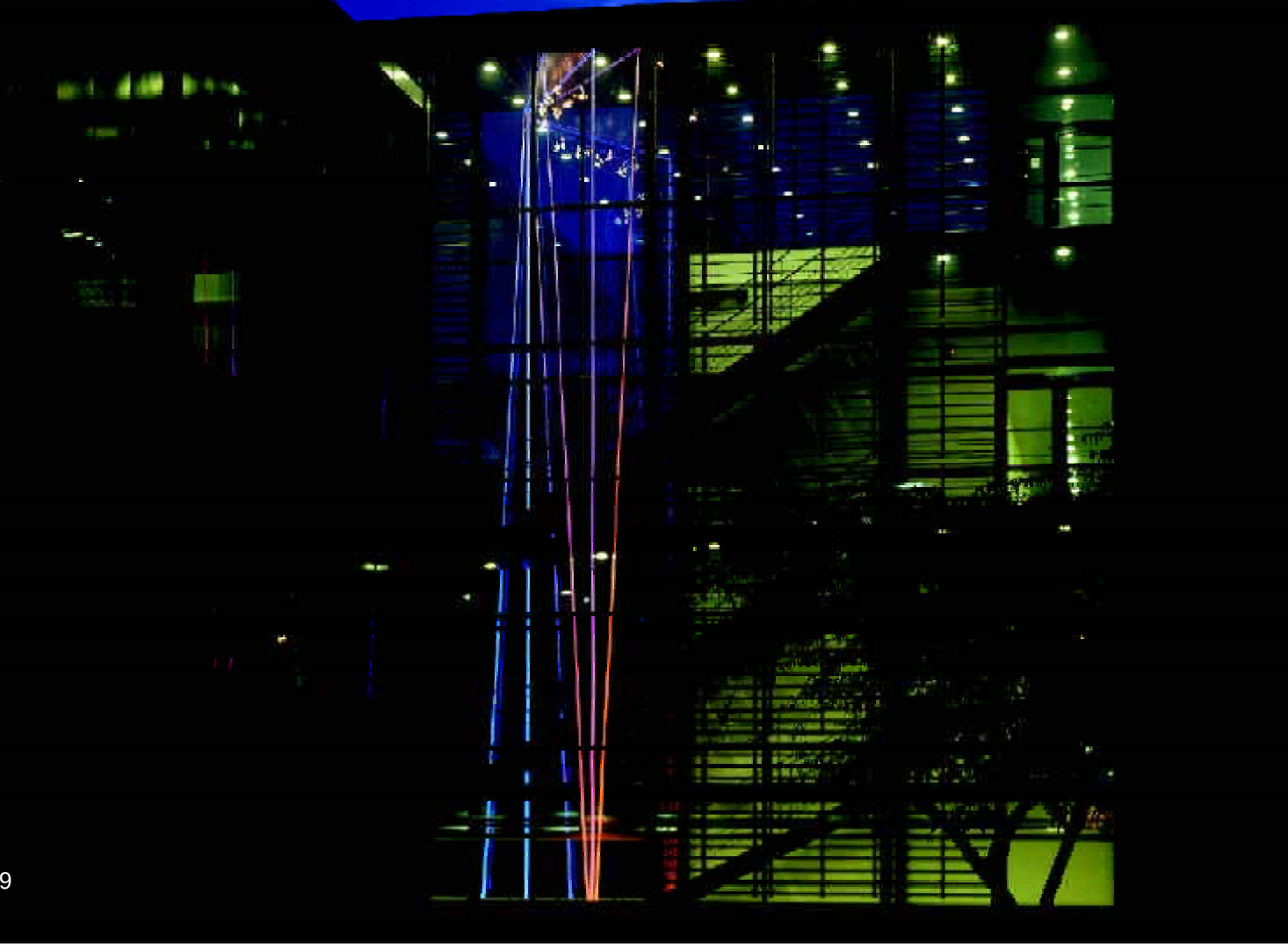
Canteens, conference rooms, baldachins, entrances and hotel lounges in *Industrial and commercial buildings* are places subject to special treatment. In *private homes* fiber light is often installed in entrances, halls, bathrooms, kitchens, sleeping rooms, eaves and gangways.

By means of a few light sources, huge starry skies can be created - 1.000 stars sparkling with light from just one single generator. The advantages are obvious as far as maintenance is concerned!

The light can be built into furniture, for instance wine racks - enabling you to read the label without the bottle leaving the rack. Running water, floors, walls and sculptures are other areas. In fact fantasy is our only limitation.

In shops it is natural to integrate innovative and safe light solutions which can be integrated without damaging the products on show. Here fiber light is an obvious choice, partly as an eye catcher, partly as permanent display light on products for which special attention is wanted. The light is flexible, as it can change character for instance by colour shift, intensity shift (sparkling) and intelligent control (DMX).

16. “Raw” fiber ends Ø 0,75 mm. **17.** Sidelight Ø 4.5 mm PMMA.



Sidelight

Roblon Fiber Optics' sidelight is known worldwide as one of the best on the market.

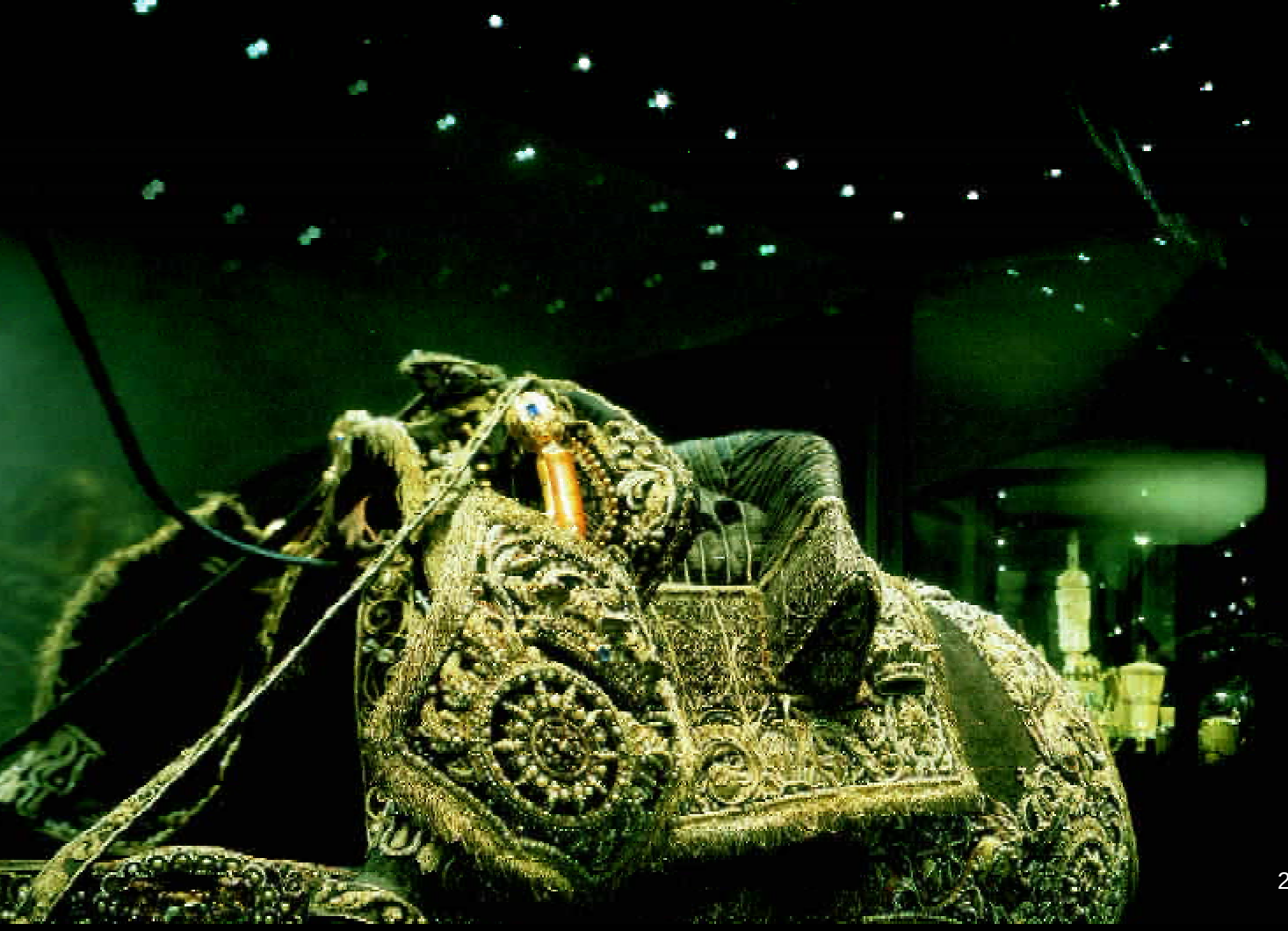
Our sidelights are known to grant an extreme softness and flexibility, high UV-resistance, exceptionally high alga resistance, and a high degree of uniformity in emitted light. Roblon's special method of twisting is patented on the American market.

Roblon Fiber Optics has delivered sidelight to the biggest fiber light installation in Denmark, *The Transformer Station at Kastrup Airport, Copenhagen*. In this 18 metres high circular building with of diameter of 35 metres, 6000 metres of side light are installed. The glass covered facade is lit in a way that allows the fiber cables to send light into the staggered glass panels.

This gives an impressive effect, as the light sort of follows the shape of the building and is visible no matter from where you observe it. The fiber cables are connected to 50 generators, each of a 150 Watt effect.

Another example is the Danish Veterinary and Food Administration in Copenhagen, where fiber light is used in the glass area facing the city. The side light cables and generators, which slowly shift colours, give the building a very special character and makes it visible in a discreet, but efficient manner.

18. Ø 8 mm sidelight, mounted vertically along each 18 metre glass column on the facade, illuminating through the 0,5 metre wide glass panel. **19.** Ø 14 mm sidelight.



22

Lighting of Objects and Exhibition Cases

Fiber light is ideal for lighting showcases and vitrines. Museums were the first ones to make use of fiber light, as the absence of heat provides very favourable conditions. Fiber light, with the light generator placed outside the showcase, offers the following advantages:

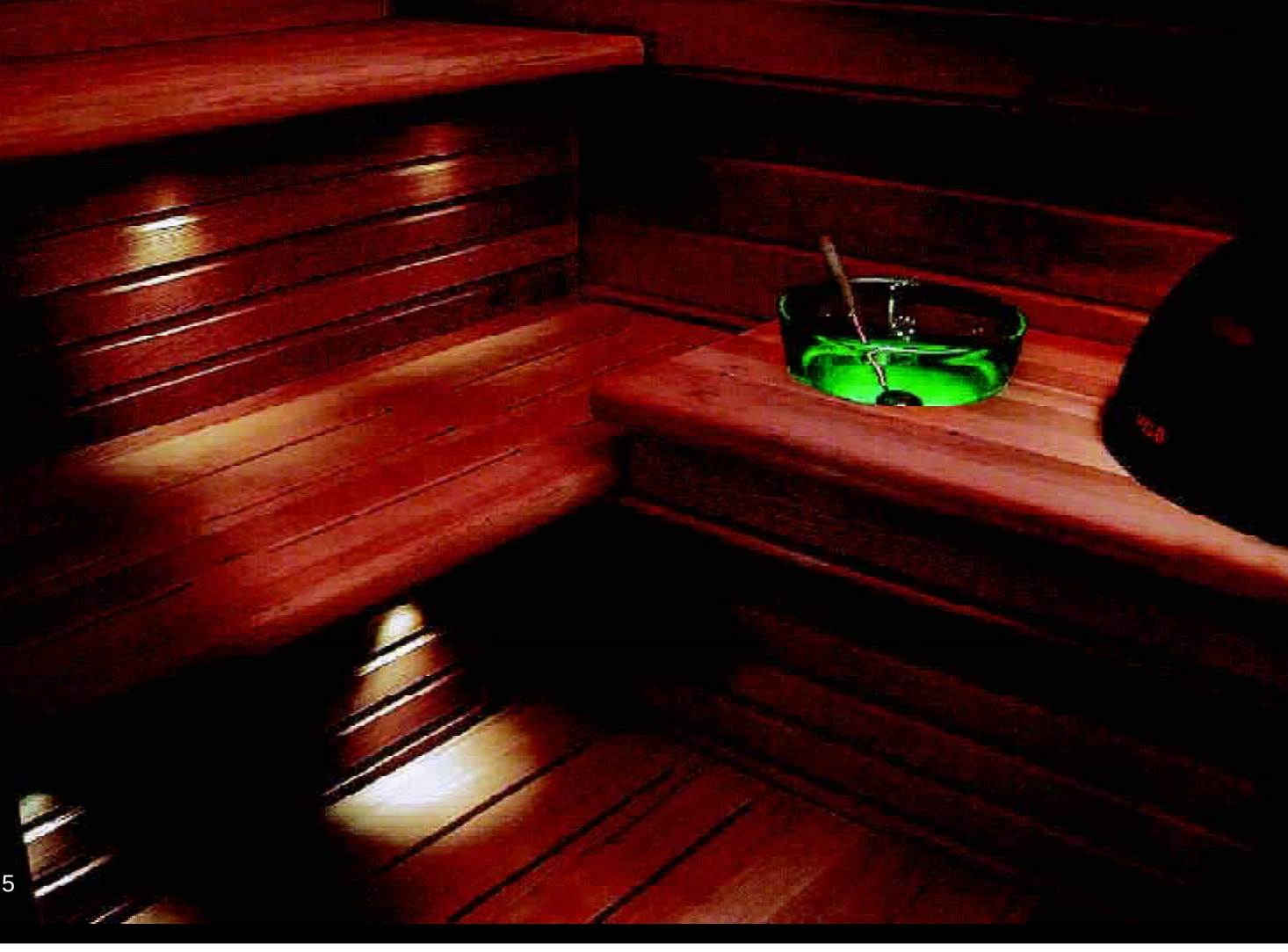
- easy change of light source
- the light can be placed close to the object, and it can come from several angles, hereby shadows can be avoided - or created - as required
- the showcase can be dust-proof, burglary- and fire safe
- one light generator can light several showcases or individual double showcases
- jewels, gold and silver objects can be lit at close distance without their surface being violated

Most often several fiber ends are used in vitrines: different or changing objects inside the vitrine will need flexible light, individual objects will require special lighting, different angles and light intensity, increased focus, etc. Informative plates behind the exhibits also need lighting. With traditional light this requires many lamps and distance to the object, perhaps even cooling, for instance in vitrines with bakery or foods. The result is often large energy consumption and frequent change of lamps.
Fiber light will reduce the consumption of energy, as it can be spread evenly in the vitrine and placed close to the object. Hereby the “light distance law” is utilised: the light intensity is four-doubled when the distance between light and object is halved. As maintenance expenses are low, fiber light systems may prove an economically favourable alternative to other types of lighting.

By using manually or electrically dimmable light generators the light intensity can be adjusted precisely. By using fixed or tiltable fittings with or without optics the light can be directed precisely and without waste. Our tube system focuses on aesthetics and finish and offers fascinating possibilities to choosy designers who want an exclusive intregration of light in showcases, vitrines and product displays.

20. No fittings – terminations only. **21.** Ø 1 mm ”raw” fiber end. **22.** Shelf fittings.


JYSKE BANK



OEM (Industrial Purposes)

Manufacturers of industrial products have realised the interesting aspects of fiber optics, especially if they want:

- innovation
- to add a built-in value to a product
- to improve existing technical solutions
- to increase the aesthetic appearance of their product
- to make an existing solution cheaper or easier to maintain
- to build in light where this was previously not physically possible or expedient

Roblon Fiber Optics supplies fiber light to other manufacturers for special solutions within many areas: explosion safe working light on petrol lorries, light in letter and money boxes to prevent vandalism, cold light inside cigar vitrines, light for (traffic) signs, light in cooker hoods, light in lifts, light in show cases, and other areas.

A leading manufacturer of signs applies products from *Roblon Fiber Optics* to create a patented corona light behind super-flat letters on facade signs. Besides being beautiful, this light is discreet, easy to maintain, and it meets increased requirements for architecture in connection with renovation of buildings.

If a constant temperature and humidity is required for instance inside a cupboard, fiber light is an evident possibility - often the only one. *Roblon Fiber Optics* can supply special components according to customer requirements, for instance very small light generators without fan for building into industrial products, or specially designed fittings to meet customer wishes. *Roblon Fiber Optics* offers know-how and experience for new developments, and we endeavour to be flexible and swift in our co-operation.

23. Special fitting with front glass. **24.** Patented corona light behind sign. No fitting. **25.** Fixed fitting without optics.

General Information

Fiber light systems differ considerably from traditional lighting systems. The following reasons have caused fiber light to become more recognised as an exciting supplement or replacement to traditional light:

- the light does not carry current
- the light is cold and therefore suitable for placing close to objects
- the light from one generator can be distributed according to requirements
- the light causes no IR or UV radiation
- the light can be steered precisely
- the light is cold and clear
- the light is applicable where traditional light is unsuitable because of heat, danger of explosion, or inaccessible maintenance
- the light can be given various built-in effect: colour-shift, sparkling, or advanced steering (DMX).
- the light is preferable in places requiring a high degree of security against vandalism
- the fiber ends and fittings are small and discreet
- light intensity can be increased to a small area by means of optical fittings assembling the light
- the generator can be placed in an expedient place to facilitate maintenance
- maintenance of fiber light is often cheaper than that of traditional light

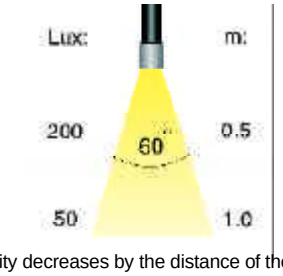
- all of wich causes fiber light to spread rapidly within decorative as well as general lighting.

In a fiber light system there is a contact loss between light source and fibers, and a transmission loss inside the fiber it self. The longer the fiber, the bigger the loss. As the light from one 75 watt light generator is distributed to 9 light points, for instance, it goes without saying that the light intensity from each point is relatively small.

Light transmission loss inside the fiber. PMMA (P) and glass (G).
The ratio between the light led into fiber and the light emitted.

Loss from the lighting system. PMMA (P) and glass (G).
The ratio between the light led towards the fibers from the light source, and the light that emits the fibers.
The values are based on a 100% filled polyconnector!

When fiber light grows more and more popular in spite of this loss it is because of its high degree of flexibility and the facilitated maintenance. Furthermore, contrary to traditional light which creates heat, this cold light can be placed close to the objects.
Using fiber light the "**distance law of light"** is utilised, meaning that the light intensity is 4-doubled when the distance between light and object is halved.



Light intensity decreases by the distance of the power of two.

However, by using fiber light fittings a relatively large quantity of light is obtainable. When the light comes from the same light source and is distributed to a varying number of fiber ends, shadows can be omitted or created as required, and the lighting is visible from many angles and directions. This yields the light designer a high degree of freedom in his planning.

When dimensioning fiber light systems it is essential to respect the limitations connected to fiber light, for instance fiber lengths.

Environment:

Outdoor fiber light fittings offer special environmental advantages; when placed indoor, the heat from the light generator contributes to the room heating.

The use of fiber light for facade- or sign lighting makes outdoor maintenance unnecessary. As the light generator can be placed inside the building, ladders and crane lifts are not needed for changing the light source. The same advantage applies to lofty rooms.

The use of fiber light very much reduces the frequency in change of light source, which is an economical as well as an environmental advantage in comparison with traditional halogen starlight illuminations.

Fiber light installed in a shop entrance.

Light Generators

Roblon Fiber Optics produces two standard light generator types: **Halogen** and **metal halide.**

Halogen light generators (42 and 75 Watt) are available with or without dimming, with white or coloured light, colour shift (75 W) or sparkling (75 W). Halogen light generators have a good colour rendering (high CRI-value = 100), and a colour temperature of 2.900-3.000 Kelvin.

Metal halide light generators (150 Watt) are available with white light, coloured light, colour shift, sparkling, and as a DMX-controllable type where colour shift and dimming can be programmed as required. Metal halide light generators are delivered with 3.000 or 4.200 Kelvin light source. Metal halide generators have a lower CRI than halogen generators. However, *Roblon Fiber Optics* can offer metal halide light generators with a very high CRI (96), and a light colour of 4.200 K.

Light generators are supplied in IP-classes 20 and 44 (some models only in IP 20).

Light generator

Metal halide light generators cannot be dimmed electrically and have no on/off function. Consequently they should not be used in rooms with such requirements, typically living rooms in private homes.
Fiber light generators generate heat and therefore must have plenty of surrounding space.

DMX 512 light control systems:

Roblon Fiber Optics manufactures DMX-controllable 150 Watt metal halide light generators, available with colour shift and/or dimming of the light. Contrary to light generators with colour wheel with an even interval between colour shifts, the colour shift and/or dimming is activated by a programmable DMX-control unit at time intervals as required. With DMX 512 up to 256 light generators can be programmed by the same control unit. DMX light generators are available as an indoor (IP20) or an outdoor version (IP 44).

Applications of Light generators:

Typical examples of the various types appear from the table below:

42 W halogen (3.000 Kelvin)	75 W halogen (3.000 Kelvin)	75 W halogen - Colour / sparkle	150 W metal halide (3.000 Kelvin)	150 W metal halide (4.200 Kelvin)	150 W metal halide with DMX
small showcases	larger showcases	colour / sparkling	indoor lighting	outdoor lighting	sidelight
small starry skies	large starry skies	lighting for effect	big starry skies	sidelight	advanced light
shower cabinets	works of art	starry skies effect	works of art	works of art	works of art
small rooms	room lighting	sidelight	larger rooms	entrances	theatres
cupboards	eaves	decoration light	lounges	light in signs	cinemas
vitrines	fountains		baldachins	fountains	special projects
working light	marking light		light in signs	swimming pools	shows & events
	working light			marking light	
	sidelight			facade lighting	
Small lighting projects	**Lighting projects**	**simple lighting for effect**	**Large lighting projects - “warm” fiberlight**	**Large lighting projects - “cold” fiberlight**	**Advanced “intelligent” light**

Fiber Specifications

Fiber types:

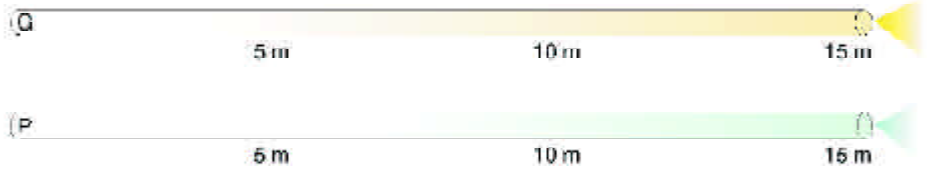
Roblon Fiber Optics uses 2 types of material for fiber light cables:
PMMA (**P**oly**M**ethyl**M**eth**A**crylate) and **Glass.**
From these materials three types of fiber light cables are made:

1. **PMMA** end light
2. **PMMA** side light
3. **Glass** end light

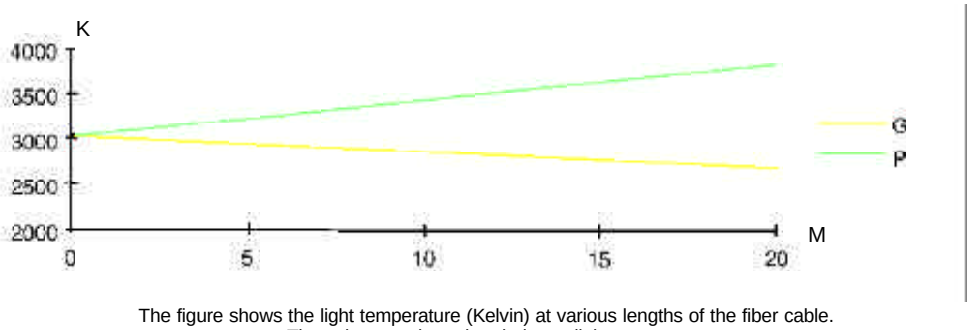
PMMA fiber cables are built of “raw fibers” with a diameter of Ø 0.75 mm or 1 mm. Standard dimensions are from Ø1 mm to Ø 6 mm. A Ø 6 mm PMMA fiber cable consists of 50 “raw fibers”, each Ø 0.75 mm. Glass fiber cables are built of “raw fibers” fine as a hair, with a diameter of 50µ. Standard dimensions are from Ø 1 mm to Ø 6 mm. A Ø 6 mm glass fiber cable is built from 11.000 “raw fibers”, each Ø 50µ.

Colour temperature:

The colour temperature changes according to the length of the fiber, and therefore it is important to be aware of the colour from PMMA and glass fiber cables respectively. Installations with strict demands on colour temperature therefore need either shorter fiber cables and / or more light generators. Glass fiber cables provide less, but “warmer” light than PMMA.



Principle drawing.The colour temperature (Kelvin) changes according to the length of the fiber cable.
The colour temperature is descreased by glass(G) and increased by PMMA (P).



The figure shows the light temperature (Kelvin) at various lengths of the fiber cable.
The values are based on halogen light sources.

Recommendable max. fiber lengths:

Light generator	Fiber	Fiber Ø	Max. length	Application
42 W	Endlight	Ø 1 / 2-6 mm	3-6 m / 2,5-3 m	Star ceilings (3-6 m) and vitrines (max 2,5-3 m)
75 W Ø 9	Endlight	Ø 2 - 6 mm	9-12 m	Lighting, decorative light, working light
75 W Ø 28	Endlight	Ø 4.5 / 6 mm	6-8 m	Room lighting, decorative light, large star ceilings
150 W CDM SA-R	Endlight	Ø 4.5 – 6 mm	16-18 m	Outdoor light, facades
150 W CDM-T	Endlight	Ø 3 – 6 mm	10-13 m	Lighting, decorative light, large star ceilings
75 W Ø 9	Sidelight	> Ø 4.5 mm	12-22 m	Decorative, length depending on ambient light level
75 W Ø 9	Sidelight	Ø 4.5 mm	12-15 m	Recommended if very low ambient light (cinemas)
75 W Ø 28	Sidelight	> Ø 4.5 mm	9-14 m	Recommended where low ambient light
75 W Ø 28	Sidelight	Ø 4.5 mm	7-12 m	Recommended if very low ambient light (cinemas)
150 W CDM-T	Sidelight	> Ø 4.5 mm	12-18 m	Decorative, length depending on ambient light
150 CDM-T	Sidelight	Ø 4.5 mm	10-16 m	Decorative, length depending on ambient light
150 W CDM SA-R	Sidelight	Ø 4.5 mm	15-20 m	Decorative, length depending on ambient light
150 W CDM SA-R	Sidelight	> Ø 4.5 mm	25-35 m	Decorative, longest fibers if coloured light

Lengths are indications. Depending on installation, demands on colour temperature and level of ambient light, lengths can be deviated from.

Light quantity:

The two fiber types are very different. More light can be loaded into PMMA fibers, and PMMA guides the light better than glass.

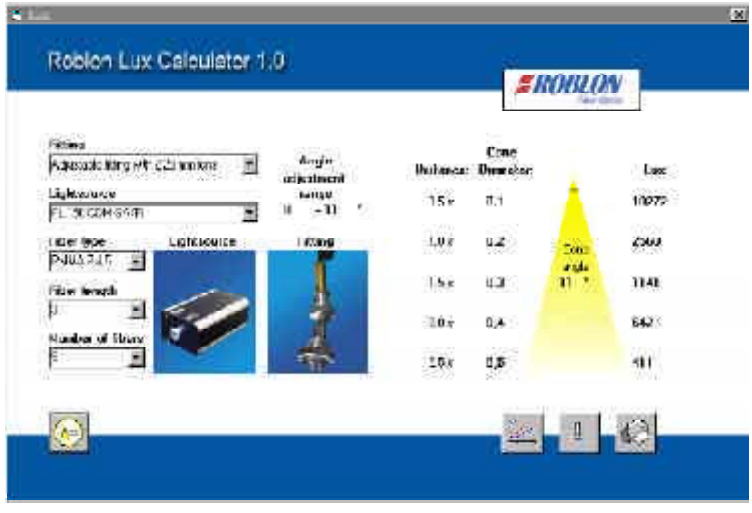
The light transmission capacity of the fiber is proportional to the diameter. The thicker the fiber, the more light it can guide:

Ø 1 mm	Ø 1.5 mm	Ø 2 mm	Ø 3 mm	Ø 4.5 mm	Ø 6 mm
0,78 mm^2	1,75 mm^2	3,14 mm^2	7,0 mm^2	15,9 mm^2	28 mm^2

A 2 mm fiber can “guide” four times as much light as a Ø1 mm.

Reference is made to **ROBLON FIBER OPTICS LUX CALCULATOR** which can be downloaded freely from **www.roblon.com**

With a vigorous generator, fiber and optics, high light intensities can be achieved with fiber light.



Lux Calculator - available for downloading from www.roblon.com.

Application:

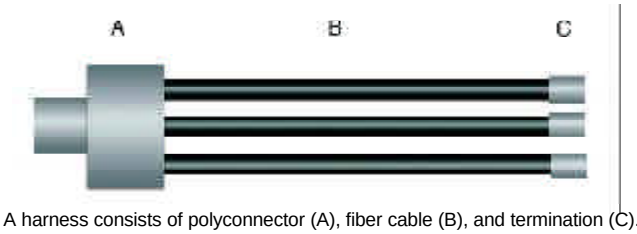
The table below indicates the most frequent demands in the choice between PMMA and glass fiber cables: PMMA is often applied if a 100% utilisation of the light generator capacity is required, and by long fiber cables:

PMMA	Glass
When a maximum light quantity is required	When “warm” fiber light is required.
Decorative purposes, for instance starry skies	When a 100% noiseless installation is required.
Room lighting, if colour temperaure is less critical or if fiber light is not the only lighting. Fiber lengths: 6-8 m.	Room lighting where the colour temperature is critical, or where fiber light is the only lighting.
When long fiber lengths are required.	Where the fiber end is exposed to direct UV-light
For outdoor lighting projects.	Where fiber cables cannot be replaced, for instance if embedded in concrete or similar.

NB: Fiber light systems with PMMA fibers generate approx. twice as much light as those with glass fibers. Consequently, PMMA fibers are preferred where light quantity is vital.

Fiber Harnesses

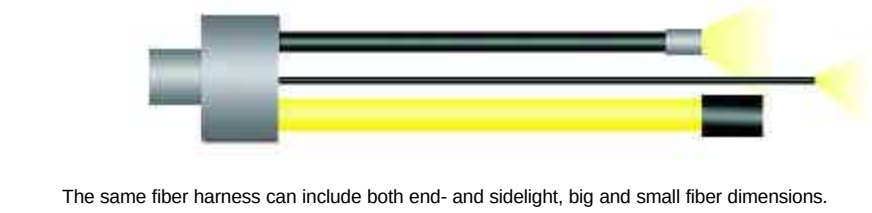
Roblon Fiber Optics manufactures standard as well as special fiber harnesses. As for standard fiber harnesses reference is made to *Roblon Fiber Optics*' product list. The fiber harness consists of 2 or 3 parts: polyconnector (common end), fiber cables, and fiber termination. The termination can be left out, for instance when each fiber cable is to be split up and the raw fibers used for a starry sky.



A harness consists of polyconnector (A), fiber cable (B), and termination (C).

Fiber harness with different fiber dimensions and types:

Fiber harnesses can be made with cables in different lengths, thicknesses and types (end- and side light). PMMA and glass cannot be part of the same harness!

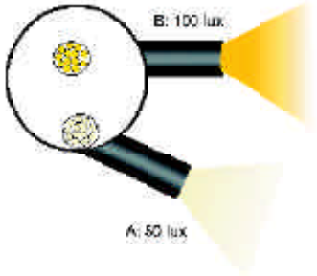


The same fiber harness can include both end- and sidelight, big and small fiber dimensions.

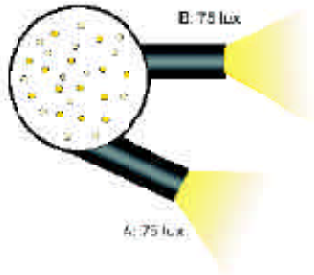
Polyconnecting:

Roblon Fiber Optics produces fiber harnesses with 3 types of polyconnectors(common end): Ø9, Ø28, and Ø 28 mm randomised (PMMA). No fiber light source can light the fiber surface of the polyconnector evenly! The fiber cables nearest the edge receive less light than the ones near the centre of the polyconnector. Therefore *Roblon Fiber Optics* uses an advanced method (randomising) for making fiber harnesses, in which the light intensity from the fiber ends are not visibly different. In the fiber cables (Ø2 – Ø 6 mm) the "raw fibers" are spread evenly over the entire surface of the polyconnector so that each fiber cable recieves light from both "high" and "low" intensity areas in the polyconnector surface. Hereby the intensity from each fiber end is more or less the same.

Light optimising. The PMMA fibers are compressed in the polyconnector by a carefully calculated pressure, which slightly deforms the "raw fibers" by making them six-sided (cubic) instead of circular. This reduces air "spots" between the fibers and the total diameter of the polyconnector's fiber surface. The result is maximum light put into the fiber cables.
The **Light variation** from fiber cables in non-randomised Ø28 mm polyconnectors (100% filled) can be up to 600%. Fiber harnesses for starry skies and decoration purposes are generally not randomised, as in such cases the light intensity from the fiber cables should rather be different.



Non-randomised polyconnector. Centrally placed fiber cables receive more light than „edge" cables.



Randomised polyconnector. „Raw" fibers from the cables are spread evenly over the entire polyconnector surface, so that light intensity from the fiber ends becomes more uniform .

Fiber capacity in the polyconnector:

The table below shows the capacity of the polyconnector, that is the max. number of fiber cables connected to one unit (common end). Max. light utilisation is only achieved if the polyconnector is 100% filled with fibers!

Endlight Glass

Item nr.	Fiber cable / active diameter ∅ (mm)	Max. fiber cables in polyconn. ∅ 9 mm	∅ 28 mm	"Raw" fibres per cable	Outer diameter ∅ (mm)
52 0001 10	Endlight Glass ∅ 1.0 mm	78	615	400 **(1)**	2.2
52 0001 15	Endlight Glass ∅ 1.5 mm	39	307	800 **(1)**	2.7
52 0001 20	Endlight Glass ∅ 2.0 mm	22	176	1.400 **(1)**	4.0
52 0001 30	Endlight Glass ∅ 3.0 mm	10	79 **(2)**	3.000 **(1)**	5.0
52 0001 45	Endlight Glass ∅ 4.5 mm	4	36 **(2)**	6.600 **(1)**	6.5
52 0001 60	Endlight Glass ∅ 6.0 mm	2	20 **(2)**	11.000 **(1)**	9.0

Endlight PMMA

52 0005 24	Endlight PMMA ∅ 1.0 mm	76	575	1 **(3)**	2.2
52 0005 50	Endlight PMMA ∅ 2.0 mm	19	145	7 **(4)**	4.0
52 0005 51	Endlight PMMA ∅ 3.0 mm	9	72	14 **(4)**	5.0
52 0005 52	Endlight PMMA ∅ 4.5 mm	5	37	27 **(4)**	6.5
52 0005 53	Endlight PMMA ∅ 6.0 mm	2	20	50 **(4)**	8.5

Sidelight PMMA

52 0006 00	Sidelight PMMA ∅ 4.5 mm	8	80	12 **(4)**	4.5
52 0006 01	Sidelight PMMA ∅ 8.0 mm	2	19	49 **(4)**	8.0
52 0006 02	Sidelight PMMA ∅ 11.0 mm	1	11	84 **(4)**	11.0
52 0006 03	Sidelight PMMA ∅ 14.0 mm	1	6	144 **(4)**	14.0

(1) Number of Ø 50 µ raw fiber per fiber cable. **(2)** Randomised (mixed) to obtain a uniform light from the cable ends.
(3) 1 mm PMMA fiber cable = one Ø 1 mm PMMA-fiber. **(4)** Number of single fiber Ø 0.75 per fiber cable.
Coating material: End light: black Megolon (UV-test: ASTM G 53) (Alga test: ISO 846, method B)

Fiber terminations:

Roblon Fiber Optics manufactures different standard fiber terminations. A termination is an aluminium-bush glued onto the cable end and polished for max. light transmission. Termination enables connection between cables and fittings, or mounting direct in the ceiling. Special terminations can be made at request. This enables you to mount or install the fiber almost everywhere, where traditional light can not be physically placed.

Fiber ends are polished in 2 manners:

- Plane polish
- Starpoint polish

With plane polish, the light emits from the fiber at a 60° angle, and more diffusely from a starpoint polish. By starpoint polish there is a loss of approx. 10-20% because part of the light is reflected backwards through the fiber instead of beaming from the fiber end.

Plane polish fiber termination.

Starpoint polish fiber termination.

Fittings

Roblon Fiber Optics produces a wide range of fittings, which can be divided in the following groups:

- light fittings, fixed and tiltable
- effect fittings (most for decoration purposes)
- special fittings (marking light, showcase light)
- uplight fittings (IP 68)
- bollard fittings (IP 67)

All fittings are made in metal: aluminium, brass, or stainless, corrosion-proof steel.


Light fitting


Effect fitting


Special fitting


Uplight fitting


Bollard

The fittings are delivered with or without optics. With optics it is possible to reduce the light beam angle from 60° to e.g. 9°. Hereby a higher light intensity is achieved, but in a smaller area. With tiltable fittings and / or optics, the light beam can be steered very precisely.

Dimensioning of Fiber Light Systems

What should be considered before designing a fiber light system?
This question is very important, because fiber light is so much different from traditional light.
It is essential to define what you want from the light! Consider as follows:

- Is the light going to be the only lighting; is it secondary lighting or perhaps merely decorative light?
- Where can the light generator be placed ? The placing is decisive of the fiber lengths and thus of the colour temperature, light intensity and number of fiber light systems needed
- The light generator requires space – does the planned placing give credit for that?
- Aesthetic requirements? Should it be a starry sky effect with many small light points (up to 1.000 per generator)? Or should it be a lighting system with fewer, stronger light outlets, with fittings?
- Design of fittings? Surface/colour? Should the fitting be tiltable? Be corrosion-proof?
- Guiding of cables? Has the recommended bending radius of the fiber been taken into account?
- Colour temperature? Glass fibers provide the “warmest” light, but also less light. Can PMMA be applied?
- Light quantity? How big is the distance to the lit object? Can one light outlet do the job or are more needed? Will overlapping of light cones provide sufficient light quantity? Distance between light points?
- Any fire restrictions? Demand for protection against vandalism?

Other things may be relevant, but if the project is tackled the right way, great results can be obtained.

Dimensioning of Room Lighting.

In general:

When using fiber optics for room lighting it is important to be observant of the utilisation grade and of the spread angle. Fiber optics is incomparable to traditional halogen lighting.

The following points should be observed:

- The spread angle (max. 60°) requires that fiber ends are placed closer to the walls than halogen spots with parabola, unless you use tiltable fittings.
- The fiber ends must be spread evenly in the ceiling.
- Overlapping increases the light level. The less distance between fiber ends, the higher the light level.

The distribution of light is very important. The walls should be illuminated in a reasonable height (1.9 – 2.3 metres above the floor, dependent on the height of the room.) The use of optical fittings will reduce the spread angle of the light. This means higher light intensity in a smaller area. The light intensity at the floor is increased, but the light hits the walls lower down, or not at all.

Fiber light should be installed close to the wall in order to light it.

Fiber light with optics. The walls may not be lit.

Overlapping of light increases light intensity by the number of overlaps.

Light generators:

Roblon Fiber Optics' light generators are among the most quiet generators on the market. Still, it is worth considering whether noise is a problem for the project you are planning. As a main rule, light generators for room lighting should have an on/off function. Therefore metal halide generators are only applicable for installations where the light is on for a long period, for instance in lobbies, hallways, entrances etc. If electrical dimming is required, halogen generators must be applied.

Fittings:

The fitting is an elegant finish on the system; it can be delivered without optics, if the biggest possible spread is wanted, with optics if a higher light intensity at floor level is required, or tiltable for guiding the light onto the walls.

Light level:

The light level can be adjusted in the following ways:

- Strength of light generator.
- Fittings with or without optics.
- Small or large distance between fiber ends.
- Small or large diameter of the fiber cable.
- Number of fiber light systems in the room.

The total light efficiency from the system is the same no matter if many small or a few thicker fiber cables are applied – as long as the poly connector is 100% filled with fiber cables. It is important to remember that a room appears light if the walls are lit!

System design:

Many or a few light points? With or without fittings/optics?
When fiber light is dimensioned for room lighting, the following rules should be remembered:

- At least 6-7 times as many light outlets are needed as by traditional parabola halogen spots.
- A combination of the system is possible: some of the fiber cables are finished with light fittings without optics, while others have fittings with strong optics, if certain areas of the room should be extra lit.
- Finally, some of the fiber cables in a fiber harness can be of larger dimensions than the rest.

Dimensioning Lighting of Objects

Vitrines:

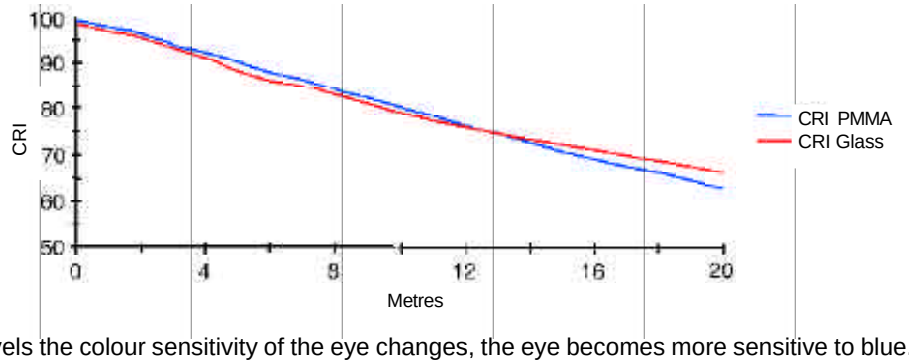
For many years fiber light has been the ultimate choice of lighting in museum vitrines. Due to the absence of IR and UV radiation, the photochemical decomposition and dehydration of the objects are the smallest possible. The large flexibility of fiber light is ideal in vitrines, where the light can be led from several angles, for instance if objects of various size should be thrown into relief in alternating exhibitions, or if shadows should be avoided.

Light level:

In case of very light sensitive materials (paper, watercolours, coloured feathers and amber), the light level must not exceed 50 lux. More light resistant materials (for instance oil paintings, leather and wooden objects) can withstand 200 lux. These values apply to exposure for 40-45 hours a week, which are the usual visiting hours of museums. As a main rule it is important to have a light intensity somewhat above the required intensity, as this enables you to adjust the colour temperature to the required level. Reference is made to ROBLON LUX CALCULATOR which can be downloaded from www.roblon.com. Light quantity from 42 W generators is approx. 50% of that of 75 watt generators (Ø9).

Colour rendering:

To obtain the best possible lighting result, the quality of the light must be as good as possible, meaning that the colour rendering index (CRI) must be bigger than 90. A CRI of 100 equals the light from a halogen lamp which contains all visible colours. The colour temperature of the light must be balanced against the actual light level (lux value).



At low light levels the colour sensitivity of the eye changes, the eye becomes more sensitive to blue. At 50 lux the colour temp. of the light should be 2500-2800 Kelvin, at 200 lux it should be approx. 3500 Kelvin.

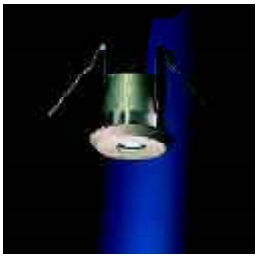
Light generators:

As a main rule, halogen lamps are recommended, partly because of the light colour (2.900 – 3.000 K), partly because of their fine colour reproduction (CRI equal to 100). *Roblon Fiber Optics'* 42 and 75 W light generators therefore cover most vitrine lighting projects. These two types are among the most quiet light generators on the market. As the light generator is often placed at the top or the bottom of the vitrine, it is essential that there is sufficient space around it so that it does not get overheated. Often it is necessary to make ventilation holes to increase the quantity of cooling air. Air intakes should be placed lower than the air outlets.

Fittings:

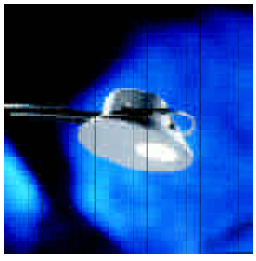
With *Roblon Fiber Optics*' large selection of tiltable and adjustable fittings is it possible to build in fiber light in the most demanding places. See examples of typical vitrine fittings below:

Ball-and-socket joint fitting.
With optics.



Fixed fitting.
Without optics.

Tiltable fitting.
With optics.



Shelf fitting.

System design:

It is important to design the light in a way that allows the objects to be lit correctly, that goes for quality as well as quantity. There must be sufficient light outlets to illuminate the entire object, the light colours must be satisfactory and the light level adequate.

Fiber types:

Glass fiber is commonly used in vitrines, due to its influence on the colour temperature. The distance between light and objects is often small, so the “light distance law” is utilised. Cables for vitrine lighting are often short, so PMMA can be used to a large extent. For CRI > 90, cables must not exceed 5 metres.

Vitrines and shop showcases:

As the light level is generally high in shops, PMMA fiber cables will most often be the first choice because of the higher light transmission ability. Also, the exhibited shop items are rarely as light sensitive as objects in museum vitrines, and they are exchanged more frequently. Apart from that, the same rules apply, and especially the correct placing of the light generator is important in order to avoid heat problems.

Vitrine and working light:

Roblon Fiber Optics' product range includes standard flex arms with PMMA-fiber cables Ø 4.5 mm. Special solutions can be made regarding length, thickness and surface. Max. recommended length is 60-70 cm, as otherwise the flex arm becomes too heavy for carrying itself.
Flex arms are also applied in vitrines.

Flex arm.

27

Glass vitrine with built-in tube system without fittings.

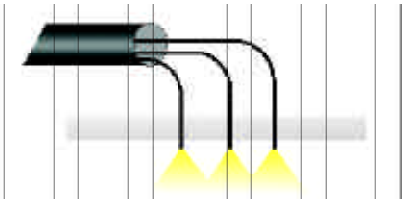
28

Glass vitrine with built-in tube system with fittings.

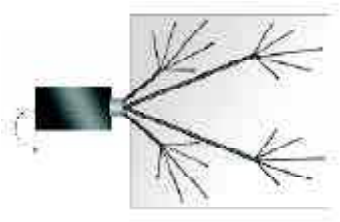
Decorative Light / Starlight Illumination

The application fields of fiber light for decorative purposes are inexhaustible, and end- and sidelight fiber cables can be used at random.

6 mm PMMA fiber cables are suitable for creating giant star ceilings. After guiding the fiber cable to the area where the stars should be placed, app. 1-1½ m of coating is removed, and the 50 “raw fibers” that appear are mounted as stars. One cable containing 50 “stars” is easier to handle than 50 single “stars”. Light generators with Ø 28 mm lightport can supply 1.000 stars with light. See principle below:



PMMA fiber cables are split up and the „raw“ fibers distributed as stars.



Splitting up is the easiest way to manage a large number of fibers for huge star ceilings (1000 stars per generator).

Crystal fittings and light generators with colorshift / sparkle are other kinds of decorative effects.

Arched starlight ceiling with 3.000 light points. Watt consumption: 3 X 75 watt.

Sidelight

Sidelight cables from *Roblon Fiber Optics* are the most flexible cables available on the market, and their uniform light effect, which is unequalled, is obtained by the twisting method (US.Pat. 5995702) of the fibers.

UV- and alga resistance:

The sidelight cables have a certified UV and alga resistance (UV-test: ASTM G53/algar test: ISO 846, Method B)

Light effect:

Sidelight fiber cables can change colour and they can “gleam” – their light effect cannot be compared to neon. To optimise utilisation of the light, the cable can be furnished with a waterproof termination with a built-in light reflector, causing part of the light to be returned through the cable.

Application and mounting:

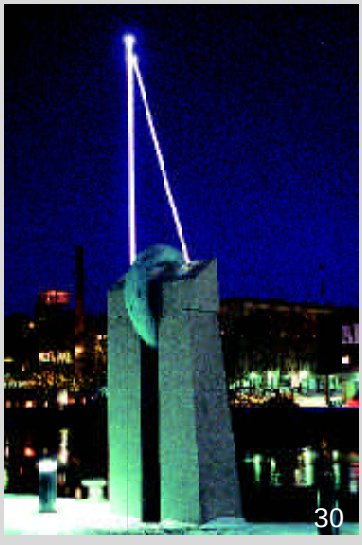
Sidelight is applied where safety, maintenance, and flexibility are important parameters. As the light is not live it can, in principle, be mounted anywhere. Sidelight cables can be mounted inside assembling rails, by strapping or by milling, e. g. into wooden profiles.
Assembling rails and straps are accessories for sidelight.

Recommended maximum fiber lengths:

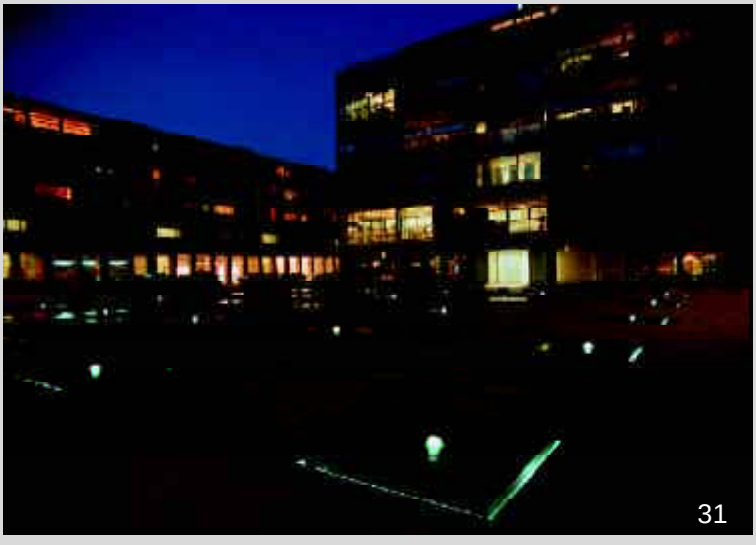
- 75 W halogen light source (Ø9): White light 12-15 metres
- 75 W halogen light source (Ø9): Coloured light 22 metres
- 150 W metal halide (4.200 K): White light 25-30 metres
- 150 W metal halide (4.200 K): Coloured light 25-35 metres

Do-it-yourself kit:

Roblon Fiber Optics supplies Do-it-yourself Kits for assembling PMMA fiber cables. A kit consists of:
1) connector 2) grinder / polisher set and 3) heating knife. The connector is available in standard sizes or with special hole size for an arbitrary number of fiber cables.



Sculpture with sidelight, Stockholm,Sweden
Photo: Joakim Humleback. Artist: Freddy Fraek



25 Water sculpturers with side- and endlight.
Tuborg Havn, København.

Mounting and Placing

Light generators:

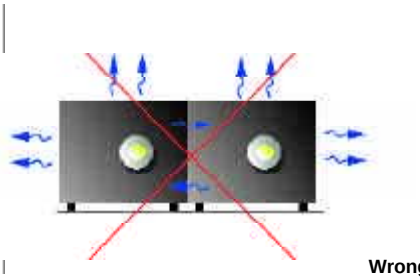
The light generator must be placed in a way that prevents it from being overheated.
Cooling of the most vital parts (polyconnector and light source) and of the generators is done in two ways:

- Cooling by means of air flow (forced ventilation by built-in fan) →
- Cooling by heat radiation through the cabinet (Heat transmission - the cabinet turns warm) ⇝

This means:

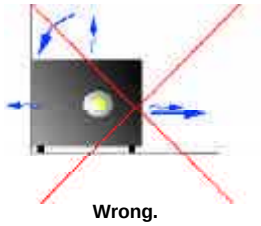
- The air flow (take-in and let-out of air) through the generators air grilles must not be blocked.
- The generator must be placed with plenty of space around it in order to allow heat transmission and keep the heat from being rejected onto the light generator.

Correct.
Space on all sides.
The generator can give off heat.



Wrong.
The generators are placed too close to each other.
Heat of radiation will overheat the generators.

Correct.
Ventilation must not be obstructed.



Wrong.
Generator too close to wall.
Blocked air grilles reduce cooling.

Noise.
Roblon's light generators
are among the quietest available.

Noise:

Roblon Fiber Optics' light generators are extremely quiet; however, the inevitable noise level always present when the light generator has a built-in fan, should be taken into account when planning the light.

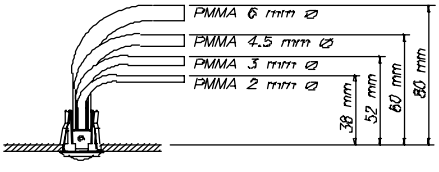
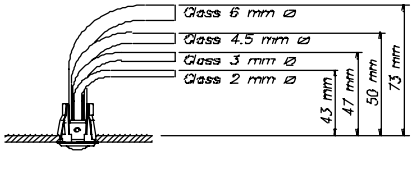
Fiber cables:

Fiber cables should always be bent "softly" – sharp bends should be avoided as they

1. Will reduce the light quantity
2. May permanently damage glass fiber cables

Recommended bending radius:
PMMA: no less than 8-10 times the active diameter. **Glass:** no less than 4-6 times the active diameter.

The table below shows the recommended minimum distances when mounting fiber light in lowered ceilings.

Recommended minimum distance between the existing and the lowered ceiling when mounting fiber light.		

The indicated distances are for guidance only. Smaller distances are physically possible.

Fittings:

Fiber cable and fitting are assembled by an allen screw in the fitting. Dependent on the type of fitting, the assembling is made by screwing or by holding the fitting with a built-in spring. Maintenance is limited to general cleaning / dusting.

Photo Reference

No	Fitting/termination	Fiber / cable	Light generator	Description
1	Eclipse (03130420)	PMMA Ø 4.5 mm (52000552)	1 x 75 W (01500178)	5 fittings lighting the gang-way of a private house [1]
2	Special, water-proof fitting	PMMA Ø 3 mm (52000551)	1 x 75 W (01500178)	Light in bubble bath in a private house[1]
3	Various fittings	PMMA Ø 3 mm (52000551)	1 x 75 W (01500178)	Light generator with fiber harness and fittings
4	Beespot Focus (03130000)	PMMA Ø 6 mm (52000553)	1 x 75 W (01500178)	1 fitting lighting fountain and sculpture in a private house[1]
5	Fixed optics (03101216) Circle H (03130400)	PMMA 4.5 mm (52000552) PMMA 3 mm (52000551)	2 x 75 W (01500179) 1 x 75 W (01500178)	Ceiling: 60 fittings, 35 lux. Bed: 9 fittings. Private home
6	Eclipse (031420), wall-Mounted	PMMA Ø 4.5 mm (52000552)	1 x 75 W (01500178)	5 fittings lighting the gang-way of a private house[1]
7	Compas (03130100) + Wide insert (03130182)	PMMA Ø 4.5 mm (52000552)	150 W (01600121)	Facade, marking light, Danish Meat Research Institute.
8	Circle H (03130400)+ 100 mm tube (03130451)	PMMA Ø 3 mm (52000551)	1 x 75 W (01500178)	9 bollard decorating a flower bed. Private home[1]
9	Compas (03130100)+ Angle insert (03130150)	PMMA Ø 4.5 mm (52000552)	1 x 75 W (01500178)	2 fittings lighting sign in front of Frederiksberg Town Hall
10	Fitting w. optics (03101216)	PMMA Ø 4.5 mm (52000552)	2 x 75 W (01500179)	Ceiling above half-open patio of private house. 60 fittings. 35 lux
11	Fittings w. optics (03101216) Fittings w. optics (03101224)	PMMA 4.5 mm (52000552) PMMA 2 mm (52000550)	75 W (01500179) 75 W (01500178)	Ceiling: 37 fittings. Sign: 13 tilt-able. Egnsbank Nord, Sæby, DK
12	Fitting w. 12 mm optics (03101216)	PMMA Ø 3 mm (52000552)	2 x 75 W (01500178)	Entrance hall, lit by 16 fittings. Tuborg Harbour, Copenhagen.
13	Special fitting 45°	PMMA Ø 2 mm (52000550)	6 x 75 W (01500178)	96 fittings in staircases, Lecture Room, Carlsberg, Copenhagen
14	Fitting without optics (03101242)	PMMA Ø 4.5 mm (52000552)	1 x 75 W (01500179)	Bathroom, 8 m^2, 30 fittings.50 lux. Shower: 7 fittings. 60 lux.
15	No fitting. Termination (99030001)	Glass Ø 3 mm (52000130)	1 x 75 W (01500178)	6 glass fibers installed in sauna ceiling in private home[1]
16	"Raw fiber" ends	PMMA Ø 6, non-coated, raw fibers Ø 0,75 mm	3 x 75 W (01500179)	Starlight illumination in office. 3.000 stars. 15 lux
17	Sidelight cables	PMMA 4.5 mm sidelight (52000600)	150 W (01600121)	Sidelight in department store, Illums Bolighus, Copenhagen.
18	Sidelight cables	PMMA 8.0 mm sidelight (52000601)	50 X 150 W (01600121)	Vertical sidelight along glass facade. Kastrup Airport, DK. [2]
19	Sidelight cables	PMMA Ø 14 mm side light (52000603)	2 x 150 W (01600122)	Colour change sidelight. Danish Veterinary & Food Adm.[3]
20	Fitting without optics. (03101230)	Glass Ø 3 mm (52000130)	4 x 42 W (01200111)	Riding saddle lit by 32 fittings. "The Green Cabinet" of Rosen-borg Castle, Copenhagen.
21	No fittings. Star termination (99029996)	PMMA Ø 1 mm (5200524)	75 W (01500179)	Fibers milled into a wine shelf construction. Private home[1]
22	Shelf fitting (03101401)	PMMA Ø 3 mm (52000551)	42 W (01200121)	Fittings installed in top and sides of vitrine. Private home[1]
23	Special fitting with plain glass (03101200)	PMMA Ø 3 mm (52000551)	75 W (01500178) – moderated	Working light on petrol a tank lorry
24	No fitting. Termination (99030001)	PMMA Ø 3 mm (52000551)	150 W (01600121)	Fibers in patented "corona" sign system. Jyske Bank, Aalborg
25	Fixed fitting (03101250)	Glass Ø 3 mm (52000130)	75 W (01500178)	8 fittings integrated in sauna[5]
26	Fittings (15 x 03101231) and (3 x 03101203) on figures	PMMA Ø 4.5 mm (52000552)	150 W (01600121)	Entrance of Forum Galleri in Sundsvall, Sweden.
27	2x32 light buttons (43000 450) in conduit system.	Glass Ø 1.5 mm (52000115)	4 x 42 W (01200111)	"Kalmar Union´s 600 years". Gown of Queen Margrete 1st
28	Light buttons (43000450) + fittings (030007350)	Glass Ø 1.5 and 3 mm (52000115 / 52000130)	2 x 42 W (01200101)	Vitrine with conduit system. Ro-senborg Castle, Copenhagen
29	"Raw" fiber ends Ø 0,75 mm – no fittings	PMMA 6 mm, not-coated, split up in raw fibers	3 x 75 W (01500179)	Flower shop with 3.000 stars in arched ceiling.
30	Sidelight cables	PMMA Ø 4.5 mm sidelight (52000600)	1 x 150 W (01600121)	Sculpture with 16 x Ø 4,5 mm sidelight, in assembling rails[4]
31	No fitting, special solution	11 mm sidelight 52000302 4x3 mm endlight 52000551	1 x 150 W (01600121)	25 fountains, end- and sidelight, Tuborg Harbour, Copenhagen

For additional information, please contact *Roblon Fiber Optics.*

[1] Design: Inge Bahn
[2] Design: Ingvar Cronhammar
[3] Design: Kim Naver
[4] Design and artist: Freddy Fraek
[5] Design: Ristomatti Ratia and Esa Vapaaavuori

Outdoor Fiber Optic Lighting

ROBLON
Fiber Optics

Outdoor Fiber Optic Lighting

Illumination by fiber optic lighting systems is a versatile lighting method with a vast scope of applications. The use of fiber optic lighting is likely to expand even further as new areas of application are continuously added.

Illumination by fiber optics is extremely well suited for outdoor environments such as building facades, as the maintenance of the lighting systems is handled centrally.

Contrary to traditional light fittings, fiber optic fittings need not to be taken apart to replace the bulb which is of particular advantage in areas difficult of access. In addition, the life of the fitting increases as the risk of faulty or leaky maintenance assembly is avoided.

Outdoor fiber optics lighting systems become cost effective as time goes by. This is due to the ease of, and long intervals between maintenance compared to traditional fittings.

Front Page: Pharmacy: Beespot. Garden: Circle H. Entrance area: Compas Wide and Compas Angle. Flagstaff: Compas Angle Max.

1. Coloumn: Compas angle and Downlight Ø26 mm Lens + PMMA-Fiber Ø6 mm. Fountain: Beespot + PMMA-Fiber Ø4.5 mm.
Flagstaff: Compas angle MAX + PMMA-Fiber Ø10 mm. Light generator 150W (4200K).

2. Facade: Compas angle + PMMA-Fiber Ø6 mm. Light generator 150W (4200K).

3

Fittings - Compas, Sirius and Eyeball

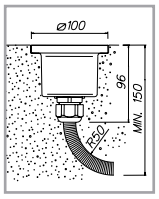
The product ranges of Compas, Sirius and Eyeball explore a new world in the area of low maintenance lighting solutions, which are adaptable to the architecture. The variety of components create numerous applications both indoor and outdoor.

Compas is developed to highlight beautiful building facades and architectural details. This product is equally convincing in the area of protected historical buildings due to its minimalistic size, wealth of variety and maintenance free positioning. Different details and materials can be accentuated and the colour temperature of the light can be adjusted by filters in the light generator. Typical applications are the illumination of monuments, statues, works of art, fountains, entrances, gardens, parks as well as interior wet environments, just to name a few examples.

Sirius is designed as a point marker in entrance areas or parking spaces. In addition it can be installed as a waterproof model for spa pools.

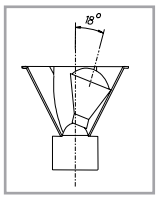
Eyeball is an adjustable uplight/downlight fitting in stainless steel. The fitting is equipped with an adjustable lens and is suitable for use as decorative lighting of facades and walls etc. The fitting can be installed in the ceiling, in the wall or in the eaves.

Fittings - Compas



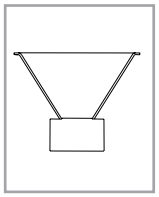
Technical Data

IP:	68 (1 m water pressure).
Carrying capacity:	Max. 2500 kg.
Breaking strength:	20 Joule.
Material:	Stainless steel (AISI 316).
Glass:	8 mm tempered.



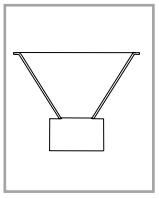
Compas Angle and Compas Angle Max

Lens:	18° tiltable lens Ø26 mm.
Insert:	Grey.
Angle:	Fiber Ø3-6 mm. Beam angle 8-21°.
Angle Max:	Fiber Ø8-10 mm (only PMMA). Beam angle 16-21°.



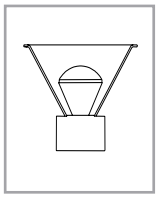
Compas Wide Opal and Compas Wide Max Opal

Lens:	Without lens. Opal glass.
Insert:	White.
Wide:	Fiber Ø3-6 mm. Uniform light spot. Beam angle 113°.
Wide Max:	Fiber PMMA Ø8-10 mm. Uniform light spot.Beam angle 113°.



Compas Wide Clear and Compas Wide Max Clear

Lens:	Without lens. Clear glass.
Insert:	White.
Wide:	Fiber Ø3-6 mm. Beam angle 52°.
Wide Max:	Fiber PMMA Ø8-10 mm. Beam angle 52°.



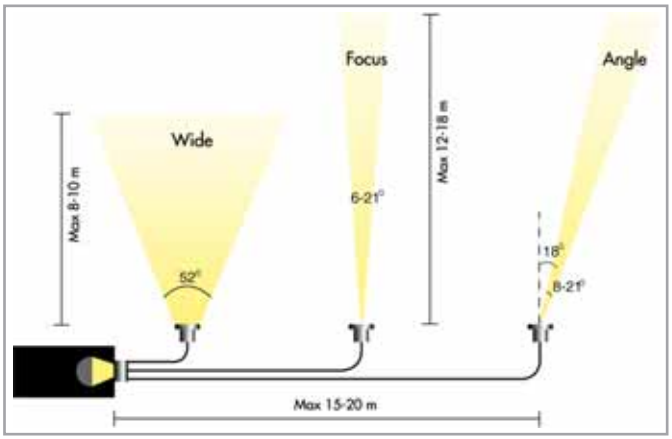
Compas Focus and Compas Focus Max

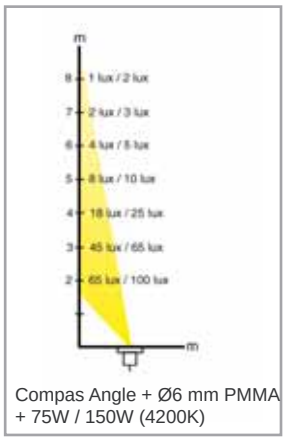
Lens:	Fixed lens Ø26 mm.
Insert:	Grey.
Focus:	Fiber Ø3-6 mm. Beam angle 6-21°.
Focus Max:	Fiber Ø8-10 mm (only for PMMA). Beam angle 16-21°.

Types

Compas is supplied with a Ø100 mm straight flange or a Ø110 mm slanting flange in stainless steel or in red brass (gun metal) with rustic appearance.

The plastic insert is available in the colours white, grey, blue, green or gold.





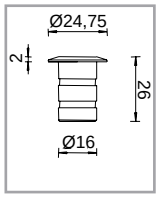
Compas Angle + Ø6 mm PMMA + 75W / 150W (4200K)

3. Entrance area: Compas Wide and Compas Angle + PMMA Ø6 Fiber. Light generator 150W (4200K).

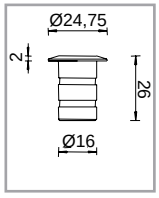
4

5

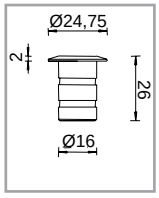
Fittings - Sirius and Eyeball



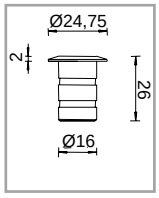
Sirius Opal
Ø25 mm. IP 44.
With opal flat glass cover.
Beam angle 113°.
Fiber Ø1-6 mm.
Stainless steel (AISI 316).



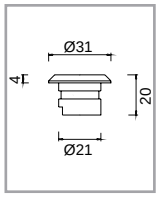
Sirius Clear
Ø25 mm. IP 44.
With clear flat glass cover.
Beam angle 52°.
Fiber Ø1-6 mm.
Stainless steel (AISI 316).



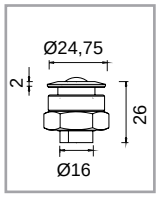
Sirius Focus
Ø25 mm. IP 44.
With Ø14 mm lens.
Beam angle 11-36°.
Fiber Ø1-6 mm.
Stainless steel (AISI 316).



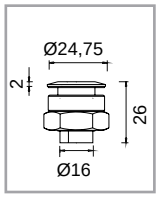
Sirius Half-Moon
Ø25 mm. IP 44.
With clear flat glass cover and black half moon insert to avoid glare.
Beam angle 52° vertical and 10°/ 26° horizontal.
Fiber Ø1-6 mm.
Stainless steel (AISI 316).



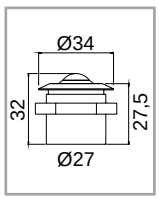
Sirius Angle
Ø30 mm. IP 44.
With fixed 30° tilted light beam and clear flat glass cover.
Beam angle 52°.
Fiber Ø1-4.5 mm.
Stainless steel (AISI 316).



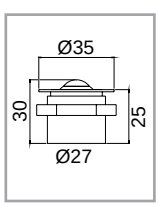
Sirius Fountain Focus
Ø25 mm. IP 68.
With Ø12 mm lens.
Beam angle 18°- 35°.
Fiber Ø1-6 mm.
Stainless steel (AISI 316).



Sirius Fountain Wide
Ø25 mm. IP 68.
With clear flat glass cover.
Beam angle 52°.
Fiber Ø1-6 mm.
Stainless steel (AISI 316).

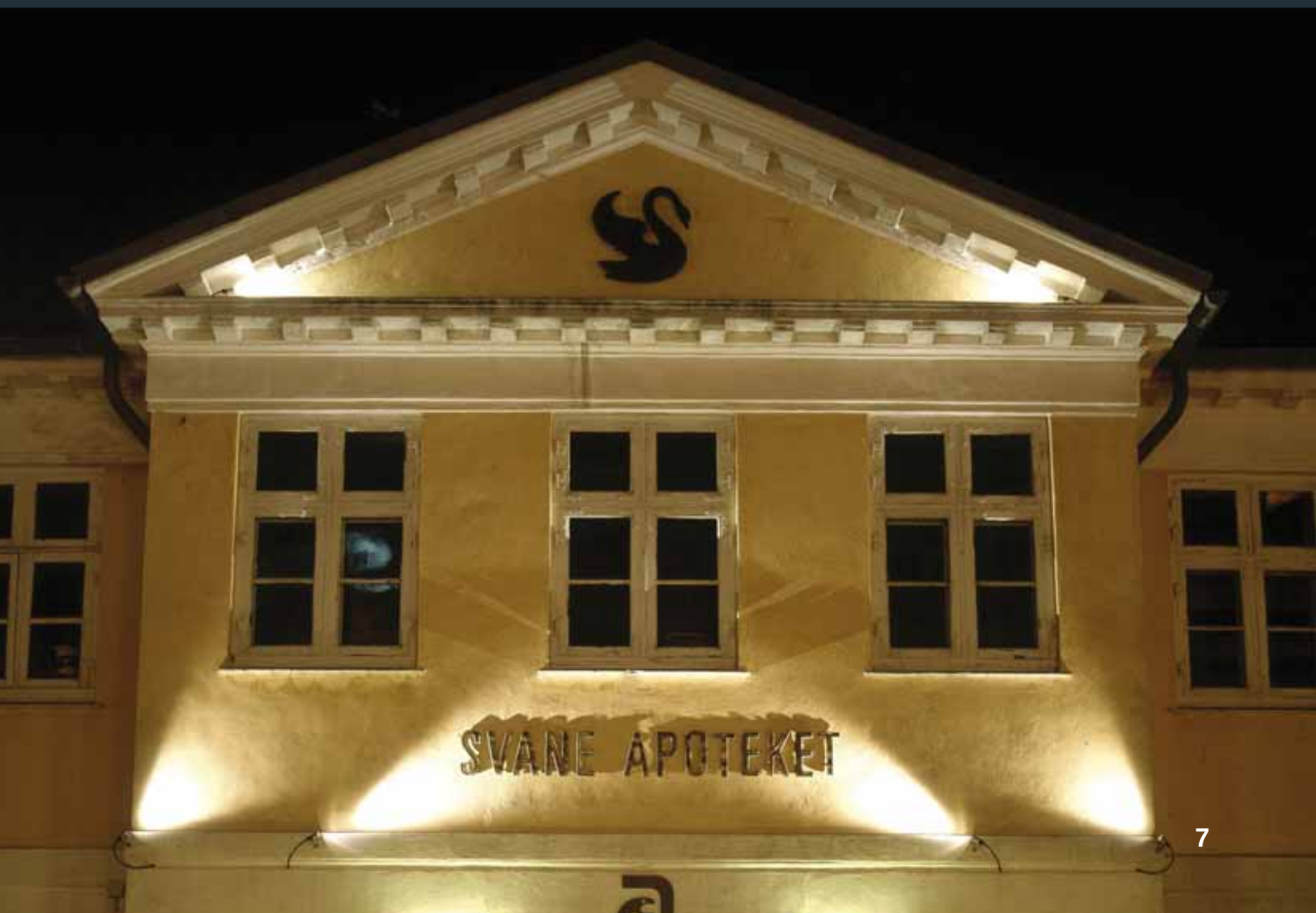


Eyeball Ø34
Ø34 mm. IP 44.
Conical flange and adjustable lens.
Beam angle 11-36°.
Fiber Ø1-6 mm.
Stainless steel (AISI 316), brushed or polished.



Eyeball Ø35
Ø35 mm. IP 44.
Flat flange and adjustable lens.
Beam angle 11-36°.
Fiber Ø1-6 mm.
Stainless steel (AISI 316), brushed or polished.

4. Parking lot: Sirius Half-Moon + PMMA-Fiber Ø3 mm. Light generator 150W (4200K).
5. Wall: Compas Angle + PMMA-Fiber Ø6 mm.
Water art: Sirius Angle + PMMA-Fiber Ø3 mm. Light generator 150W (4200K).


SVANE APOTEKET

Spot Lighting - Beespot

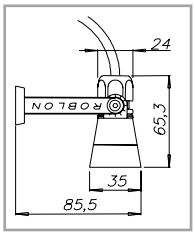
Due to the traditional problems with heat, overexposure or large and unaesthetic spotlights, Roblon Fiber Optics has developed a waterproof, maintenance free minimalistic spotlight for interior and exterior use.

Beespot opens new avenues where creative lighting solutions are required, if objects are to be illuminated safely and discretely or if the placement of the spot makes maintenance difficult or expensive.

Beespot provides a heat-free, concentrated light beam allowing for the illumination of objects over long distances. Due to the design and size, Beespot is suitable for many lighting applications:

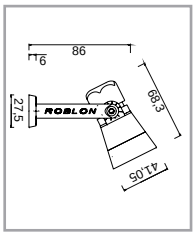
- Installation in or under water, in fountains, in ponds or water features
- Highlighting of monuments, building facades and signs
- Protected historical buildings, as Beespot is discreet and does not require maintenance at the light outlet
- Shops, as Beespot can be placed everywhere
- Objects, which are heat sensitive, can be illuminated from a small distance.

Beespot is available in 4 designs for outdoor use:
- Beespot XT Wide and Beespot XT Focus.
- Beespot XT Wide Max and Beespot XT Focus Max.



Beespot XT Focus and Beespot XT Wide

IP:	68.
XT Focus:	With Ø26 mm lens. Beam angle 16-30°.
XT Wide:	Flat glass cover. Beam angle 52°.
Fiber:	Ø3-6 mm PMMA.
Material:	Stainless steel (AISI 316).
Accessories:	500 mm extension arm for Ø3-6 mm PMMA fibers.



Beespot XT Focus Max and Beespot XT Wide Max

IP:	68.
XT Focus Max:	With Ø26 mm lens. Beam angle 18-34°.
XT Wide Max:	Flat glass cover. Beam angle 52°.
Fiber:	Ø8-10 mm PMMA.
Material:	Stainless steel (AISI 316).

Wide/Wide Max

Focus

Focus Max

6 + 7 Beespot XT Focus + Ø6 mm PMMA fiber. Light generator 150W (4200K).

8

9

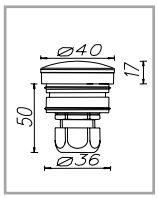
Bollard Lighting - Landscape

The Landscape range represents a new dimension of decorative fiber optic fittings for outdoor applications.

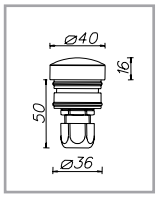
The specially developed prisms with their unique design make fascinating lighting effects possible in most environments: along pathways, in parks and gardens, in entrances or in front of buildings and walls. The optical design of the different fittings enables fascinating illumination of pathways, walls and plants.

The Landscape range is offered with different fittings:
- Circle H (Ø40 mm) bollard top with horizontally directed light beam
- Circle V (Ø40 mm) bollard top with vertically directed light beam
- Eclipse (Ø50 mm) bollard top with diagonally downward light beam
- Plus V (Ø40 mm) bollard top with slightly diagonally upward light beam
- Plus H (Ø40 mm) bollard top with diagonally downward side light beam.

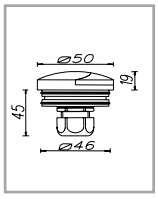




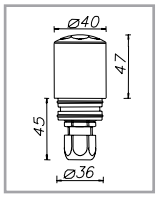
Circle H
IP 67.
Ø40 mm bollard top particularly suitable as spot marker for corners or along driveways and pathways.
Produces a 360° horizontal and 30° downward light beam.
Material: Stainless steel (AISI 304), glassblown, PMMA.

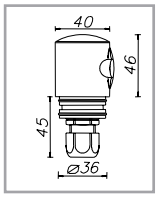
Circle V
IP 67.
Ø40 mm bollard top particularly suitable as light pool for pathways and bushes.
Produces a 60° vertical main light beam and a secondary diffuse sidelight beam of 240° (seen from horizontal view).
Material: Stainless steel (AISI 304), glassblown, PMMA.

Eclipse
IP 67.
Ø50 mm bollard top in half moon shape with 10° diagonally downward light beam when mounted on a bollard tube.
Also suitable for mounting on a vertical surface.
Material: Stainless steel (AISI 304), glassblown, PMMA.

Plus V
IP 67.
Ø40 mm bollard top with clover leaf optics.
Directs the light upwards, 15° tilted from vertical.
Suitable for illumination of walls, plants and trees.
Material: Stainless steel (AISI 304), glassblown, PMMA.

Plus H
IP 67.
Ø40 mm bollard top with clover leaf optics.
Directs the light downwards at a 45° angle. The light can be adjusted in one plane.
Material: Stainless steel (AISI 304), PMMA.

8. Circle H + Ø4.5 mm PMMA. Light generator 150W (4200K)
9. Circle V + Ø4.5 mm PMMA. Light generator 150W (4200K)

Beespot XT Focus
PMMA Ø6 mm +
150W (4200K).

Compas Angle
PMMA Ø6 mm +
150W (4200K).

Circle H
PMMA Ø4,5 mm +
150W (4200K).

Beespot XT Focus
PMMA Ø6 mm + 75W (3000K).

Eclipse
PMMA Ø4,5 mm +
75W (3000K).

Hotel before illumination with
fibre optics.
Facade height 13 m.

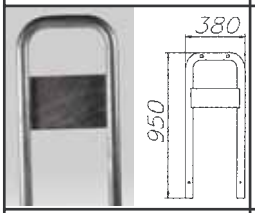
Hotel illuminated with 6
Compas.

Outdoor Light Generators

Light generators by Roblon Fiber Optics for exterior placement include nine models.

The generators are installed with the light port directed downwards. Can be mounted on a wall, on a freestanding mounting rack or in a well. The XT range can be equipped with a brace and screwed tight from the inside to prevent disassembly.

All light generators:
IP 44.
75 Watt, halogen (3000K).
150 Watt, metal halide CDM-SA/R (4200K).
Ambient temperature (Ta) during operation: Max. 40°C.

Illustration	Product type / Light port	Ø	Voltage	LxWxH / Kg
	**FL 75 XT B** 75 Watt, white light.	**Ø28**	230/240V 50/60Hz	350x250x160 8.5
	FL 75 XT F 75 Watt, 6-colour wheel[1] for external on/off.	**Ø28**	230/240V 50/60Hz	350x250x160 8.5
	FL 75 XT C 75 Watt 6-colour wheel[1]. Colour and Synchron.	**Ø28**	230/240V 50/60Hz	350x250x160 8.5
	FL 75 XT C DMX DMX-controllable light generator. 75 Watt, 6-colour wheel[1].	**Ø28**	230/240V 50/60Hz	350x250x160 8.5
	**FL 150 XT** 150 Watt, white light.	**Ø28**	230V 50Hz	400x350x200 13
	FL 150 XT-E 150 Watt, 6-colour wheel[1] and external on/off.	**Ø28**	230V 50Hz	400x350x200 13
	FL 150 XT DMX DMX-controllable light generator. 150 Watt, 6-colour wheel[1] and 6-step dimmer.	**Ø28**	230V 50Hz	400x350x200 13
	FL 150 XT DMX DMX-controllable light generator. 150 Watt, 6-colour wheel[1].	**Ø28**	230V 50Hz	400x350x200 15
	FL 150 XT DMX DMX-controllable light generator. 150 Watt, 6-step dimmer.	**Ø28**	230V 50Hz	400x350x200 15
	**Mounting rack for FL 150 XT** Rack for separate mounting of light generator. Galvanized steel. Incl. cover plate and screws.			
	Cylinder lock for FL XT. Metal security lock. Incl. 2 keys.			

Lamp life: Avarage 6000 hours.
[1] Colour wheel: green, white, yellow, red, blue and orange.

Beam Angle and **Lux-values** depend on the fiber diameter and the lens focus. The **Roblon Lux calculator** used for calculating lux-values can be downloaded from Roblon Fiber Optics at **www.roblon.com**.

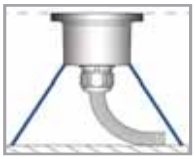
See Roblon Fiber Optics Product List for further product information.

Assembly Specifications – Compas

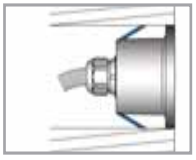
Compas is suitable for wall or floor mounting as integrated or recessed light. Relevant assembly kits for different applications ease the installation of the fitting. In addition, Compas can also be fixed in a pipe with 76 mm diameter or screwed to a screen of boards.

It is recommended to guide the fiber optic cables through a conduit to avoid potential damage to the fibers.

Embedment Kit
Consists of protective cover, 3 fixation legs and screws.

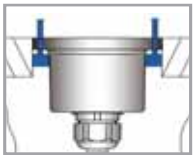


Embedment Kit for casting
The fitting is fixed by the 3 fixation legs onto a board. Concrete is poured around the fitting.



Embedment Kit for concrete casting / spring fixing
The fixation legs are shortened and bent so that they hold the light while the silicone or concrete hardens.

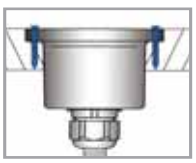
Cementation Kit
Consists of assembly ring, fixing bow and screws. Tiling adhesive can be used for attachment.



Cementation Kit
The assembly ring is glued to the tile hole with tiling adhesive and the fitting is screwed to it.

Fixed casting without assembly accessories
A 102 mm hole is drilled into a tile. The hole is filled with concrete and the fitting is then pressed in.

Fixed casting with platform
A 102 mm hole with a depth of 10 mm is cut into the tile and drilled through with a Ø76 mm hole. This creates a platform, on which the fitting can be fixed with tiling adhesive or silicone.



Screwing onto wood
A 76 mm hole with chamfered edges is drilled and the fitting is screwed to it.

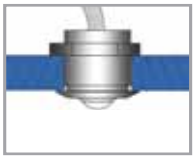
Recess in a plastic tube
A plastic tube with an internal diametre of 76 mm is recessed in concrete. The Compas fitting is fixed in the plastic tube and possibly sealed with silicone.

Assembly Specifications – Sirius

Wet zone
Sirius is attached with a flexible hose and sealed with silicone.
Hole: Ø21 mm. Sirius Angle: Ø26 mm.
Dry zone
Sirius can be glued directly in a Ø16 mm hole.
Sirius Angle: Ø21 mm hole.

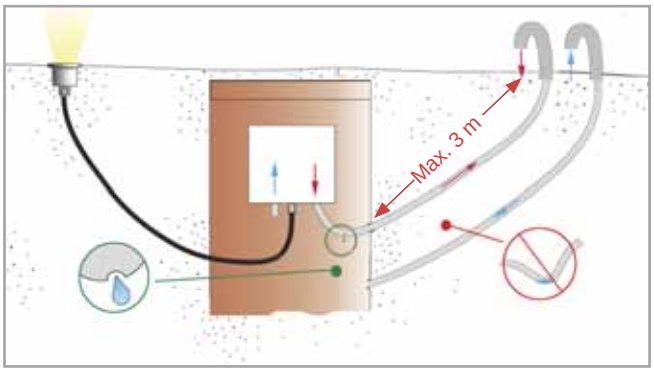
Fixing onto a plate – Sirius Fountain
Sirius is fixed onto a plate with a locking screw.
Hole: Ø16 mm.
Plate thickness: Minimum 1 mm and maximum 15 mm including seal and distance ring.

Assembly Specifications – Eyeball



Fixing onto a plate - Eyeball
Eyeball is fixed onto a plate with the enclosed locking screw.
Hole: Ø27 mm.
Plate thickness: Minimum 1 mm and maximum 16 mm including seal and distance ring.

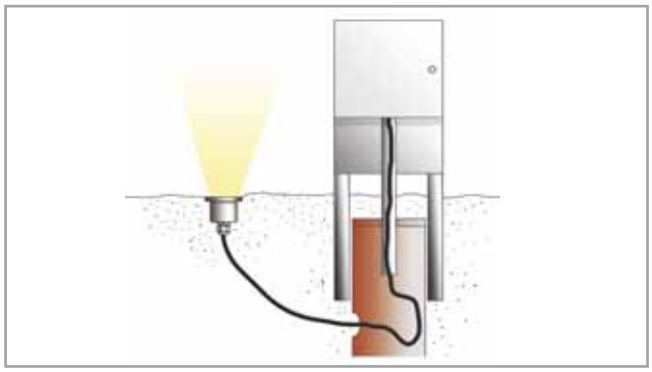
Assembly Specifications - Well Solutions



Placement of light generator in a well
Dimensions of the well:
0,5 m³ with a minimum depth of 1 meter.
For wells < 0.5 m³, a direct fresh air inlet and an extraction from the light generator to the outside is required.

The light generator has to be assembled with a ventilation flange for connection to a Ø54 mm ventilation pipe (recommended: DMI Nyflex, no. 2631).

It is recommended to drill a small hole (max. Ø5 mm) to avoid condensation in the air hose so that condensation can flow off the air hose. See illustration.



Fiber well
The excess fiber lengths can be collected below the light generator in a fiber well.

Roblon Fiber Optics
Nordhavnsvej 1
P.O. Box 120
DK-9900 Frederikshavn
Tel: + 45 96 20 33 66
Fax:+ 45 96 20 33 96
E-mail: info@roblon.com
www.roblon.com