# ADDITIONAL SAFETY WITH LUMINOUS MARKINGS

# YFESTOS®

## THE BRIGHT SOLUTION

BEELE
ENGINEERING

YFESTOS

**Websites: http://www.actifoam.com, www.beele.com, www.csdplugs.com, www.rise-systems.com, www.riswat.com and www.yfestos.com**

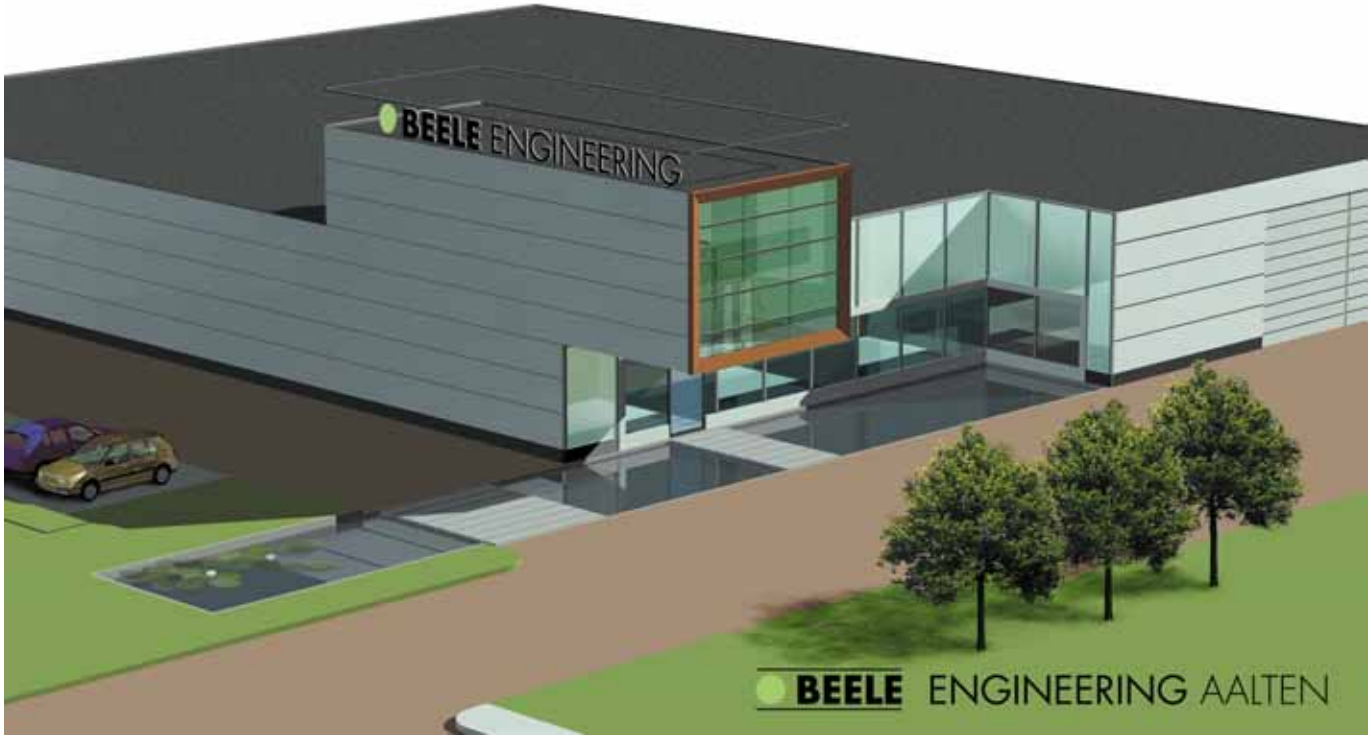
# BEELE ENGINEERING: FOR ALL SAFETY

BEELE Engineering and CSD International have been working in the field of water and gas tight and fireproof sealing of conduits for pipes and cables for more than 25 years. In the field of passive fire prevention, we have invested substantial amounts of money in the development of systems which are capable withstanding fires for extended periods of time. Passive fire prevention is a very complicated matter due to the fact that cable and pipe penetrations have to be designed to the actual circumstances at site and not for a laboratory test. In case of a catastrophe penetrations are subject not only to flame erosion and very high temperatures, but also to mechanical loads due to collapsing cable ways and possibly a jet of fire-fighting water. This means that the performance in actual situations can differ dramatically from that in a regular fire test. In fact, the systems could only be applied as tested to guarantee the required fire safety.

**And this means discussions and limitations!**

We have ensured that our systems will function under all circumstances, and the classification societies have awarded us signed and stamped installation drawings of our sealing systems. Approved for steel and aluminium partitions. Guaranteed safety in your installation will be the result.

***The R&D department of BEELE Engineering is constantly working in the field of rubber and systems techniques to optimize the existing systems and to develop new concepts for cable and pipe conduits in buildings, technical installations and on board of vessels and offshore installations. Although installation of the CSD sealing systems is in fact an easy matter, a full training programme can be given in-house by our engineers. Because the advantages and possibilities of passive fire prevention and evacuation signposting can most effectively be discovered in an environment that matches the practical situation as closely as possible, a unique research and development centre has been constructed. As far is known, this R&D centre is the only institute world-wide where visitors can experience for themselves all the aspects of fire prevention and evacuation signposting systems.***




Research and development centre with a training and schooling institute for passive fire prevention products and systems and for the improvement of evacuation signposting systems in buildings and on board ships.

The centre consists of a presentation theatre seating up to 45 persons, and a mock-up covering about 500 square metres in which various evacuation signposting systems are installed to enable their effectiveness to be determined in the dark.

The behaviour of escaping persons inside the test facility can be recorded from a separate technical area (with an associated showroom) by means of infra-red cameras and an audio-video system.

In addition the centre comprises three laboratories with a total surface of about 300 square metres in which, respectively, large-scale fire tests, mechanical tests, and light emission investigations are performed.

# Materials that give light in the dark: helping to increase safety

The population density is still in the increase, particularly in major cities. At the same time, the shortage of land coupled with its high cost has resulted in a trend to increase the height of buildings to live or work in. This means that, generally speaking, far larger numbers of people are present in a given building today than used to be the case in past. We see the same trend in hotels, hospitals, homes for the elderly, shopping centres, cinemas, theatres, etc., which these days have to be designed on a large scale to make them cost-effective. If we also consider today's general individual mobility and observe the masses of people thronging airports, railway stations, ferries, passenger ships, etc., it is self-evident that any outbreak of panic due for example to a fire or a power failure can have potentially very grave consequences. For that reason, a high level of fire protection is legally required in many structures and in many cases auxiliary power systems are prescribed as well.
However, none of this alters the fact that the possibility of a fire or a power failure can never be ruled out entirely. Evacuation of the people present, certainly in case of fire, is the number one priority.
The large numbers of people and the general complexity of modern buildings have not made this any easier with the passing years.

Admittedly, the time available for evacuation of personnel has been lengthened by the advent of smoke notifiers to provide early alarm and sprinkler systems to attack the fire in its early stages, but time and again it appears retrospectively that 'there was just too little time'.
The human panic factor also plays a role here. In the past, there are numerous examples showing that people get into a panic when there is an outbreak of fire and as a result take an inappropriate escape route and get more and more disoriented because of the extremely dense and foul fumes. The panic is further aggravated many times more if the people are completely unable any longer to find their way out.

In this kind of situation, what is the function of the illuminated 'EXIT' signs, the pictograms indicating exit routes and stairways, and the floor plans marking escape routes. Beyond doubt they are excellent aids, there can be no doubt about that. But just how many people will really take the time and trouble to study the floor plan the moment they arrive in an unfamiliar building? Generally speaking, surely nobody considers the possibility of a fire or other disaster occurring? Will people in a panic still recognize those pictograms, which are often located quite a distance away?

## YFESTOS: THE BRIGHT SOLUTION

# LIGHT IN THE DARK

***If a fire breaks out, all the people inside the building must leave it as soon as possible. However, the panic which can occur following a fire outbreak will result in a considerable deterioration in their sense of direction. Quite possibly, the fire may also be accompanied by failure of the lighting system. Under such conditions, it is anything but a simple matter to find one's way to safety.***

FIRE!
DENSE SMOKE
LIGHTING FAILURE
PANIC
ESCAPE
BUT: WHERE TO?

**The 'EXIT' signs are generally located above doors. Because the fumes formed by a fire tend naturally to accumulate near the ceiling, these signs will soon become invisible. They will only remain functional at places where - as yet - no fumes have formed. Another important aspect is that persons fleeing in panic will by nature tend to direct their vision downwards rather than upwards. For these reasons, it is worth considering the provision of additional markings besides the exit signs and pictograms, in order to further increase safety during an emergency evacuation.**
**This can be done by using a lighting system that functions independently of the energy system installed in the building.**
**Such a system could be applied, preferably on the floors and walls at a maximum height of one metre, so providing extra markings leading to safe exit routes, such as staircases and escape ladders.**
**The risk of dense fumes accumulating just above floor level is far less than below ceiling level, which means that the visibility of the route markings applied on floors and on walls is retained for a far longer period. This also satisfies the 'direction of vision' criterion better. Also, if such a system operates independently of the building's energy system, it will retain its luminescent function in the case of a power failure.**
**Products that emit stored energy in the form of light in the dark are the functional solution for this problem, because no electrical energy is required. Safety measures of this kind can speed up the evacuation enormously. We should never forget that, when disaster strikes, every second counts.**

# SPEED OF EVACUATION OF PERSONNEL

***In cases where personnel and passengers have to be evacuated from ships and offshore installations or from hotels and office towers etc. in the event of a sudden disaster, the speed at which the evacuation takes place is a defining factor when it comes to limiting the number of potential victims. Loss of time during an evacuation operation is mainly caused by panic breaking out and by what is often unclear signposting of escape routes. The degree of panic is dependent on the greater or lesser degree of threat posed by the situation, and is therefore difficult to influence in a preventive way. Effective signposting of escape routes, however, is an area which offers a great deal of scope for preventive measures.***

**Two examples speak for themselves in this respect:**

**1) Any lift to which people are directed by the EXIT signs carries notices stating that the lift must not be used in case of fire. Therefore, persons arriving at the lift have to re-orientate themselves by means of the same EXIT signs in order to find the stair-case leading to safety. This is extremely confusing, specially in a panic situation.**

**2) The lighting has failed, and people have to leave their room and find their way to an escape staircase or an assembly point.**

**How can they find the shortest route in total darkness? So there are numerous examples of situationswhich hamper the speed of escape and which must therefore be improved in order to raise the general level of safety on board ships and in facilities and buildings.**

**On the basis of a simulated evacuation operation carried out by the staff of our Research & Development department, a list of recognizable recommendations has been drawn up specifically for improving the signposting of escape routes.**

***Suppose people are staying in a ship's cabin or hotel room, and in the middle of the night the alarm goes signalling them to abandon the ship or leave the building. To make matters worse, the electric power has failed. In such a situation, the speed of escape can be improved by a number of measures:***

***1) They will attempt to dress as quickly as possible and collect their most important personal belongings.***

**a) People will first try to turn on the room lighting. It can be made easier to find the switches by providing them with luminescent marking. If there is a power failure, it will be extremely difficult to find unmarked switches. Once the occupants have found the switches and made a number of attempts to put on the lights, they will soon realize there is no electricity.**

**b) A luminescent plate on which personal belongings can be placed will enable them to be found quickly in the event of evacuation, even in the dark.**

# SPEED OF EVACUATION OF PERSONNEL

***2) Once people are ready to escape they will not stop to look at the floor plan (which they won't be able to read in total darkness anyway), and leave the room immediately.***

**a) If the outlines of the door leading out to the corridor are luminescent, people will be able to find their bearings with ease.**

**b) The escape route should be clearly marked inside the rooms, so that people don't have to find their bearings again in the corridor. This can be simply done by fixing a luminescent pictogram on the inside of the door. Our proposal is that this pictogram should show the 'SOS' sign together with an arrow indicating the direction of escape. This cannot be confused with EXIT signs, which normally lead to the lifts. An additional advantage is that the necessary reading time is minimal. A lot of time is gained by the fact that people are immediately guided in the right direction.**

***3) A long dark corridor is not a particularly inviting place. It will cause an increased sense of panic, certainly if a persons is alone.***

**a) The luminescent SOS pictograms should be fixed on the corridor walls prefer ably at eye-level and at well chosen intervals (certainly no higher than eye-level because escaping persons tend no to look upwards). We have developed a formula which makes it possible to calculate the legibility distances of the pictograms on the basis of light emission levels.**

**b) Application of a continuous 'low location lighting' system on the walls set at a maximum height of 300 mm above the floor and interrupted by the letters 'SOS' achieves a dual purpose. First, the direction of escape is clearly indicated by the arrows on the LLL strips, and secondly the floor is illuminated so that potential obstacles will be seen clearly. (Note that in a normally illuminated environment LLL strips without arrows are totally non-functional, simply because they don't indicate any direction at all.)**

**c) If lamps provided with a luminescent coating are fitted at regular intervals along the corridors, or if luminescent material is incorporated in their shades, there will be at any rate some kind of emergency lighting.**

# SPEED OF EVACUATION OF PERSONNEL

***4) In an evacuation, doors form an uncertainty factor if escape doors are not clearly recognizable as such.***

**a) An SOS pictogram indicating to the escape door makes the door clearly recog nizable.**
**b) If luminescent strips are fixed around the contours of the door and luminescent floor tiles are laid in front of the door, they will be visible from a large distance. Moreover, light acts as an invitation to approach it.**
**This shortens the decision time.**

***5) Once they have arrived in a stairwell, people will certainly not yet have regained their feeling of safety, and they may still tend to take the wrong direction.***

**a) Here again, a number of luminescent lamps should preferably be fitted.**
**b) The LLL system should at any rate continue in the same way as in the corridors.**
**c) Wrapping the handrail in luminescent tape and providing the steps for example with a luminescent coating can prevent people from tripping, falling etc.**

***6) The moment of evacuation and that of the power failure will seldom coin cide. It is perfectly possible that the lighting may have failed long before the evacuation alarm is given.***

**a) Along escape routes it is important to use only luminescent material having a high level of light emission, to ensure that it will remain functional after several hours of darkness. This requires a luminance of at least 150 mcd/m$^2$ after 10 minutes and at least 20 mcd/m$^2$ after 60 minutes.**

YFESTOS®:

SET THE LIGHT AT GREEN FOR YOUR OWN SAFETY

AND THE SAFETY OF OTHERS

# SPEED OF EVACUATION OF PERSONNEL

**The following systems have low or zero functionality for the purpose of effective escape route signposting:**

* **LLL systems based on glowing LEDs in the floor, because:**
  **a) these systems are electricity-dependent, and**
  **b) they do not give a really clear indication of the direction of escape.**

* **pictograms and/or arrows set above eye-level. When people are trying to escape, they will normally be looking downwards rather than upwards. It is quite possible that they will not notice obstacles in their path when they have to look upwards and consequently trip up. People coming up behind will fall over them in turn. What is more, if smoke is present the highest signs will be the first to be lost to view.**

* **luminescent LLL systems not provided with arrows or the SOS sign, because:**
  **a) the LLL system has no functionality at all under normal lighting conditions, and**
  **b) people will try to find their bearings by means of the EXIT signs, and therefore in all probability end up at a lift.**

* **luminescent systems whose light emission has fallen in a short time to such a low level that it can hardly be said to perform a secondary lighting function or be visible from some distance.**

* **pictograms positioned between large numbers of posters and other materials distracting attention. Pictograms must be readily recognizable, and they must be positioned far away from other objects.**

***BEELE Engineering's R&D department has for some considerable time been conducting research and trials designed to raise the light emission of luminescent YFESTOS® products to the highest possible level while retaining the duration of clearly visible light emission for over twelve hours. The technological level that we have reached with YFESTOS® products is unrivalled. In addition, we have performed a tremendous amount of research into commonly occurring conditions on the basis of which legibility distances are defined in relation to light emission levels, whilst we have also paid all due attention to aspects of product design.***

# SPEED OF EVACUATION OF PERSONNEL

***New products and designs are added regularly to the YFESTOS® program to optimize signposting of escape routes.***
***The examples below speak for themselves.***

**luminescent footsteps**

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**door marks**


**stroke proof polycarbonate covers for lighting systems**

# SPEED OF EVACUATION OF PERSONNEL

***New products and designs are added regularly to the YFESTOS® program to optimize signposting of escape routes.***
***The examples below speak for themselves.***

**luminescent handrail and low location luminescent emergency lighting**

**luminescent strips on the floor in stead of emergency lighting on the walls**

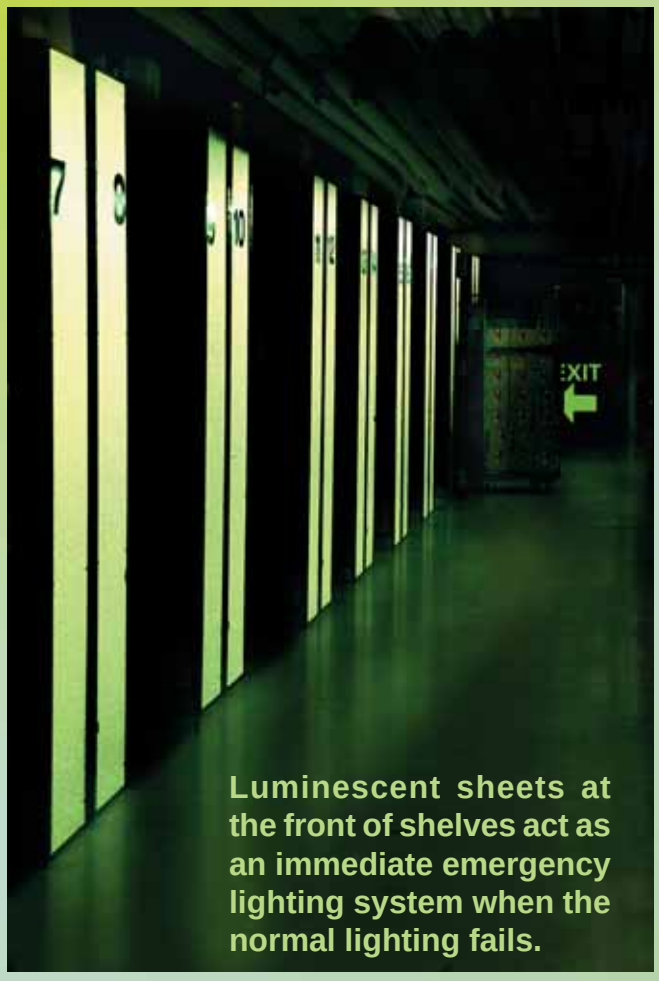
YFESTOS®

**The walls of the stairwell should be brilliant white in colour. This will make sure that the light emission of the luminescent materials used is reflected as efficiently as possible. This will only benefit the ultimate lighting level.**

**Painting a wide strip – with luminescent paint, of course – above the handrails will increase the light emission still further, and improve the general lighting level even more.**

**All in all: simple means to optimize evacuation safety!**


**With the aid of luminescent letters, arrows and strip the way to exit in this staircase is highlighted in total darkness such that no time will be lost in case of an emergency.**



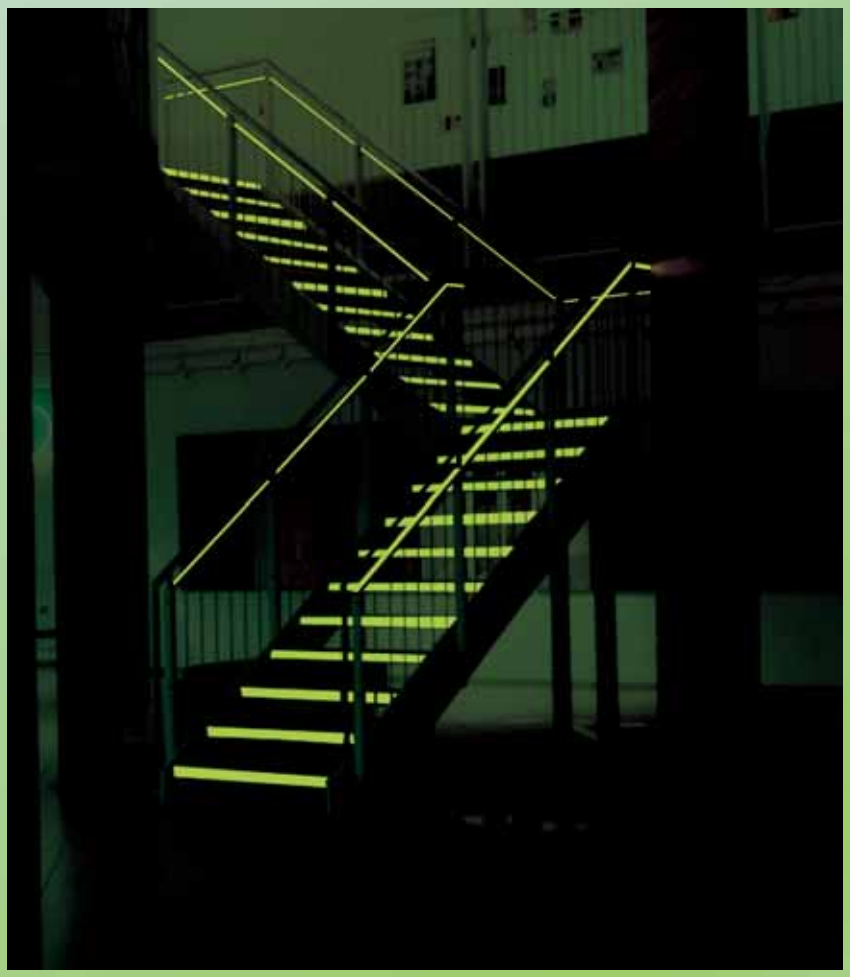

Luminescent sheets at the front of shelves act as an immediate emergency lighting system when the normal lighting fails.

**Luminescent materials are of essential importance for assuring the safety of escape routes in buildings and facilities. In addition, these products are also highly suitable to increase the general level of everyday personal safety.**

# YFESTOS®: THE BRIGHT SOLUTION

To be able to locate items in the dark will save a lot of time in case of an emergency evacuation. Luminescent products are used for this reason in hotels, hospitals, elderly homes, etc.

# YFESTOS®: THE BRIGHT SOLUTION



**Disasters always happen unexpectedly and we are usually not properly prepared. For that reason, and particularly in the course of the past decade, standards and procedures relating to safety in buildings have been raised to higher and higher levels.**

**In many ways YFESTOS® contributes to even more safety by visualizing the way out in darkness.**

**Markings that emit light in the dark can be of vital importance when a disaster occurs.**

**The product range of YFESTOS® enables a wide variety of applications.**

***It is worth considering!***

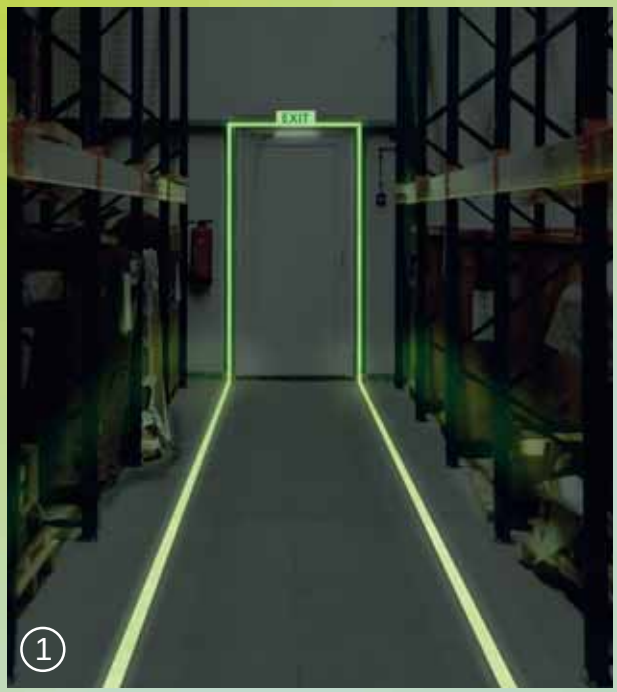

**Providing ceilings and/or floors in elevators with a luminescent plating to keep people calm in case of a power failure. The emitted green light is in any case reassuring.**
**The panel with buttons inside the elevator can be highlighted by means of the YFESTOS® putty.**


The example on this page shows how improvements can be made, as in this basement, by applying YFESTOS® luminescent products as a total system to optimize visibility in case of an emergency caused for instance by a failure of the lighting system:

1) to find vital equipment in the dark is just one step to more safety.
2) A clear routing indicating the wayout is an absolute must.
3) where YFESTOS® plates of silicone rubber are fixed behind or under normal fluorescent tubes emergency lighting will be immediately available if the normal lighting fails!
4) luminescent YFESTOS® floor tiles in front of exit doors and strips around their contours make these doors visible from a longer distance.

Luminescence in the dark can save a lot of time by finding the right way out and contributes to a higher level of the safety in our environment.

## *YFESTOS®: green light for safety!*

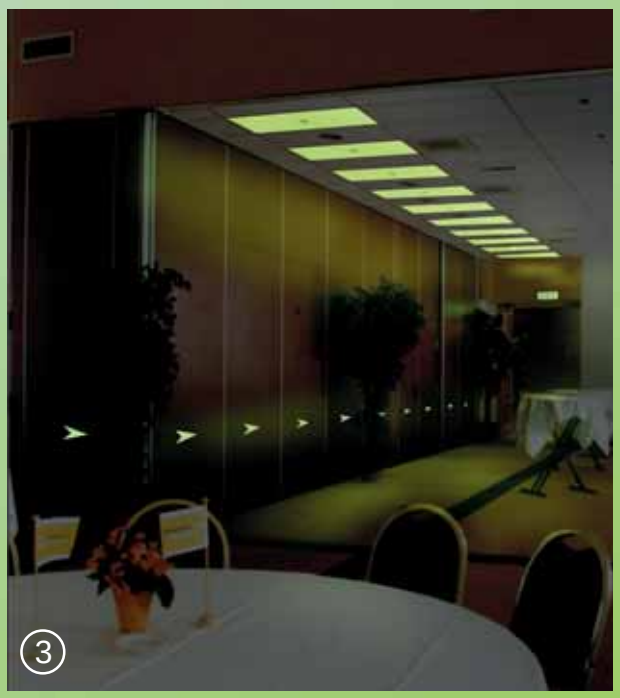


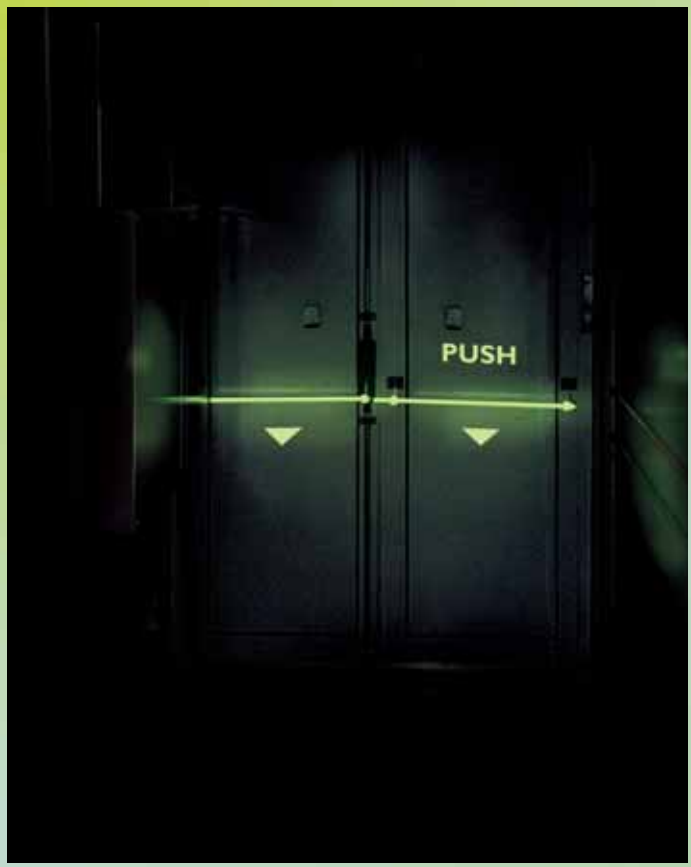
**By making use in a creative way of the different YFESTOS® luminescent products a substantial improvement can be achieved in the markings for escape routes and highly contributed to general safety:**

1) **luminescent strips for the safe routing to exit in warehouses, archives, etc.**
2) **clear routing in a stair case with the aid of luminescent letters, arrows and strips.**
3) **luminescent arrows on the wall and tiles on the ceiling to indicate the exit route in a conference room**
4) **communication in case of a disaster is of utmost importance. Telephones can be made clearly visible in the dark with the aid of YFESTOS® products.**

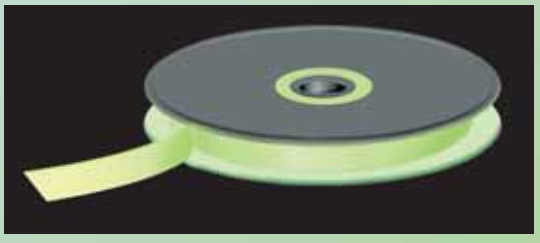
**Luminescence in the dark can save a lot of time by finding the right way out and contributes to a higher level of the safety in our environment.**

## *YFESTOS®: green light for safety!*



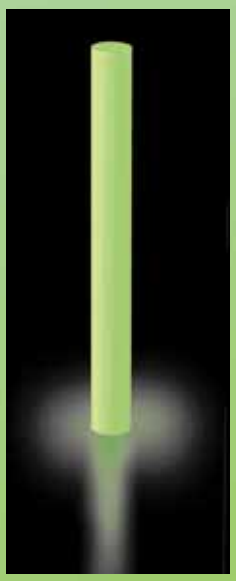




The unlock bars of emergency doors can be found easily in darkness when the bars are wrapped with luminscent tape. In combination with luminescent letters and arrows an optimum of visibilty and handling in case of an emergency is obtained.




By fixing YFESTOS® batons on lifejackets, lifebuoys and lifeboats or any safety jacket it is provided that there is always a light available to be located in the dark even after many days.
The optimum is achieved when the luminescent batons are combined with retro-reflective material. Then they will be not only visible when light shines on, but also when the onshining light disappears.

***YFESTOS® does not need a battery to be able to emit light day after day after day!***



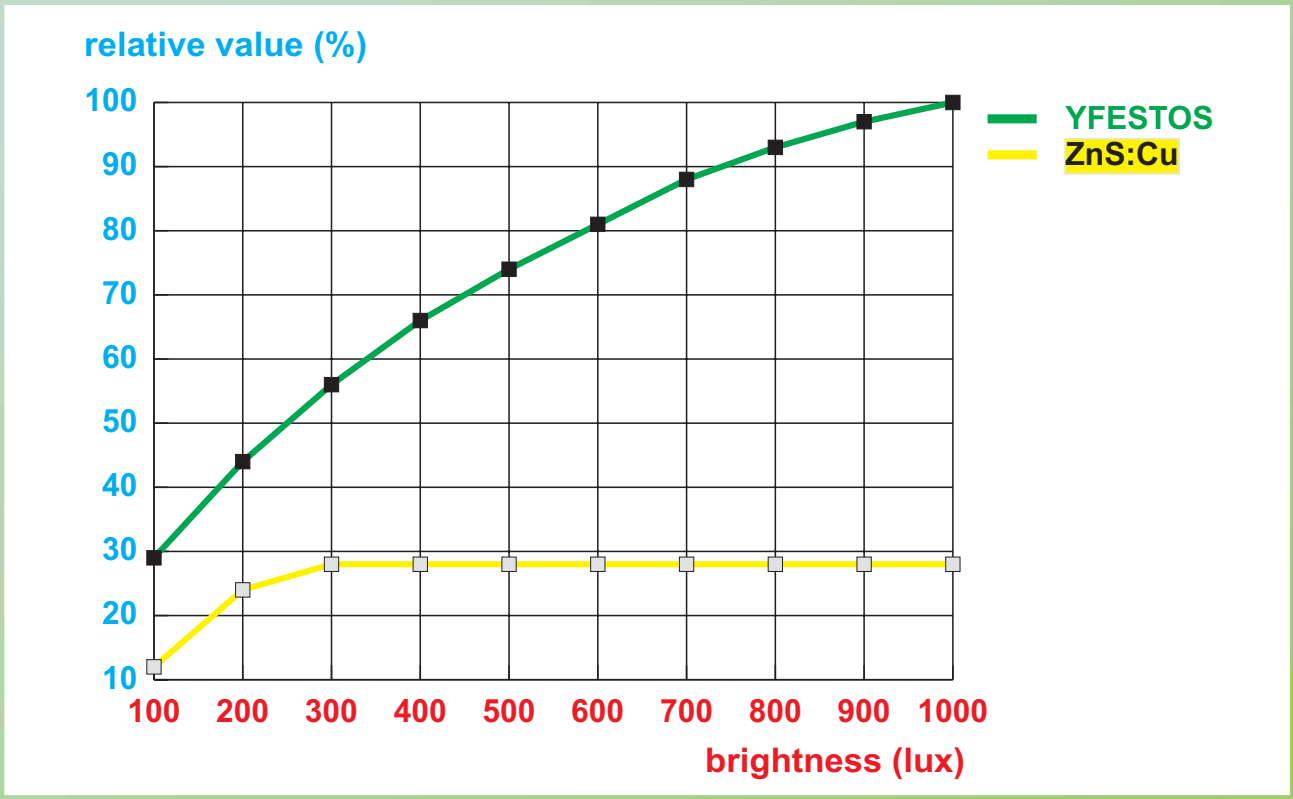
# LUMINESCENT PIGMENTS

***When the power supply fails, we have to resort to battery-powered sources for lighting purposes (in this context we had better forget about the old-fashioned candle!). The problem with this kind of back-up lighting measures is the size of the system and its maintenance. As a matter of fact, who keeps a flash-light close at hand all the time anyway? And can you be sure the battery isn't flat?***

For applications of this kind, materials which emit stored energy in the form of light are much more practical. In the 1980s the watch-making industry modified the familiar luminous dials by switching from the use of radio-isotopes to copper-treated zinc sulphide pigments. The advantage of these pigments is that they contain no radioactive components. However, they do have one drawback in that their light emission is limited both in intensity and duration.

For escape route marking to be effective, it requires a luminescence which remains active for several hours. Some years ago, a new type of light-emitting pigments was developed which possesses ten times the intensity and duration of luminescence featured by zinc sulphide pigments.

Of course, these new pigments also contain no radioactive components.

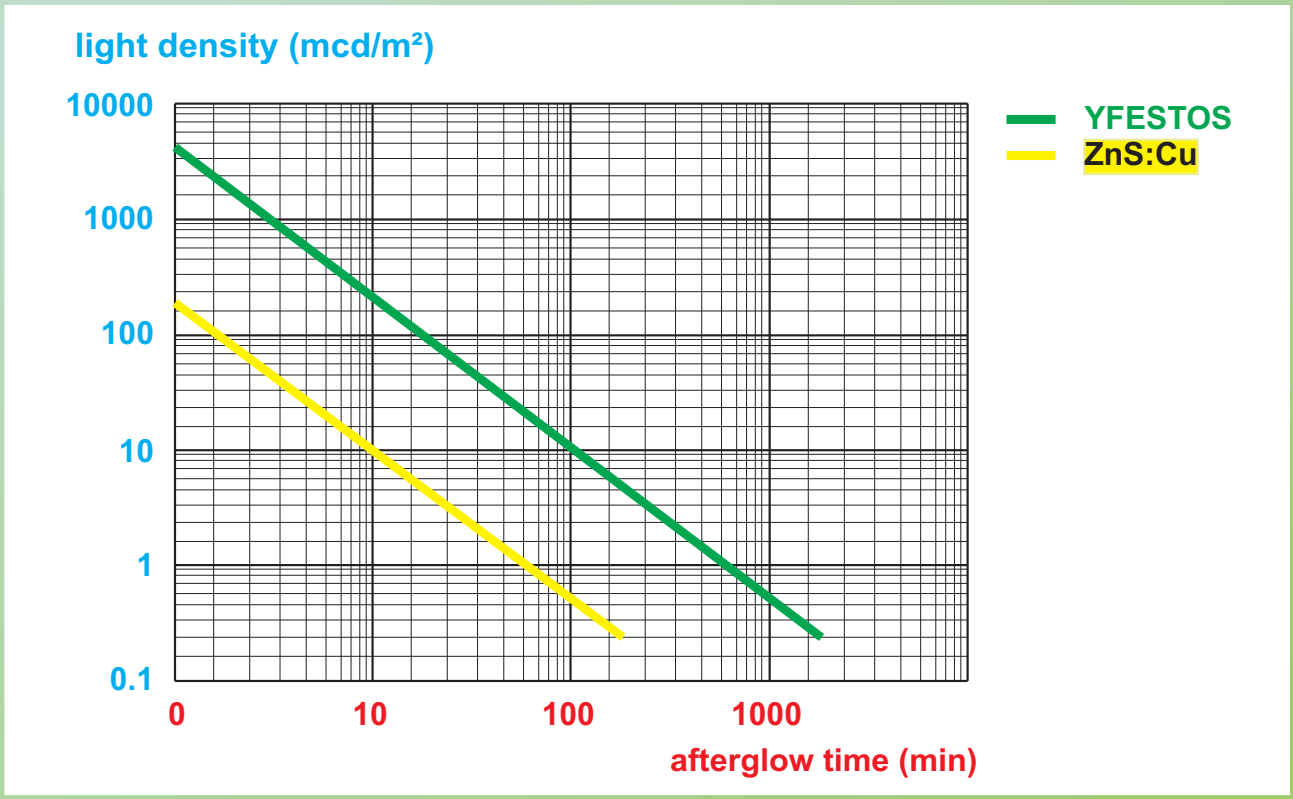



The pigments are 'charged' by irradiation with daylight, fluorescent light and light from halogen sources. The higher the ultraviolet content of the light, the faster the charging process takes place. Depending on the nature of the light source and the distance between the source and the luminescent material, the charging time is between 5 and 10 minutes. Light sources producing an illuminescence below 200 lux (like incandescent lamps) require a minimum charging time of half an hour. This irradiation method will produce a correspondingly lower luminescence, because the light from these sources contains relatively little ultraviolet. Unlike the zinc sulphides, which can only be 'charged' up to a certain level, the longer and more intensively the new pigments are irradiated, the more energy they are capable of absorbing and subsequently emitting.

# LUMINESCENCE

***In darkness, the energy stored in the YFESTOS® pigments is emitted in a wavelength range of 520 nm. The colour of the emitted light is bright green, and therefore clearly visible to the human eye. The value of luminescence is expressed in millicandelas/m² (mcd/m²). The human eye can perceive values down to as low as 0.003 mcd/m².***

At such low values, however, the distance between the eye and the emitting object has to be very small. Otherwise the emitting object must be very large in size to allow it to be seen at all clearly.
As darkness falls, the intensity of emissions from luminescent pigments decreases proportionally with time because no new energy is supplied. The decrease is highest during the first few minutes of total darkness, whilst the decrease in intensity becomes much more gradual after about 30 minutes. Most standards specify a lower limit of 0.3 mcd/m². But even this hundredfold value of what is still visible to the human eye is, strictly speaking, too low for an effective visibility distance.
Escape route marking systems should possess a visibility distance of at least several metres.




This means that the luminescence of the marking must be many times higher than 0.3 mcd/m².
By extended irradiation, the new pigments can be 'charged' to such a degree that an initial emission level of several thousand mcd/m² is achieved.
This luminescence value, as a matter of fact, is still only 15% of that of a white surface illuminated by a 100 lux lamp.

Compared with the former zinc sulphide pigments, however, the value is no less than ten times as high.
The decrease in intensity of the light emission is also relatively high with the new pigments.
On the other hand, because the emission level is much higher at the onset of darkness, an effective emission level is nevertheless maintained for many hours.

# LUMINESCENCE

***It will be clear that - given the current state of the art - a light emission with a value comparable to that of a normal lamp is not feasible. However, by means of appropriate formulation of the material, judicious choice of background, appropriate positioning to ensure sufficient contrast with the surroundings, and adjustment of the size of the emitting object, the visibility limit can be raised to a very acceptable level. The design of the escape route marking is thereby also a determining factor to optimize visibility in darkness.***

# HOW MUCH LIGHT EMISSION IS NEEDED?

**Standards differ from country to country. In general, the light emission of luminescent objects is expressed as E10/E60-T, where E10 is the measured luminescence in mcd/m$^2$ after 10 minutes darkness, E60 is the luminescence in mcd/m$^2$ after 60 minutes darkness, and T is the time in minutes extrapolated from these values until the lower limit of 0.3 mcd/m$^2$ is reached. In Germany, a minimum value of 20/2.8-340 is specified in the regulations. We are of the opinion that an effective escape route marking requires a far higher emission value.**

**In the meantime, materials developed on the basis of the new pigments have been used to demonstrate that higher values are indeed feasible.**
**An innovative method of compounding base materials and pigments has been applied to develop a luminescent rubber possessing an emission value of 209.9/29.8-2970; over four times as high as the level specified in standards. A silicone putty has also been developed on the basis of this compounding method. Of course, worldwide patent rights on this technology have been applied for.**

# BASE MATERIALS

***In the eventuality of a fire, the carriers of the pigments should have good temperature resistant properties. It is not much good making paper or plastic stickers, which will deform or melt at temperatures as low as 60 to 70 °C. When a fire occurs, far higher temperatures are soon reached.***

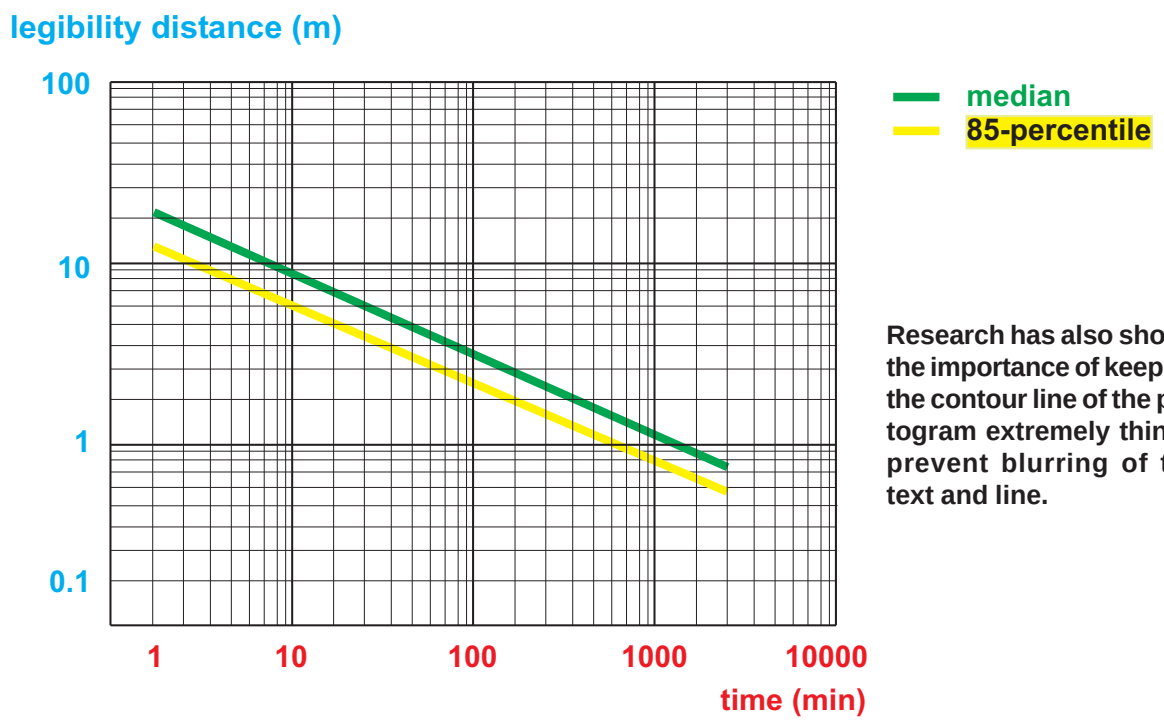
**Silicone rubbers and compounds capable of resisting brief exposure to temperatures above 300 °C, EPDM rubbers and thermoplasts with peak loads above 100 °C, and pictograms screen-printed on aluminium are the base materials of choice.**
**These carriers guarantee that the luminescent function will be retained at any rate for the period of time that escape remains possible.**
**The transparency of the base material, the arrangement of the pigments admixed in the carrier, the appropriate dosages and grain sizes of the pigments used, and the thickness and size of the end-product will ultimately determine the distance at which the luminescence is sufficiently visible. In addition, of course the design of the escape route marking system is of crucial importance. In this respect special attention should focus on a good choice of the light source to be applied for 'charging' purposes.**

# PICTOGRAMS

***In spite of the fact that the regulations do not require it, our Research & Development Department performed an investigation into the legibility distances of luminescent pictograms as a function of time. They were requested to develop a formula enabling us to calculate the legibility distance of a given letter size at a given light emission level. A table is available from us showing the correlation between legibility distance and light emission.***

# LEGIBILITY DISTANCE

**Legibility distance is an important factor for the purpose of designing escape routes. Unlike illuminated signs and signs in a well illuminated environment, as darkness falls luminescent signs are subject to a decrease in the level of light emission. This means that their legibility also decreases as time passes.**
**For YFESTOS® pictograms, we proceeded on the basis of a capital (upper case) letter type corresponding with the 'ANWB-Ee' alphabet as used in the Netherlands for the road traffic signposting system.**
**The calculations were carried out on the YFESTOS® 'EXIT' pictogram in letters 4.7 cm high. In addition, the legibility distance was calculated for a median fobserver and for an 85 percentile observer, in order to enable the design to allow for eyesight quality. We chose dimensions of 150 by 150 mm for the standard pictograms, because under normal lighting conditions this gives a legibility distance of 15 metres.**
**In those cases, the letter height or the symbol are larger than the 4.7 cm of the letters on the EXIT sign (75 by 175 mm). The legibility distance can be recalculated according to the formula $d_1 = d \times h_1 : h$, where d is the value in metres calculated for the 4.7 cm letter height, $h_1$ is the modified letter size in cm, and h is 4.7 cm.**
**The decrease of the legibility distance in function of time is illustrated in the following graph.**




**Research has also shown the importance of keeping the contour line of the pictogram extremely thin to prevent blurring of the text and line.**

YFESTOS®: BRIGHTNESS ASSURING YOUR PERSONAL SAFETY

# LEGIBILITY DISTANCE

***The legibility distance of luminescent pictograms is determined by the luminescence, the letter size and the observer's visual acuity. Because the legibility distance of pictograms is the factor determining at what distance apart they should be positioned in order to ensure optimized signposting in the dark, our Research & Development Department has developed a formula enabling legibility distances to be calculated for a given light emission level.***

| Luminescence in mcd/m² | Legibility distance in m for a letter height of 50 mm | |
|---|---|---|
| | median observer | 85 precentile observer |
| 1 | 1.43 | 0.94 |
| 2 | 2.01 | 1.33 |
| 3 | 2.45 | 1.61 |
| 4 | 2.82 | 1.86 |
| 5 | 3.14 | 2.07 |
| 6 | 3.42 | 2.25 |
| 7 | 3.68 | 2.42 |
| 8 | 3.92 | 2.58 |
| 9 | 4.14 | 2.73 |
| 10 | 4.35 | 2.86 |
| 11 | 4.55 | 2.99 |
| 12 | 4.73 | 3.12 |
| 13 | 4.91 | 3.23 |
| 14 | 5.08 | 3.35 |
| 15 | 5.25 | 3.45 |
| 20 | 5.97 | 3.93 |
| 30 | 7.15 | 4.71 |
| 40 | 8.10 | 5.33 |
| 50 | 8.90 | 5.86 |
| 60 | 9.60 | 6.32 |
| 70 | 10.22 | 6.73 |
| 80 | 10.79 | 7.10 |
| 90 | 11.31 | 7.44 |
| 100 | 11.78 | 7.76 |
| 150 | 13.74 | 9.05 |
| 200 | 15.25 | 10.04 |

***The legibility distance for other letter sizes can be calculated using the formula $D_1=DxH_1/50$, where $H_1$ is the letter size in mm and D the legibility distance in the above table.***

**Assuming an illumination of 500 lux in a normal working/living environment where the light emission of the YFESTOS® materials reaches levels of 148 mcd/m² after 10 minutes' darkness and 27 mcd/m² after 60 minutes' darkness, it is recommended that the pictograms be positioned at a maximum distance of 5 metres apart.**
**This will still make it possible even for observers with poor eyesight to read the signposting after one hour.**
**In an environment with an illumination of only 100 lux, if the pictograms are spaced 4 metres apart they will still remain legible to poor-sighted observers after 60 minutes' darkness (see table on page 24). For that reason, it is advisable to choose the 4 metre limit because it will assure a prolonged period of visible and optimum signposting in the dark under all lighting conditions occurring in our day-to-day environment.** ***A value of 0.3 mcd/m² as described in the regulations is quite meaningless. In that case, the legibility distance will be well under 1 metre.***

# VISIBILITY

***It will be clear that there is a correlation between the light emission of the luminescent material and the visibility distance. The IMO resolution gives an indication of this by basing the minimum strip width of 75 mm for the LLL systems on the lower limit of 2 mcd/m² after 60 minutes darkness, while stating at the same time that the strips may be narrower if the light emission of the luminescent material is proportionally higher.***

**ISO/CD 15370 goes further, and indicates the appropriate luminance levels after 60 minutes in mcd/m² for strip widths from 35 mm to 75 mm, at 5 mm intervals.**
**To underline the importance of being able to determine the visibility distance in particular of pictograms on the basis of the measured light emission levels, we produced a series of photographs of two pictograms, both of which comply with DIN 67510. We illuminated both pictograms for about one hour on a desk-top with normal office lighting, and then hung them up in the darkroom of a photo studio.The zinc sulphide pigments-based pictogram has a letter height twice as large as the pictogram based on the newly developed YFESTOS® pigments. The camera was positioned at a distance of 3 metres from the pictograms, and photographs were taken after 1 minute, 10 minutes and 30 minutes in darkness. The result speaks for itself.**




**The pictogram containing the much larger letters is hardly legible after only 10 minutes due to the lower light emission, while the smaller pictogram can still be read from a distance of 3 metres after 60 minutes.**

***Products with low emission values must be either spaced closely together or enlarged significantly in order to ensure an acceptable visibility distance.***

YFESTOS®: BRIGHTNESS ASSURING YOUR PERSONAL SAFETY

# VISIBILITY

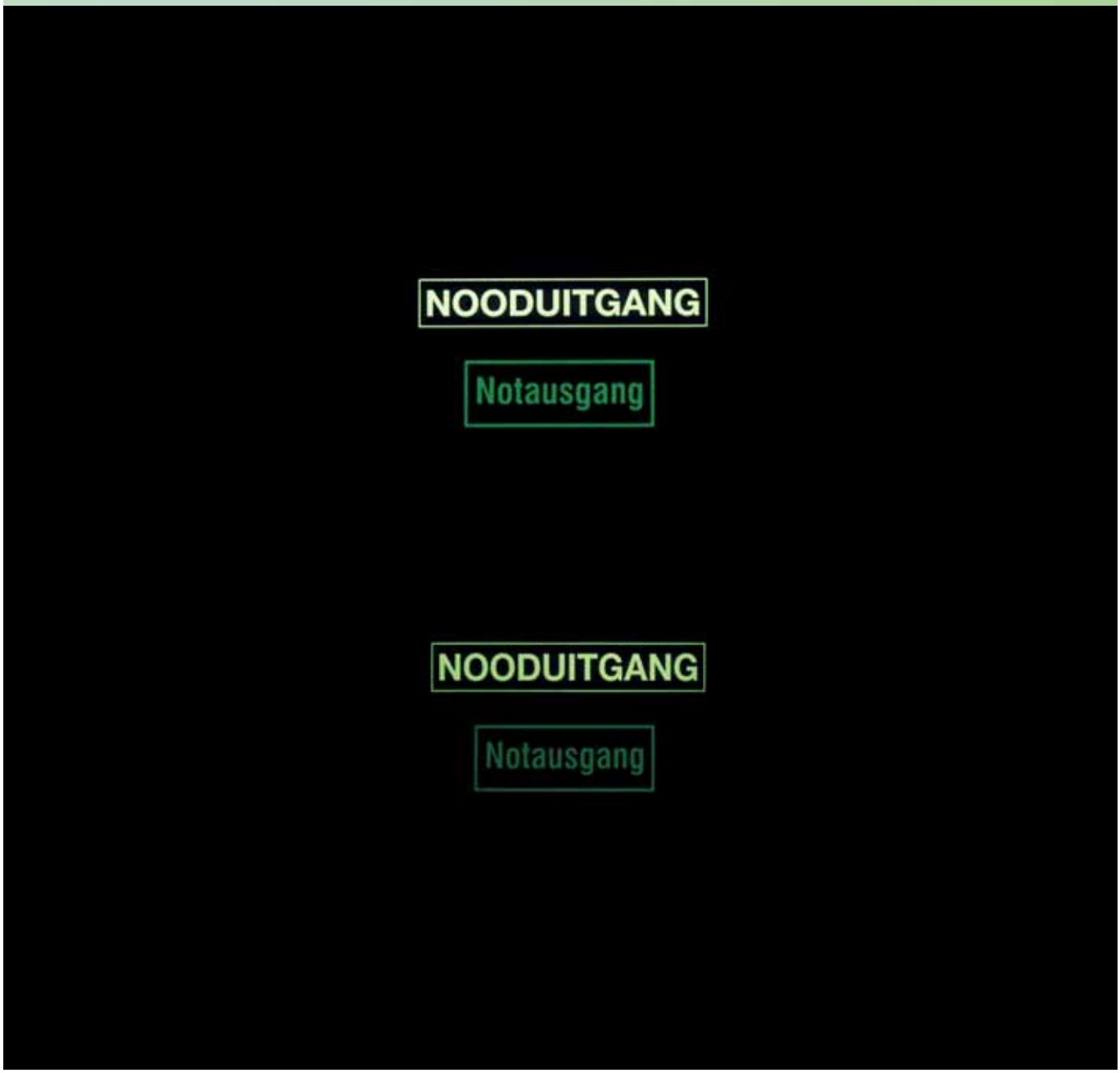
***The relationship between the light emission of the luminescent material and the legibility distance has been fully explained before. Important factors governing legibility distance are also letter size and font type as well as layout of the pictogram.***

***Small type fonts, just for making a smaller sign, do not contribute to a better legibility!***

***The photos below demonstrate what this means. Hold this page some distance from your eyes to see the difference in legibility between the two pictograms.***

YFESTOS®:

SET THE LIGHT AT GREEN FOR YOUR OWN SAFETY AND THE SAFETY OF OTHERS

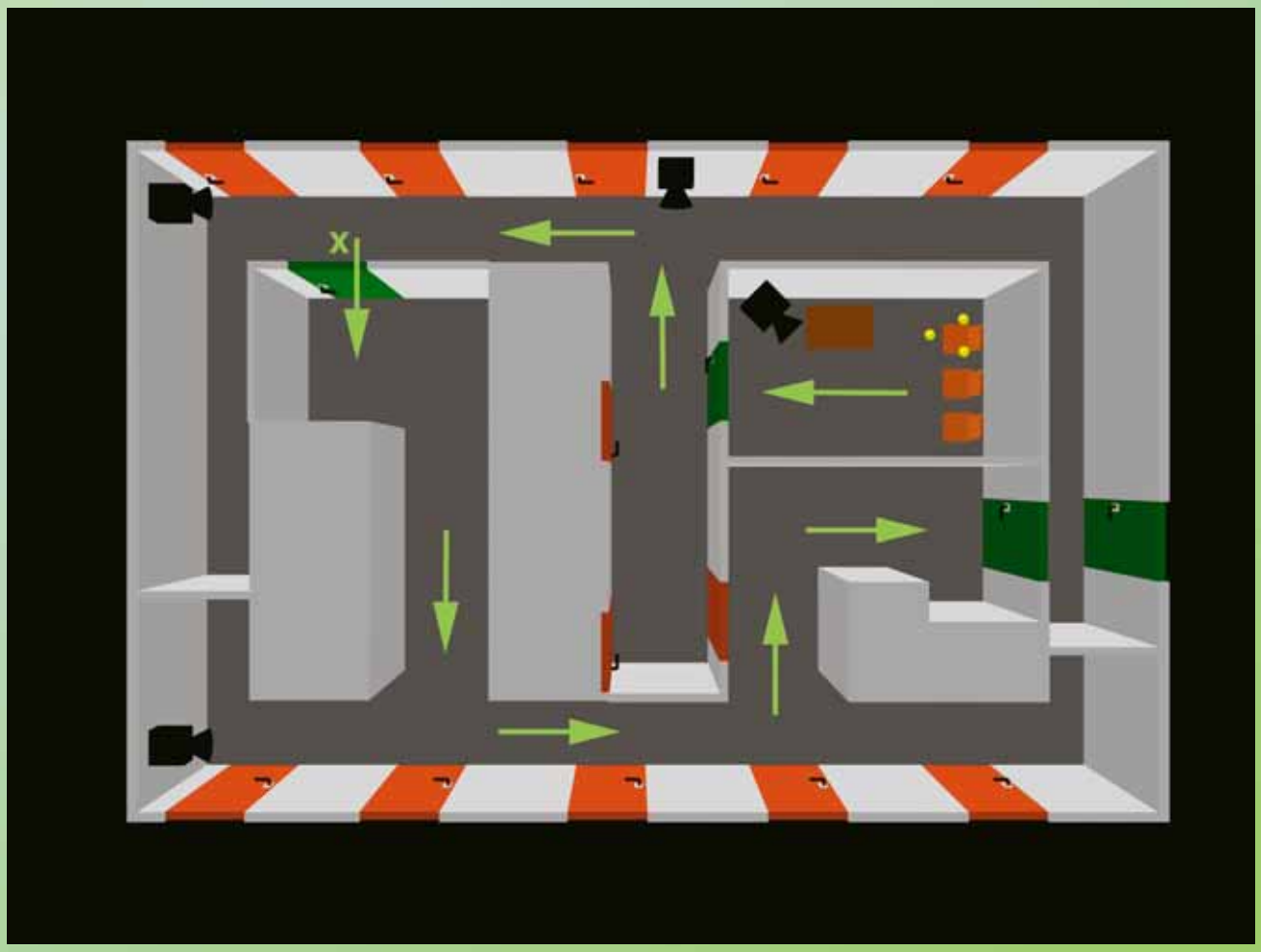


# MOCK-UP TRIALS

***In order to thoroughly test a variety of safety systems, trials were carried out in two mock-up ship interiors constructed to investigate the human behaviour in darkness. In these mock-up environments YFESTOS® products were compared with conventional zinc sulphide systems.***

**The mock-up environments simulate the route passengers have to take when leaving their cabins to go to a central assembly point. A luminescent safety signposting system guides the passengers from their cabins through the ship's corridors to a central mustering station.**

**The question is to what extent the various systems are effective. In order to record their performance, infra-red cameras were installed in the cabins and corridors. This provided perfect evidence of whether the test persons follow the planned route in the dark.**



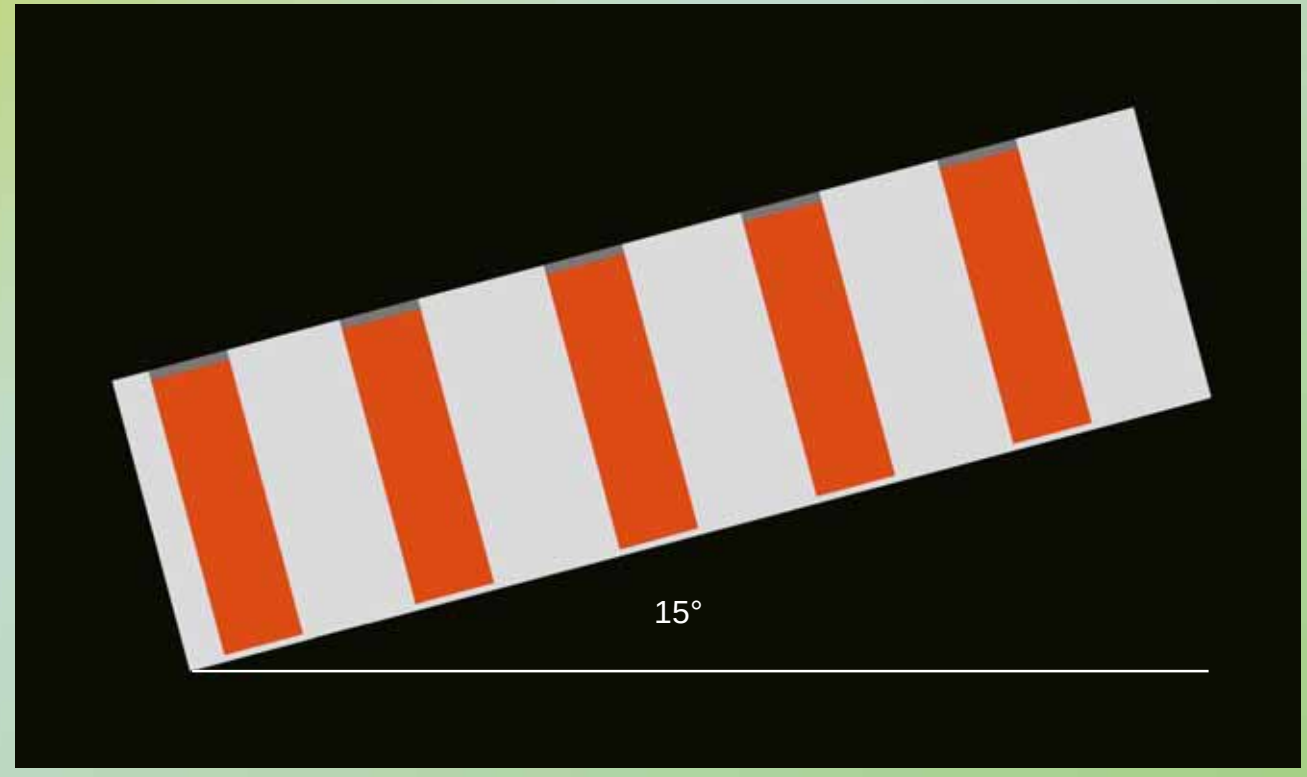

**It turned out that the zinc sulphide systems are soon lost from view. The emergency exit signs proved to be insufficiently visible to passengers, which in a real-life situation would have disastrous consequences. In fact, in the mock-up trials the passengers missed the sign on the door, marked above with X. No doubt what severe consequences that would have in a real situation.**
**These try-outs clearly demonstrated that a group of people tend to follow the leader and have difficulty to turn back in a corridor or to change direction. The whole group rely on the person at the front to lead the way, those behind just follow.**

**This means that a missed sign is a lost sign!**

**Interviews with the passengers after their escape showed that most of the signs were unclear, that the leader of the group missed a few signs and that even under these controlled conditions a form of fear occured.**

# MOCK-UP TRIALS

***The second mock-up environment simulated a ship that is listing at 15 degrees. Escaping under these circumstances is much more difficult. However, in this trial the corridors were fitted with YFESTOS® products (i.e. pictograms, LLL system, luminescent material in the lamp hoods, tape around the hand rails, floor tiles and paint).***




**All the signs in the corridors were clearly visible for a long time. In fact, the YFESTOS® LLL system illuminated the floor sufficiently, highlighting potential obstacles. The YFESTOS® lamps acted as emergency lighting and the luminescent hand-rail prevented passengers from tripping and falling. As a result, despite the 15 degrees list, all the passengers were able to go quickly and directly to the central assembly point. This was made possible by YFESTOS®, as the half-life periods of YFESTOS® pigments are many times higher than those of conventional systems. While conventional systems become ineffective after only a short time, YFESTOS® remains clearly visible – even from a large distance.**



**The reactions of the passengers proved clearly the high level of safety offered with the YFESTOS® products. They were able to find their way out in a few minutes and missed no signs! To be able to define the exact moments evacuees take wrong decisions and how the speed of evacuation can be increased, BEELE Engineering is building a new test and research environment for YFESTOS® products. Ask for our most informative video!**

# PICTOGRAMS

***The guidelines for the application of luminescent pictograms and low location lighting (LLL) escape guidance signs on board ships are laid down in IMO (International Maritime Organization) Resolution A.752(18). Although this code does not specify the method of testing, it does require minimum luminance levels of at least 15 mcd/m² measured 10 minutes after the removal of the external illuminating sources and at least 2 mcd/m² after 60 minutes. In addition, section 7.3 states that the illuminating source must be of sufficient quality to achieve the values indicated.***

# LIGHT MEASUREMENTS (1)

**In view of the fact that few international regulations exist as yet with regard to luminescent materials, at first the classification societies required light measurements to be performed according to DIN 67510 part 1 for the purpose of obtaining a type approval certificate. Section 4.2 of this DIN standard states that the luminescent test material must be charged by means of a so-called Xenon lamp. The illumination of the test material must be set at 1000 lux. Then the test material must be illuminated for five minutes.**
**A Xenon lamp is a light source that emits light which virtually corresponds to natural daylight and has a fairly high UV content. Although the charging time is relatively short, the test material is bombar-ded with UV light such that the luminescent pigments exhibit a very high level of light emission at the beginning of the measurement. With this measurement method, the reduction in light emission is relatively high during the first 30 minutes because the pigments discharge a great deal of energy. Only after about 30 minutes does a more gradual reduction in the light emission set in. The DIN standard requires measurements to be carried out for 120 minutes. The period of time until the minimum light emission level of 0.3 mcd/m² is reached is then extrapolated from the measurements after the first 15 minutes.**
**The value of this extrapolation however is relative, because only the effective decay from 15 to 120 minutes is taken into account, leaving the light emission level out of the calculation.**

# LIGHT MEASUREMENTS (2)

**Xenon lamps are not used for lighting purposes in our day-to-day living environment. In view of this, the values measured according to DIN 67510 part 1 only give an indication of the light emission of the various products, and therefore the actual lighting conditions at the place where the materials are positioned must be taken into account.**
**For that reason, IMO Resolution A.752(18) requires that in addition the minimum illumination of the light source must be determined at which the emission values of 15 mcd/m² after 10 minutes and 2 mcd/m² after 60 minutes continue to be reached after removal of the illuminating source. Again, this resolution does not specify the method of testing to determine this value.**
**Measurements of the light emission of LLL systems are therefore performed on-site after installation, in accordance with DIN 67510 part 2.**
**However, this is a time-consuming and hence expensive procedure.**
**In effect, a testing method is needed that is based more on the actually prevailing conditions, thereby making it possible to determine that the emission achieved at a given level of the ambient lighting complies with the minimum IMO requirement. In future, this method is to be laid down in an ISO standard. The classification societies have already accepted the draft ISO/CD 15370 for this measurement. Section 4.2.2 specifies the same light emission as prescribed by IMO. Section A.4.1 of Annex A to the ISO standard states that illumination must take place with a tubular fluorescent lamp having a colour temperature of 2700° K and that the test material must be exposed to the minimum amount of light for a minimum of 24 hours. This method provides the closest possible approximation to practical conditions. Moreover, use of this method means that the only measurement still required on-site is that of the level of the ambient lighting.**

# IMO RESOLUTION A.752(18)

***According to IMO Resolution A.752(18) no flame propagation test is (as yet) required to be conducted on the carrier material used. In the meantime this requirement has nevertheless been set in combination with ISO/CD 15370. As a result, the choice of carrier materials for LLL systems and for the IMO symbols is now limited. In our view, aluminium with silk-screen printed texts and/or symbols is greatly to be preferred to the commonly used hard PVC. Aluminium is non-toxic, can withstand a high temperature load, and does not contribute to flame propagation in the event of fire.***

# FLAME PROPAGATION TESTS

**IMO Resolution A.752(18) requires not only that luminescent IMO symbols shall be applied in an installation but also that a continuous low location lighting (LLL) system shall be applied at a height of less than 300 mm above the deck. For that reason the classification societies have included in their type approval programmes a test designed to demonstrate the low flame propagation properties of the materials used. This test shall be carried out in accordance with IMO Resolution A.653(16). In view of the fact that plastics can also be used for LLL systems, ISO/CD 15370 also requires a flame propagation test in accordance with IEC 92-101.**

**As the use of LLL systems becomes more widespread, attention is increasingly being focused on the fact that the materials used should preferably have a low smoke index and low toxicity. However, this requirement has not (as yet) been incorporated in the SOLAS and IMO regulations. Section 4.7 of IMO Resolution A.752(18) states that 'materials used in the manufacture of LLL products should not contain radioactive or toxic materials'.**
**The smoke and toxicity test is defined in IMO Resolution MSC.41(64) and ISO 5659-2.**
**To comply with all these requirements, silk-screen printing on aluminium was chosen for YFESTOS® pictograms and the LLL system.**

# FLAME PROPAGATION TEST ACCORDING TO IMO RESOLUTION A.653(18)

**Only materials which have low flame propagation properties may be used in escape routes. The flame propagation test described above is applied as standard in order to determine the flame propagation properties of ceilings and floor coverings. Because continuous LLL systems are applied to the wall low above the floor, these applications are subject to the same criteria as floor coverings. The tests on the YFESTOS® LLL system were performed with a favourable successful result at the Fire Technology Institute of Ghent University. We will be happy to send a copy of the test report upon request.**

# SMOKE AND TOXICITY TEST ACCORDING TO ISO 5659-2

**Only materials which in the event of fire produce a slight amount of smoke - for which purpose the ppm values of the various combustion gases must remain below maximum ISO limits - may be used in escape routes. Because continuous LLL systems could be the source of a considerable amount of potentially combustible and toxic material (such as PVC) in the escape routes, an investigation to establish their smoke index and toxicity is a prerequisite. The tests on the YFESTOS® LLL system were performed with a successful result at the Danish Institute of Fire Technology. We will be happy to send a copy of the test report upon request.**

# PICTOGRAMS

***It will be clear from the preceding text that materials which have light emission values measured according to DIN 67510 and which do not considerably exceed the values as stated in IMO Resolution A.752(18) are virtually useless in practice. In our laboratory, tests were carried out to establish what light source provides values comparable to those as measured with the Xenon lamp. This was found to be a video lamp giving an illumination of the test material of 10,000 lux. However, this type of light source is not used for our day-to-day lighting purposes either.***

# LIGHT MEASUREMENT DIN 67510


**This photograph of the test set-up for the light measurement according to the DIN standard with the Xenon lamp clearly illustrates the amount of light needed to charge the test material.**
**The distance from the light source to the test material is determined by the required illumination of the test material of 1000 lux.**

# LIGHT MEASUREMENT ISO/CD 15370


**The illumination with the 2700° K tubular fluorescent lamp of the test material is extremely low. The detector for measuring the illumination of the test material is visible alongside the test material. The value is read off on the measuring instrument to which a second detector (visible on the left-hand side) is connected for measuring the light emission in mcd/m². The measuring instrument transmits the measured values to a computer which calculates the duration of light emission.**

***Products which have to be 'charged' with 1000 lux daylight (UV content) in order marginally to exceed the IMO emission values are certainly not suitable for application in areas with low levels of ambient lighting.***

YFESTOS®: BRIGHTNESS ASSURING YOUR PERSONAL SAFETY

# PICTOGRAMS

***For the purpose of obtaining the type approval certificates for the shipbuilding application of YFESTOS® pictograms and the LLL system, under the supervision of the classification societies, TNO Industrie in Delft carried out light measurements on the luminescent materials silk-screen printed on aluminium. To ensure compliance with the old requirements in this matter as well as the new ones, measurements were performed in accordance with both DIN 67510 and ISO/CD 15370. Copies of the TNO report and the certificates will be sent upon request.***

# LIGHT EMISSION (1)

**On the basis of the measurement method according to DIN 67510, it was demonstrated that the YFESTOS® materials silk-screen printed on aluminium possess light emission values of 209.9 mcd/m² after 10 minutes and 29.8 mcd/m² after 60 minutes following removal of the illuminating source. It was also calculated that the emission will persist for 2970 minutes until the lower limit of 0.3 mcd/m² has been reached. On the basis of these data, it may be assumed that the pictograms and the LLL system will remain readily visible for many hours in darkness. The above-mentioned values are approximately 13 times as high as those requi-red by the IMO and ISO codes and approximately 10 times higher than required by the DIN standard. Altogether, these are values which guarantee optimized visibility in the dark. On the basis of the measurement method according to ISO/CD 15370, it was demonstrated that the YFESTOS® materials silk-screen printed on aluminium can be used in an illuminated environment with the extremely low value of 7.5 lux in order nevertheless to reach light emission values of 15 mcd/m² after 10 minutes and 2 mcd/m² after 60 minutes darkness.**

**Bearing in mind the fact that a tubular fluorescent lamp on an office ceiling gives an average illumination of about 500 – 600 lux at desk-top level, it becomes quite clear just how little light 7.5 lux actually represents.**

**Effectively it amounts to twilight. In spite of that, YFESTOS® pigments continue to be sufficiently charged at these minimal light levels. At an illumination of 9 lux, light emission values were measured of 17 mcd/m² after 10 minutes and 6 mcd/m² after 60 minutes darkness. These figures are still well above the IMO requirements.**

# LIGHT EMISSION (2)

**From the above, it is clear that even under the worst possible lighting conditions YFESTOS® pictograms silk-screen printed on aluminium and the LLL system continue to emit sufficient light to enable them to perform as an escape guidance system. It will also be clear that under better lighting conditions (and using normal fluorescent lamps) the light emission will be correspondingly higher and that the visibility in darkness will be increased. The following figures are given for purposes of comparison when charging the material at different levels with the tubular fluorescent lamp 2700° K:**

| *luminance* | *10 minutes* | *60 minutes* |
|---|---|---|
| 9 lux ambient: | 17 mcd/m² | 6 mcd/m² |
| 15 lux ambient: | 30 mcd/m² | 10 mcd/m² |
| 100 lux ambient: | 90 mcd/m² | 20 mcd/m² |
| 250 lux ambient: | 125 mcd/m² | 24 mcd/m² |
| 500 lux ambient: | 148 mcd/m² | 27 mcd/m² |

***See the impact of these values on the legibility distances in the table on page 21.***

**By referring to tables we have compiled, on the basis of the illumination measured in lux at the places where the pictograms and the LLL system are to be installed it is effectively possible to determine in advance the level of light emission in darkness.**

**However, the regulations do not provide a method for the calculation of visibility distances on the basis of the light emission.**

**It makes little sense for pictograms, even though they may comply with the light emission levels as required by IMO, to be positioned at distances so great that they can no longer be seen in darkness. IMO Resolution A.752(18) (section 7.3) and ISO/CD 15370 (section 4.2.1) state that the strip width of LLL systems shall be at least 75 mm.**

**Narrower strips may be applied if the light emission of the luminescent material exceeds 2 mcd/m² after 60 minutes. The reduction in width is shown in the table of Annex E to ISO/CD 15370.**

YFESTOS®: BRIGHTNESS ASSURING YOUR PERSONAL SAFETY

# LUMIREFLEC®: THE OPTIMUM SOLUTION FOR SAFETY IN TOTAL DARKNESS


**LUMIREFLEC® is the brand name for a newly developed safety sign posting system by BEELE Engineering, based upon retro-reflective stickers on which afterglowing YFESTOS® signs are silk screen printed.**
**The objective is to have clearly visible escape routing under normal lighting conditions,**


**a reflective sign when light is shining on the sign in total darkness,**


**with an afterglowing effect when the shining light is taken away.**

# LIGHT IN DARKNESS


**On the basis of the new luminescent pigments, BEELE Engineering has developed under the product-name YFESTOS® (the name of the god of fire in Greek mythology) a range of products for additional safety in our daily environment. Carrying out a 'creative safety audit' of one's own specific living and working environment will reveal that luminescent materials could potentially play a literally life-saving role in many places.**

**Besides the generally mandated pictograms, but in this case screen-printed on aluminium, this product range includes among other things:**

* **arrows and letters, made of dirt repellant thermoplast SEBS**
* **tapes, cords and strips made of an elastic thermoplast type SEBS**
* **sheets of silicone rubber**
* **discs, batons and other moulded articles made of silicone rubber**
* **profiles and hoses made of thermoplast type SEBS**
* **rubber bossed tiles made of an abrasion resistant, dirt repellant SEBS**
* **silicone putty and paint**

**Regularly new products are added to this range to offer the safety market a total package of solutions.**

# YFESTOS® AFTERGLOWING PRODUCTS FOR OPTIMUM VISIBILITY IN THE DARK

*** ULTRA BRIGHT AFTERGLOW EFFECT
- IMPROVED VIEWING DISTANCE OF SAFETY SIGNS IN TOTAL DARKNESS

*** EXTENDED DURATION OF AFTERGLOW EFFECT
- VISIBLE WHENEVER A DISASTER STRIKES ... AND MANY, MANY HOURS AFTERWARDS

*** INNOVATIVE DEVELOPMENT OF AFTERGLOWING PIGMENTS
- LIGHT EMISSION GUARANTEED FOR DECADES

*** NO MORE PIGMENT AGEING
- NO REDUCTION IN PRIME BRIGHTNESS WITH TIME

*** PICTOGRAMS SILK SCREEN PRINTED ON ALUMINIUM
- FORM NO ADDITIONAL TOXIC SMOKE AS PVC SIGNS DO IN CASE OF FIRE
- REMAIN FUNCTIONAL AT VERY HIGH TEMPERATURES
- PAPER OR VINYL STICKERS WILL HAVE WRINKLED OR MELTED LONG BEFORE THEN

*** PRODUCTS OF HEAT RESISTANT SILICONE RUBBER
- REMAIN FUNCTIONAL AT TEMPERATURES OF 200 °C

*** PRODUCTS OF ABRASION RESISTANT, DIRT REPELLENT RUBBER
- ENABLE LUMINESCENT MARKING ON FLOORS

*** PRODUCTS OF ELASTIC THERMOPLASTICS
- FOR WRAPPING AROUND VITAL EQUIPMENT

*** PRODUCTS OF STROKE PROOF POLYCARBONATE
- FOR LUMINESCENT, PROTECTIVE LAMP SHIELDS

*** LUMINESCENCE INCORPORATED IN NORMAL LAMPS
- EMERGENCY LIGHTING ALWAYS STANDBY

*** COMPLETE RANGE OF PRODUCTS AVAILABLE
- FOR ENGINEERING A TOTAL LUMINESCENT SAFETY CONCEPT
- INCLUDES PICTOGRAMS, PRODUCTS, PAINT AND PUTTY

*** CONTAIN NO RADIOACTIVE COMPONENTS

## PREVENTION IS BETTER THAN CURE

# YFESTOS PRODUCTS

## LUMINESCENT PAINT


YFESTOS® luminescent paint is a polyurethane-based water dispersion.

Simple to apply on most subsurfaces commonly occuring in the construction industry. For optimum light emission, the paint should be applied on a white subsurface.

Directions for use:

Clean and degrease the subsurface thoroughly.
Remove any irregularities.
If the subsurface is not white, it should be coated with white primer having a good hiding power.

For brushing or rolling, dilute the dispersion with 0 to 10% with the thinner supplied. For spraying, 15 to 30% thinner should be added.

Stir the paint thoroughly, and continue stirring during use. Because the pigments tend to settle out, the paint should not be prepared in very large batches.

Surface-dry after about two hours, re-coatable after about four hours.

For optimum light emission, at least two coats are recommended.

When used on floors, the YFESTOS® paint should be treated with a wear-resistant transparent top coat, such as floor varnish.

The paint is supplied in tins containing 0.5 kg. This quantity is enough to treat about 3 square metres.

The space where the paint is being used should be kept well ventilated while work is in progress. Do not inhale the fumes. Avoid contact with eyes and skin. Keep out of reach of children.

Store in a fost-free place.

Clean tools with warm water.
Hand in any residues to the chemical waste collection service.

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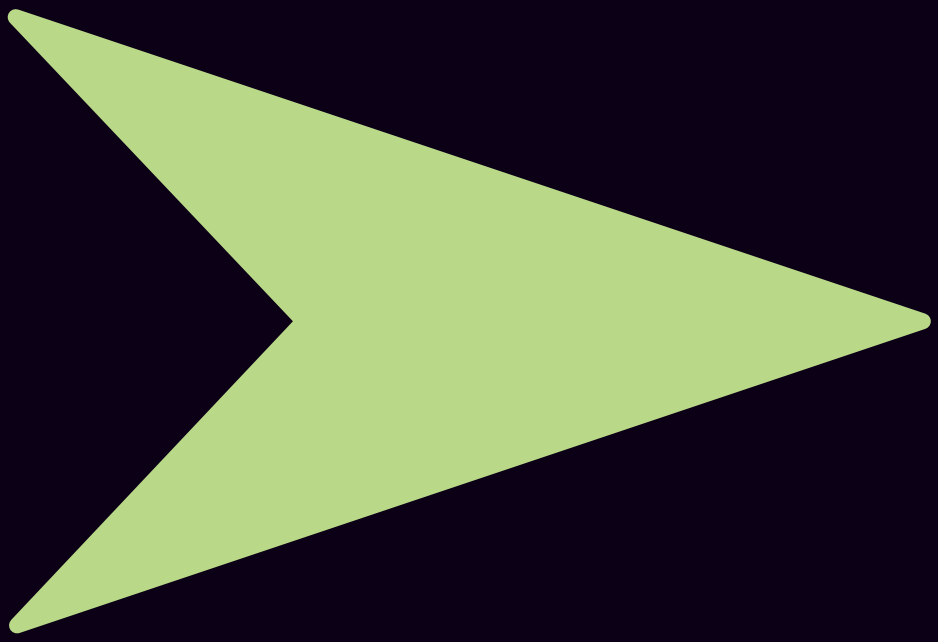
*Our sales department will be pleased to advise on the application and use of YFESTOS® luminescent paint.*

# YFESTOS®

A B C D E F G
H I J K L M N
O P Q R S T U
V W X Y Z
0 1 2 3 4 5 6 7
8 9

The YFESTOS® program contains letters and figures, made of heat resistant silicone rubber, with a standard height of 100 mm (above letter is real size) with a thickness of 3 mm. The letters and figures can be glued on the wall by means of the YFESTOS® luminescent putty.



For an effective routing to escape staircases it is recommended to place luminescent arrows, which are set for example one metre above the floor at two metre interspacing along the walls of corridors, indicating the direction to follow. The YFESTOS® arrows are supplied in an overall length of 100 mm (above arrow is real size) and a thickness of 1 and 3 mm. They are made of SEBS and can be glued to the wall by means of the YFESTOS® luminescent putty.

# YFESTOS PRODUCTS

letters and figures 100 mm high, 3 mm thick. Material: SEBS
Catalogue numbers are identified as follows: A - 100 - G, which stands for A = type of letter/figure; 100 = the overall hight.

E

A - 100 - G
B - 100 - G
C - 100 - G
D - 100 - G
E - 100 - G
F - 100 - G
G - 100 - G
H - 100 - G
I - 100 - G
J - 100 - G
K - 100 - G
L - 100 - G
M - 100 - G
N - 100 - G
O - 100 - G
P - 100 - G
Q - 100 - G
R - 100 - G
S - 100 - G
T - 100 - G
U - 100 - G
V - 100 - G
W - 100 - G
X - 100 - G
Y - 100 - G
Z - 100 - G

7

0 - 100 - G
1 - 100 - G
2 - 100 - G
3 - 100 - G
4 - 100 - G
5 - 100 - G
6 - 100 - G
7 - 100 - G
8 - 100 - G
9 - 100 - G

---

arrows 100 mm high, 1 or 3 mm thick. Material: SEBS
Catalogue numbers are identified as follows:
ARR - 100 x1-r, ARR - 100 x1-l, ARR - 100 x3-r and ARR - 100 x3-l which stands for ARR = arrow; 100x.. = the size and thickness in mm and r or l = indicating to the right or left.

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collars (rectangular, square and round) for instance for light switches, in various dimensions
Materaal: silk screen printed polystyrene.
Catalogue numbers are identified as follows:
collar square 136x96, collar round 136x96 and collar round 92x52

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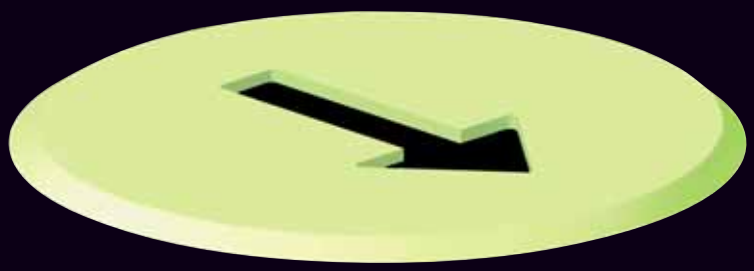
*For special sizes of letters, figures, arrows, tapes, strip, cords, profiles and sheets ask our sales department.*

R
E
A
L

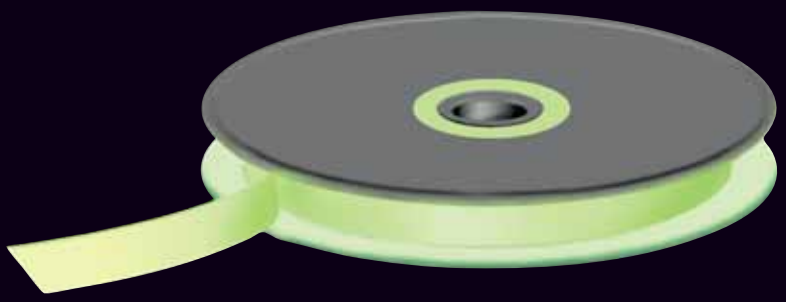
S
I
Z
E


YFESTOS® round discs can be fitted on doors, to indicate in the dark whether they are “shut” or “open”. These discs can also be used as a place mate to locate a glas of water in the dark and for many other applications. The discs are supplied in sizes 100 x 4 mm. Made of heat resistant silicone rubber or a dirt repellent SEBS polymer.

The discs are also manufactured with a cut-out arrow to indicate the way to exit. They can be glued on the floor. For this type of application the edges of the discs are flattened to avoid stumbling. Made of heat resistant silicone rubber and of abrasion resistant SEBS polymer.



YFESTOS® tape, made of an elastic thermoplast type SEBS 25 mm wide with a thickness of 1 mm. Length per roll 10 meter. The tape can be wrapped, for instance, around door-handles of emergency exits.
Also available in various thicknesses and or widths.



# YFESTOS PRODUCTS

discs 100 mm diameter, 3 and 4 mm thick. Material: silicone rubber and SEBS thermoplast.
Catalogue numbers are identified as follows: DIS - (arr) - 100x3(4) - G - SIL(SEBS), which stands for DIS = disc; arr = with cut out arrow; 100x3(4) = the overall sizes; SIL or SEBS the material quality.

DIS - ARR - 100x3 - SIL - G

DIS - 100x4 - SIL - G

DIS - 100x4 - SEBS - G

DIS - ARR - 100x3 - SEBS - G

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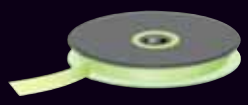
abrasion resistant, elastic tape 25 mm wide, 1.5 mm thick. Material: thermoplast SEBS.
Catalogue numbers are identified as follows: TP - 25x1 - G (-adh), which stands for TP = tape; 25x1 = the width and thickness and adh = with adhesive back. Standard length is 10 meters per roll.



TP - 25x1 - G

TP - 25x1 - G - adh

---

elastic cord 3 and 4 mm diameter. Material: thermoplast SEBS.
Catalogue numbers are identified as follows:
CRD - 3(4) - G (R), which stands for CRD = cord; 3(4) = the diameter.
Standard length is 25 meters per roll.

CRD - 3 - G
CRD - 4 - G

---

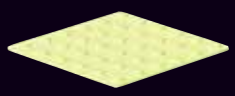
abrasion resistant strip 50 mm wide, 3 mm thick. Material: thermoplast SEBS.
Catalogue numbers are identified as follows: SP - 50x3 - G (-adh), which stands for SP = strip; 50x3 = the dimensions in mm and adh = adhesive back. Standard length is 10 meters per roll.

SP - 50x3 - G

SP - 50x3 - G - adh

---

abrasion resistant floor tiles, dirt repellent, 125x125x5, 250x250x5 mm and 500x500x5 mm. Material: SEBS thermoplast.
Catalogue numbers are identified as follows: FT - 125(250)(500) - G, which stands for FT = floor tile; 125(250)(500) = the size.



FT - 125 - G
FT - 250 - G
FT - 500 - G

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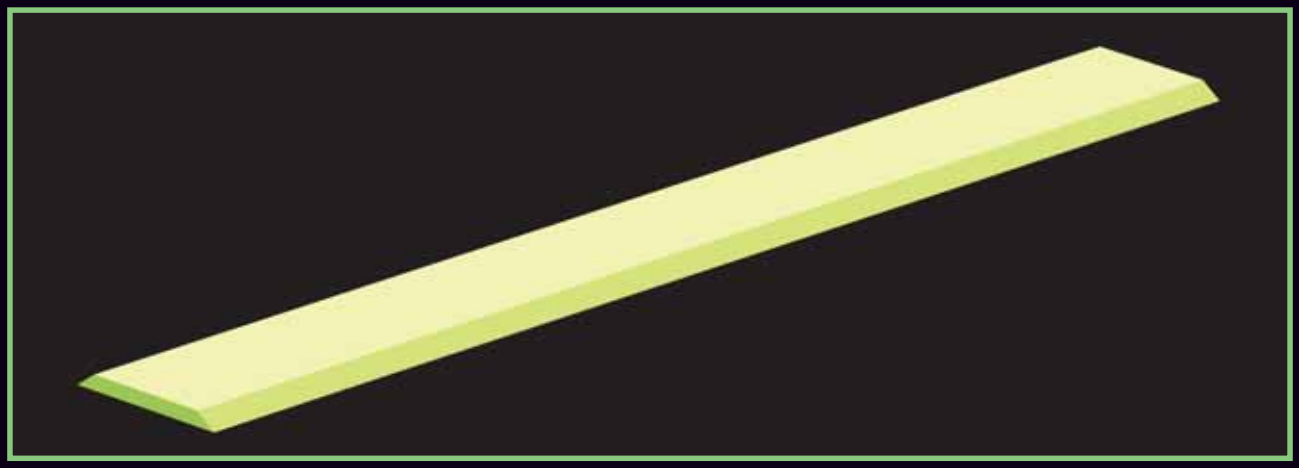
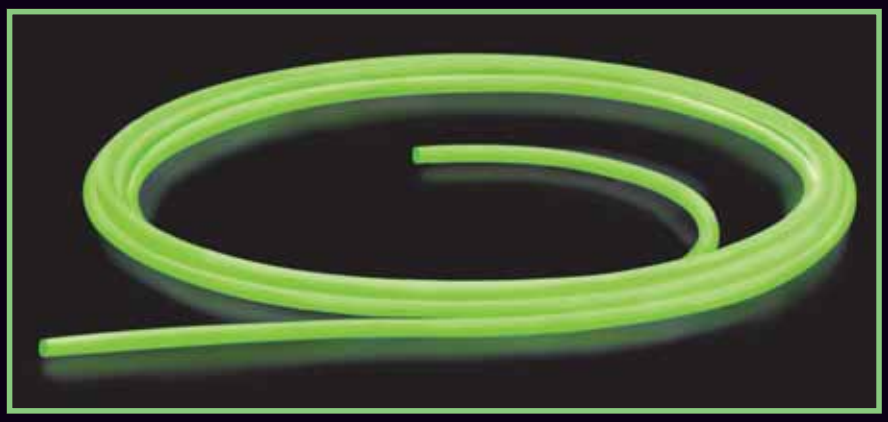
*For special sizes of letters, figures, arrows, tapes, strip, cords, profiles and sheets ask our sales department.*



YFESTOS® strip, made of an extrudable thermoplast, can be glued on floors to outline obstacle-free zones in warehouses, archives, etc. The luminescent strip is 50 mm wide and 3 mm thick. At the back is a self-adhesive tape. The side parts of the strip are rounded off to avoid stumbling and not to hinder to drive over with pallet carts. The strip is supplied in lengths of 10 meters.

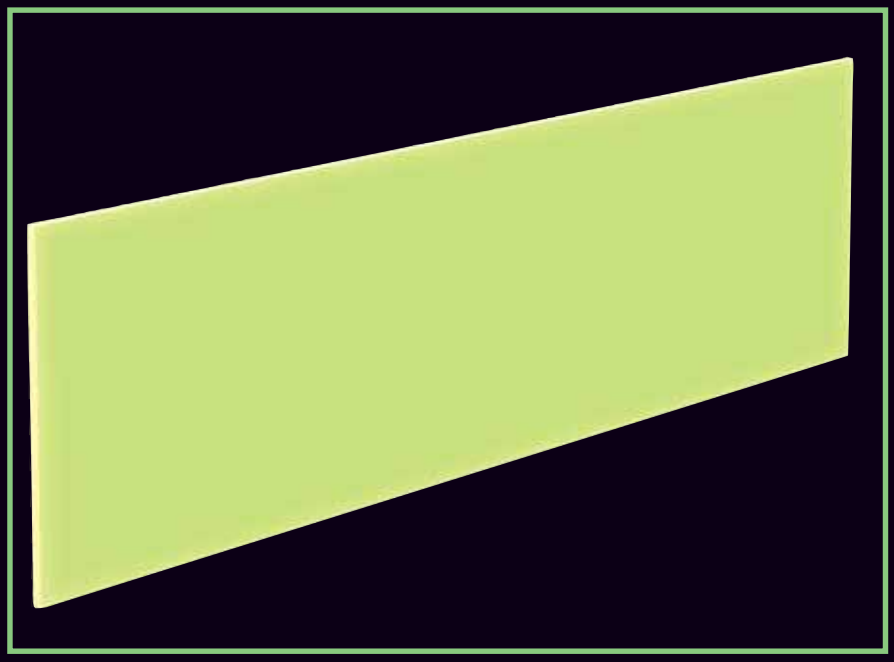
YFESTOS® elastic round profiles 3 and 4 mm thick can be used for instance at the front of stairs or on top of handrails on landings. These profiles can also be used to highlight the contours of doors, important equipment, etc.
The profiles are supplied in lengths of 25 meter.



*Since we have our own dye-making shop customized profiles can be supplied to order.*

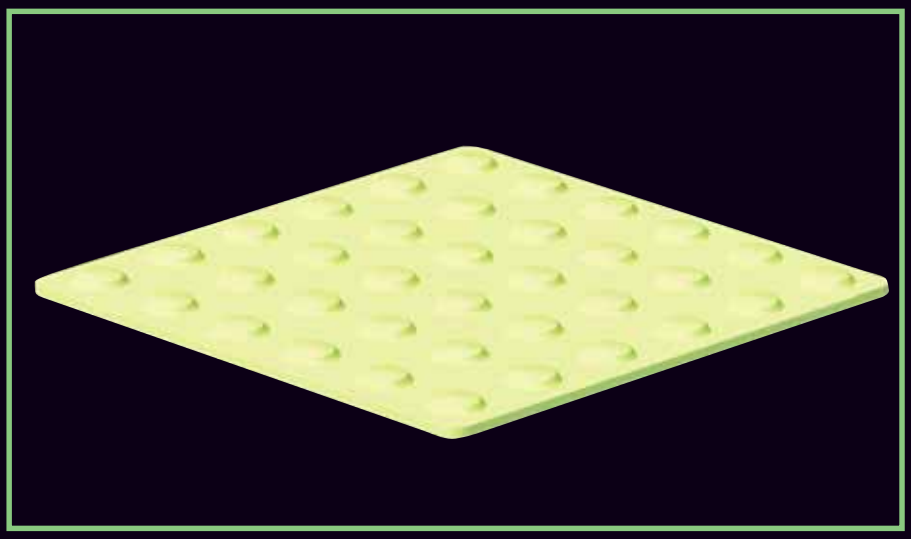

cartridges of 310 ml contents

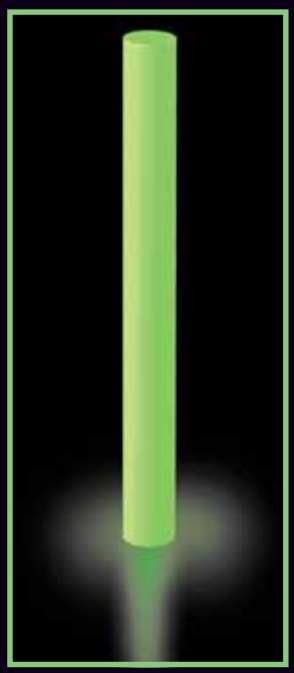
The most easy way to foresee in luminescent markings is to make use of the YFESTOS® silicone putty. The putty can be applied on skirting boards in corridors and around doors, in order to highlight the contours in the dark. The putty can also be helpfull to locate in the dark electrical switches, etc. How many times people are looking for these switches in for them unfamiliar buildings?



YFESTOS® luminescent heat resistant silicone rubber sheets are supplied in dimensions 1000 x 500 x 2 mm and 1000 x 500 x 3 mm.
They can be attached in front or under TL-lamps, so that in case of a lighting failure a spontaneous emergency lighting system will be created. Imagine how much energy could be saved on a yearly basis when the emergency lighting system would be equipped with these plates. Just irradiate these plates for a couple of minutes every hour and they will be visible all the time.

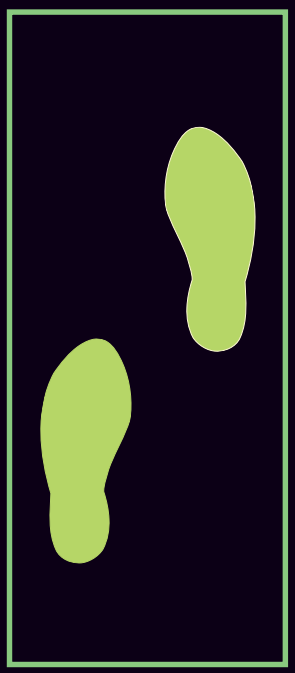
YFESTOS® luminescent rubber bossed floor tiles are supplied in sizes 250x250 and 500 x 500 mm with an overall thickness of 5 mm.
Made of an abbrasion resistant SEBS polymer. They are most usefull when placed in front of emergency or exit doors. The larger surface of luminescent material in front of the doors make them visible at a larger distance.



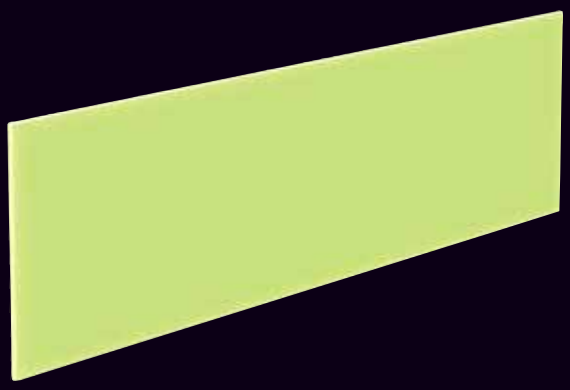


YFESTOS® luminescent batons are initially developed to replace the well-known candle in case of a failure of the lighting system.
The baton, however, is most usefull to draw attention in the dark. They are supplied in a length of 200 mm with a thickness of 15 mm. Be amazed how bright these batons are directly after irradiating with UV light!

YFESTOS® luminescent footsteps will help to direct people in darkness to the emergency exits. The foorsteps are 1 mm thick to prevent stumbling.
Made of an abbrasion resistant SEBS polymer.



# YFESTOS PRODUCTS



rubber sheets 1000x500x2 and 1000x500x3 mm.
Material: silicone rubber.
Catalogue numbers are identified as follows:
RSH - 2(3) - G, which stands for RSH = rubber sheet; 2(3) = the thickness.

RSH - 2 - SIL - G
RSH - 3 - SIL - G

safety batons. Material: silicone rubber.
dimensions 200 x 15 mm

Luminescent hoses. Material: elastic thermoplast type SEBS.
Wall thickness 3 mm. In lengths up to 5 meter.
Catalogue numbers are identified as follows:
HS - 10/4 - G, which stands for HS = hose; 10/4 = the outer and inner diameter in mm.

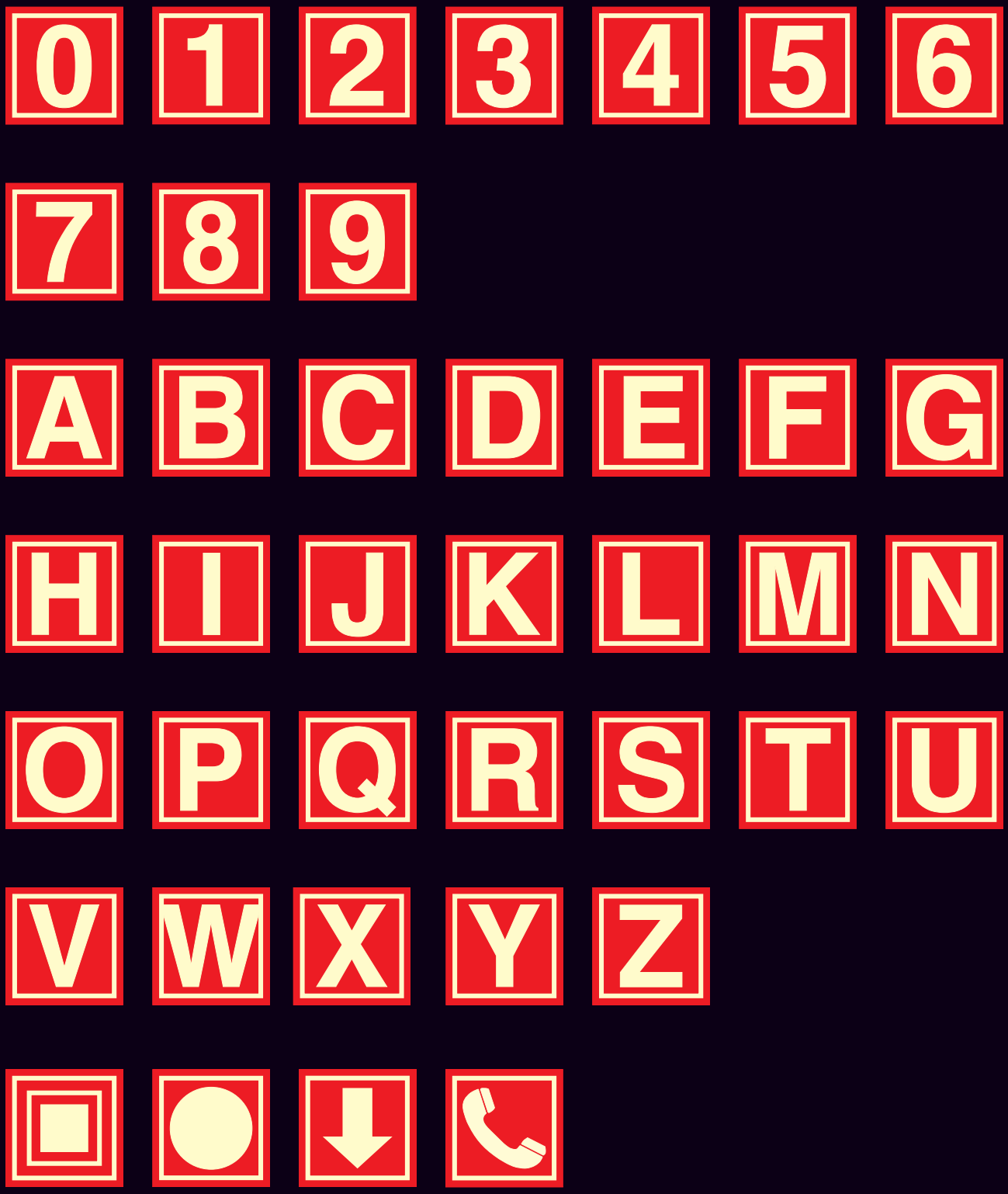
HS-10/4-G, HS-12/6-G, HS-14/8-G, HS-16/10-G, HS-18/12-G, HS-20/14-G, HS-22/16-G, HS-24/18G and HS-26/20-G

Luminescent “footsteps”. Material: elastic thermoplast type SEBS.
Thickness 1 mm.
Catalogue numbers are identified as follows: footstep_l and footstep_r


sealing mastic in cartridges of 310 ml

*For special sizes of letters, figures, arrows, tape, strip, cords, profiles and sheets ask our sales department.*

# YFESTOS STICKER SHEETS

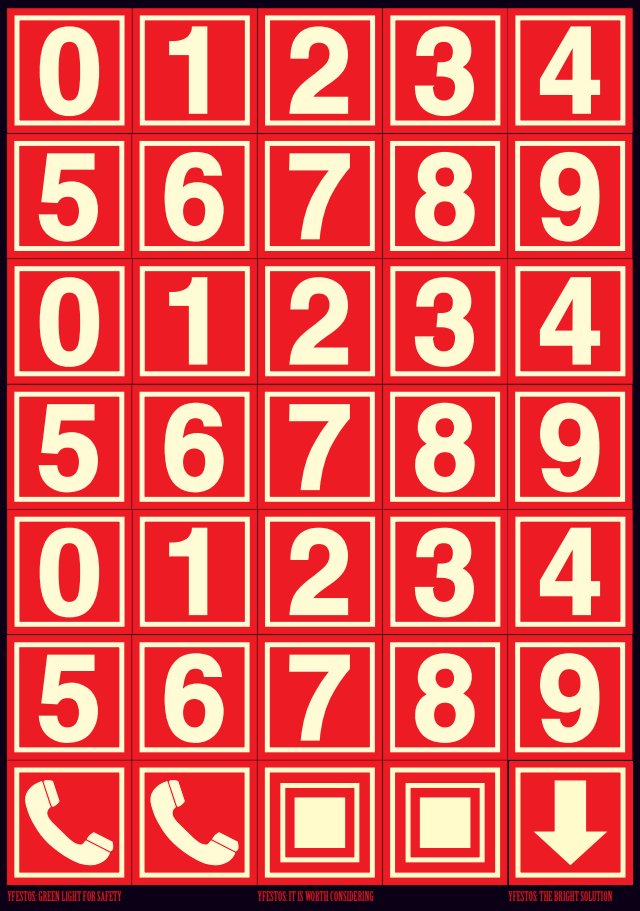



letters, figures and speciale signs 40x40 mm (35 per sheet).

*We recommend to use for the marking of escape routes only pictograms silk screen printed on aluminium. This because of the low melting point of stickers.*

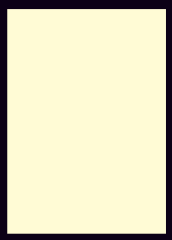
*For special pictograms ask our sales department.*

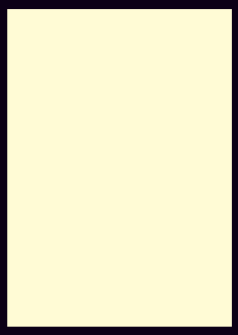
# YFESTOS STICKER SHEETS

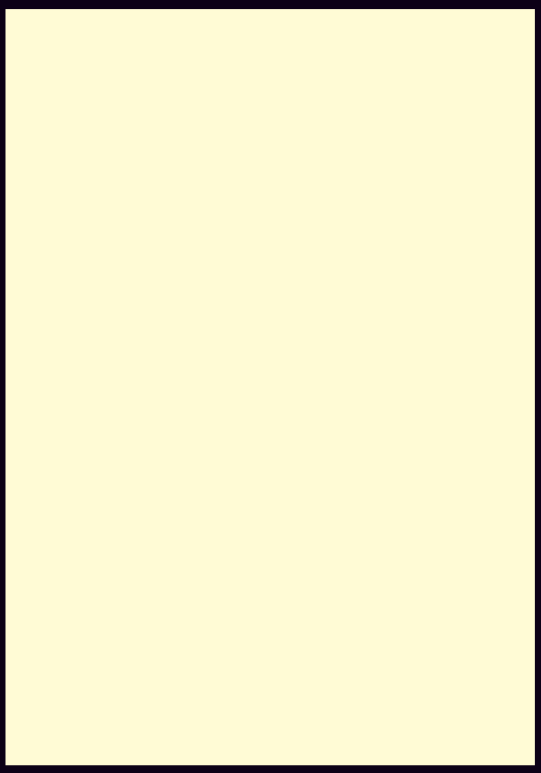



A4 sticker sheet 85-1900

letters, figures and speciale signs
40x40 mm (35 per sheet).







A4 sticker 85-1951
A4 alu 85-2951

A3 sticker 85-1950
A3 alu 85-2950

1000x700 sticker
85-1955

*We recommend to use for the marking of escape routes only pictograms silk screen printed on aluminium. This because of the low melting point of stickers.*

*For special pictograms ask our sales department.*

# YFESTOS PICTOGRAMS

sticker 85-1300
aluminium 85-2300

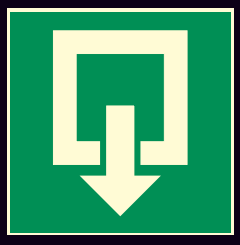
sticker 85-1301
aluminium 85-2301

sticker 85-1302
aluminium 85-2302

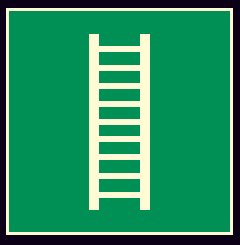
sticker 85-1303
aluminium 85-2303

sticker 85-1304
aluminium 85-2304

sticker 85-1305
aluminium 85-2305

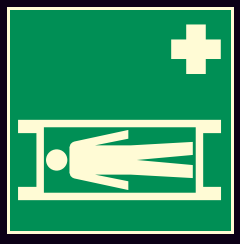


sticker 85-1306
aluminium 85-2306



sticker 85-1307
aluminium 85-2307

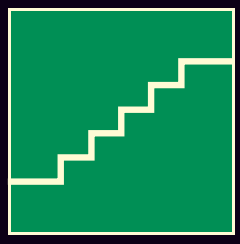
sticker 85-1308
aluminium 85-2308



sticker 85-1309
aluminium 85-2309

sticker 85-1310
aluminium 85-2310

sticker 85-1311
aluminium 85-2311



sticker 85-1312
aluminium 85-2312

sticker 85-1313
aluminium 85-2313


sticker 85-1314
aluminium 85-2314


sticker 85-1315
aluminium 85-2315

*pictograms*
*150x150 mm*

*We recommend to use for the marking of escape routes only pictograms silk screen printed on aluminium. This because of the low melting point of stickers.*

*For special pictograms ask our sales department.*

# YFESTOS PICTOGRAMS

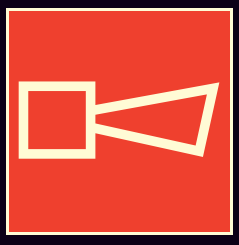
sticker 85-1400
aluminium 85-2400

sticker 85-1401
aluminium 85-2401

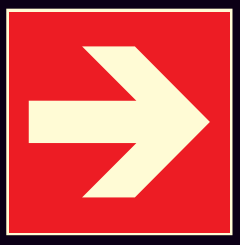
sticker 85-1402
aluminium 85-2402

sticker 85-1403
aluminium 85-2403

sticker 85-1404
aluminium 85-2404



sticker 85-1405
aluminium 85-2405



sticker 85-1406
aluminium 85-2406

sticker 85-1407
aluminium 85-2407

sticker 85-1408
aluminium 85-2408

sticker 85-1409
aluminium 85-2409

sticker 85-1410
aluminium 85-2410

***pictograms 150x150 mm***

***We recommend to use for the marking of escape routes only pictograms silk screen printed on aluminium. This because of the low melting point of stickers.***

***For special pictograms ask our sales department.***

# YFESTOS PICTOGRAMS

electric power
aluminium 85-8000

caution noise
aluminium 85-8001

danger
aluminium 85-8002

slip hazard
aluminium 85-8003

mind your head
aluminium 85-8004

fork lift trucks
aluminium 85-8005

explosion risk
aluminium 85-8006

caution acid
aluminium 85-8007

toxic
aluminium 85-8008

mind the step
aluminium 85-8009

risk of electric shock
aluminium 85-8010

flammable
aluminium 85-8011

electr-magnetic
radiation
aluminium 85-8012

biological hazard
aluminium 85-8013

radioactive
aluminium 85-8014

***pictograms 150x150 mm***

*We recommend to use for the marking of emergency equipment and escape routes only pictograms silk screen printed on aluminium. This because of the low melting point of stickers. The above listed pictograms can be supplied as sticker as well. The catalogue numbers are 85-7...*

***For special pictograms ask our sales department.***

# YFESTOS PICTOGRAMS

eye protection
aluminium 85-8100

ear protection
aluminium 85-8101

head protection
aluminium 85-8102

wear gloves
aluminium 85-8103

wear boots
aluminium 85-8104

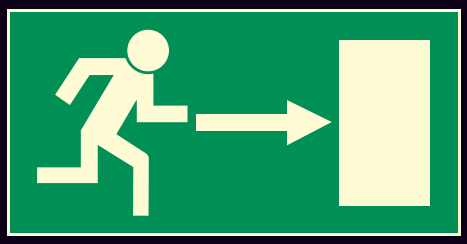
wash hands
aluminium 85-8105

***pictograms 150x150 mm***

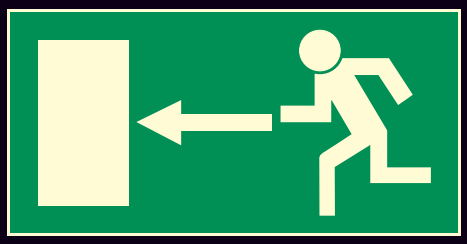
*We recommend to use for the marking of emergency equipment and escape routes only pictograms silk screen printed on aluminium. This because of the low melting point of stickers. The above listed pictograms can be supplied as sticker as well. The catalogue numbers are 85-7...*

***For special pictograms ask our sales department.***

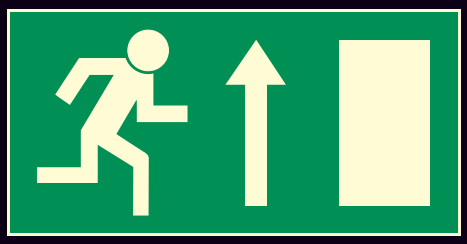
# YFESTOS PICTOGRAMS



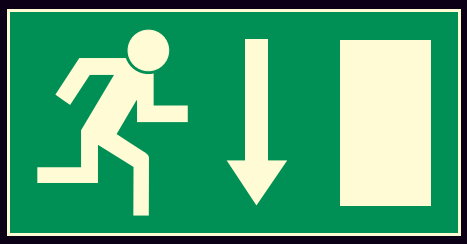
sticker 85-1500
aluminium 85-2500



sticker 85-1501
aluminium 85-2501



sticker 85-1502
aluminium 85-2502



sticker 85-1503
aluminium 85-2503

*pictograms 150x300 mm*

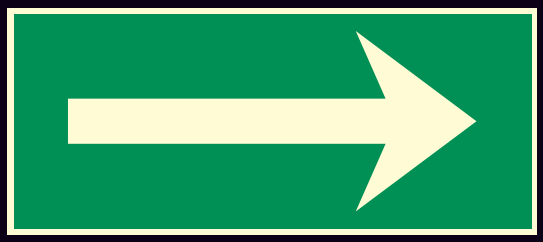

sticker 85-1504
aluminium 85-2504


sticker 85-1505
aluminium 85-2505


*pictograms150x350 mm*

sticker 85-1550
aluminium 85-2550


sticker 85-1551
aluminium 85-2551



sticker 85-1552
aluminium 85-2552

*We recommend to use for the marking of escape routes only pictograms silk screen printed on aluminium. This because of the low melting point of stickers.*

*For special pictograms ask our sales department.*

# YFESTOS PICTOGRAMS


sticker 85-1802
aluminium 85-2802


sticker 85-1803
aluminium 85-2803

*pictograms 300x75 mm*

sticker 85-1804
aluminium 85-2804

*pictogram 75x75 mm*


sticker 85-1000
aluminium 85-2000


sticker 85-1800
aluminium 85-2800

sticker 85-1001
aluminium 85-1001


sticker 85-1003
aluminium 85-1003


sticker 85-1005
aluminium 85-2005

*pictograms 75x175 mm*

*pictogram 250x65 mm*


sticker 85-1801
aluminium 85-2801


*pictogram 75x300 mm*

sticker 85-1079
aluminium 85-2079

*We recommend to use for the marking of escape routes only pictograms silk screen printed on aluminium. This because of the low melting point of stickers.*

*For special pictograms ask our sales department.*

# YFESTOS PICTOGRAMS


sticker 85-1602
aluminium 85-2602


sticker 85-1603
aluminium 85-2603

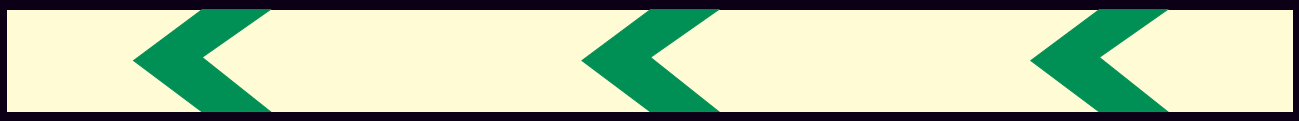
*pictograms*
*150x450 mm*


sticker 85-1604
aluminium 85-2604

*We recommend to use for the marking of escape routes only pictograms silk screen printed on aluminium. This because of the low melting point of stickers.*

*For special pictograms ask our sales department.*

# YFESTOS PICTOGRAMS



LLL alu-strip 85-6070 (1000x75 mm) - sticker 85-4070 (980x75 mm)
LLL alu-strip without arrows 85-6075 (1000x75 mm) - sticker 85-4075 (980x75 mm)

LLL alu-strip 85-6071 (1000x50 mm) - sticker 85-4071 (980x50 mm)
LLL alu-strip without arrows 85-6076 (1000x50 mm) - sticker 85-4076 (980x50 mm)

LLL alu-strip 85-6072 (1000x35 mm) - sticker 85-4072 (980x35 mm)
LLL alu-strip without arrows 85-6077 (1000x35 mm) - sticker 85-4077 (980x35 mm)


sticker 85-1102 aluminium 85-2102


sticker 85-1106 aluminium 85-2106


sticker 85-1103 aluminium 85-2103


sticker 85-1107 aluminium 85-2107


sticker 85-1104 aluminium 85-2104

*pictograms 75x350 mm*


sticker 85-1650 aluminium 85-2650

*pictogram 180x450 mm*

*pictogram 150x150 mm*


sticker 85-1998
aluminium 85-2998

**Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)**

*We recommend to use for the marking of emergency equipment, muster and embarkation stations only pictograms silk screen printed on aluminium. This because of the low melting point of stickers. The above listed pictograms can be supplied as sticker as well. The catalogue numbers are 85-1... and 85-4... for LLL*

# YFESTOS PICTOGRAMS


sticker 85-1700
aluminium 85-2700


sticker 85-1701
aluminium 85-2701


sticker 85-1702
aluminium 85-2702


sticker 85-1703
aluminium 85-2703


sticker 85-1704
aluminium 85-2704


sticker 85-1705
aluminium 85-2705


sticker 85-1706
aluminium 85-2706


sticker 85-1707
aluminium 85-2707


sticker 85-1710
aluminium 85-2710


sticker 85-1711
aluminium 85-2711


sticker 85-1712
aluminium 85-2712


sticker 85-1713
aluminium 85-2713


sticker 85-1714
aluminium 85-2714


sticker 85-1715
aluminium 85-2715


sticker 85-1716
aluminium 85-2716


sticker 85-1717
aluminium 85-2717


sticker 85-1719
aluminium 85-2719


sticker 85-1720
aluminium 85-2720

*pictograms 100x300 mm*

**Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)**

*We recommend to use for the marking of emergency equipment, muster and embarkation stations only pictograms silk screen printed on aluminium. This because of the low melting point of stickers. The above listed pictograms can be supplied as sticker as well.*

# YFESTOS PICTOGRAMS


sticker 85-1780
aluminium 85-2780


sticker 85-1781
aluminium 85-2781


sticker 85-1782
aluminium 85-2782


sticker 85-1783
aluminium 85-2783


sticker 85-1820
aluminium 85-2820

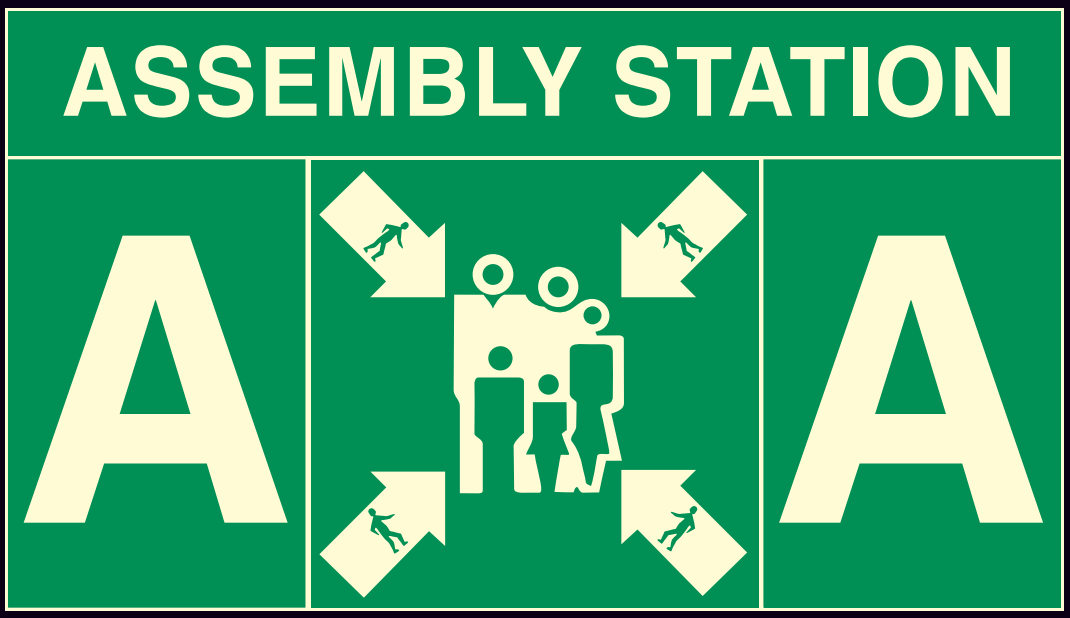
*pictogramms 100x300 mm*


sticker 85-1999
aluminium 85-2999

*pictogram 100x700 mm*

*combination of pictograms*

aluminium
100x700 mm
85-2999




aluminium
300x200 mm
85-6151

aluminium
300x300 mm
85-6150

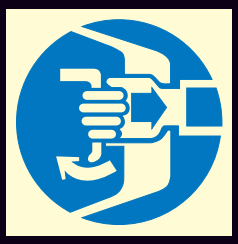
aluminium
300x200 mm
85-6151

**Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)**

*We recommend to use for the marking of emergency equipment, muster and embarkation stations only pictograms silk screen printed on aluminium. This because of the low melting point of stickers. The above listed pictograms can be supplied as sticker as well. The catalogue numbers are 85-1... and 85-4...*

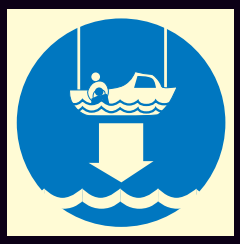
# YFESTOS PICTOGRAMS (IMO)

fasten seat belts
aluminium 85-6000



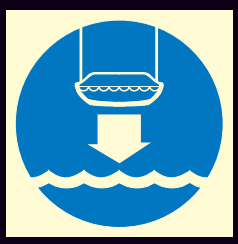
secure hatches
aluminium 85-6001

start engine
aluminium 85-6002



lower lifeboat
aluminium 85-6003

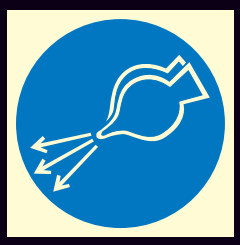
lower liferaft
aluminium 85-6004



lower rescue boat
aluminium 85-6005

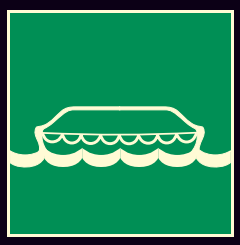
release falls
aluminium 85-6006

start water-spray
aluminium 85-6007



start air supply
aluminium 85-6008

release gripes
aluminium 85-6009



lifeboat
aluminium 85-6010

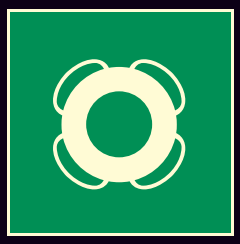
rescue boat
aluminium 85-6011

liferaft
aluminium 85-6012

david liferaft
aluminium 85-6013

embarkation
ladder
aluminium 85-6014

evacuation slide
aluminium 85-6015



lifebuoy
aluminium 85-6016

lifebuoy with line
aluminium 85-6017

lifebuoy with light
aluminium 85-6018

lifebouy with light
and line
aluminium 85-6019

*pictograms 150x150 mm*

**Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)**

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# YFESTOS PICTOGRAMS (IMO)

lifebouy with light
and smoke
aluminium 85-6020

lifejacket
aluminium 85-6021

child's lifejacket
aluminium 85-6022

immersion suit
aluminium 85-6023

survival craft
portable radio
aluminium 85-6024

EPIRB
aluminium 85-6025

radar transponder
aluminium 85-6026

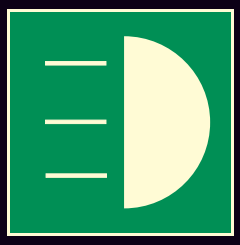
survival pyrotech
distress
aluminium 85-6027

rocket parachute
flares
aluminium 85-6028

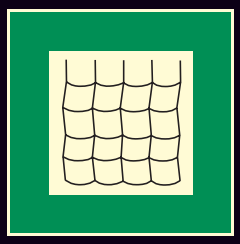
line-throwing
appliance
aluminium 85-6029

muster station
aluminium 85-6030


emergency exit
aluminium 85-6031



daylight
telegraphy device
aluminium 85-6032



climbing net
aluminium 85-6033

emergency escape
breathing device
aluminium 85-6034


marine evacuation
system (chute)
aluminium 85-6035


thermal
protective aid
aluminium 85-6036

*pictogrammen*
*150x150 mm*

## Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)

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# YFESTOS PICTOGRAMS (IMO)


aluminium
85-6080


aluminium
85-6081


aluminium
85-6082


aluminium
85-6083


aluminium
85-6084


aluminium
85-6085


aluminium
85-6086


aluminium
85-6087


aluminium
85-6088


aluminium
85-6089

direction
indicator
alu 85-6090

emergency
exit indicator
alu 85-6091


aluminium
85-6051


aluminium
85-6052


aluminium
85-6053


aluminium
85-6054


aluminium
85-6384

*pictograms*
*150x100 mm (85-60..) and*
*300x200 mm (85-61..),*
*150x150 mm (85-64..)*
*and in red 150x100 mm*
*(85-63..) and 300x200 mm*
*(85-65..)*

***pictograms***
***150x100 mm***

aluminium
300x300 mm
85-6150


aluminium
300x200 mm
85-61..


*Figures and indicators can be used in combination with all other pictograms. They always have to be placed at the right-hand side of the pictogram.*


keep shut
aluminium 85-6149

***pictogram 200x150 mm***

## Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)

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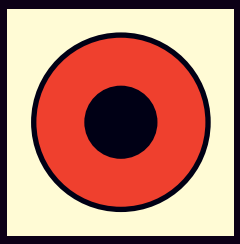
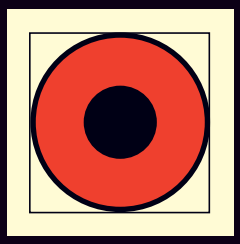
# YFESTOS PICTOGRAMS (IMO)

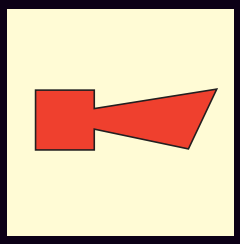

fire control plan
aluminium 85-6200



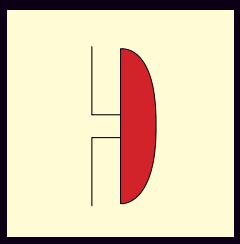
push button fire alarm
aluminium 85-6201



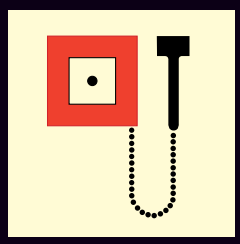
push button general alarm
aluminium 85-6202



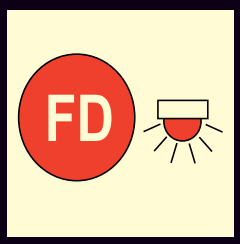
horn fire alarm
aluminium 85-6203



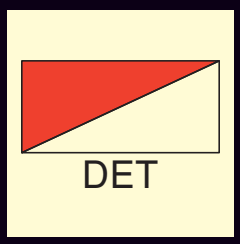
bell fire alarm
aluminium 85-6204



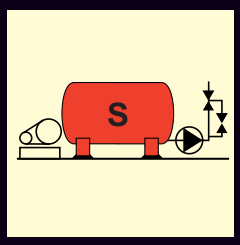
manually operated call point
aluminium 85-6205




space protected by automatic fire alarm
aluminium 85-6206

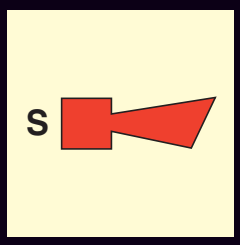



fire alarm panel
aluminium 85-6207

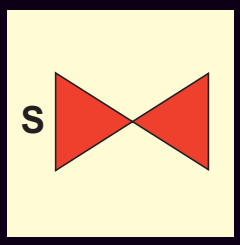



sprinkler installation
aluminium 85-6208

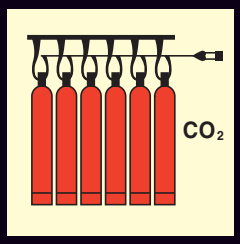

space protected by sprinkler
aluminium 85-6209



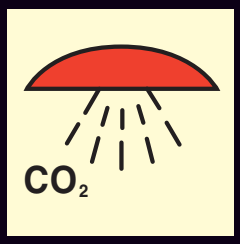

sprinkler horn
aluminium 85-6210



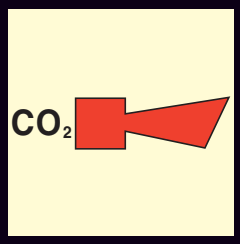

sprinkler section valve
aluminium 85-6211



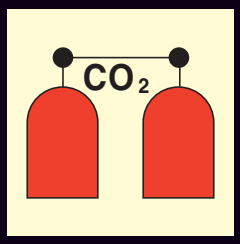

$CO_2$ battery
aluminium 85-6212




space protected by $CO_2$
aluminium 85-6213



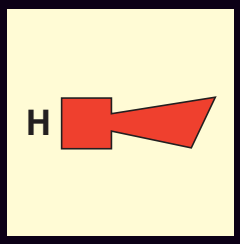

$CO_2$ horn
aluminium 85-6214




$CO_2$ release station
aluminium 85-6215


halon 1301 battery
aluminium 85-6216


space protected by halon 1301
aluminium 85-6217




halon horn
aluminium 85-6218

***pictograms 150x150 mm***

## Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)

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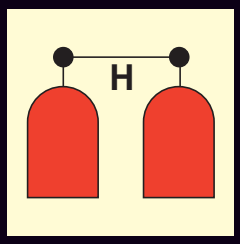
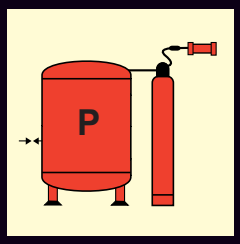
# YFESTOS PICTOGRAMS (IMO)

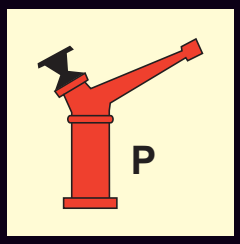



halon release station
aluminium 85-6219

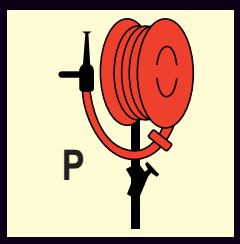

halon 1301 bottles in protected area
aluminium 85-6220



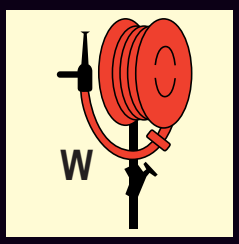

powder installation
aluminium 85-6221



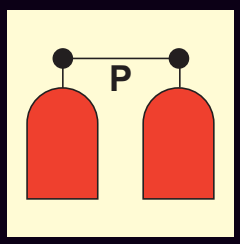

powder monitor (gun)
aluminium 85-6222



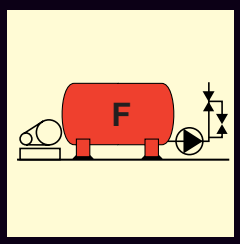

powder hose and handgun
aluminium 85-6223



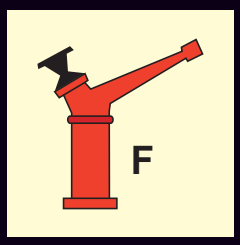

water hose and handgun
aluminium 85-6301



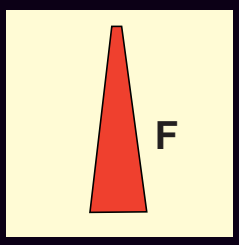

powder release station
aluminium 85-6224



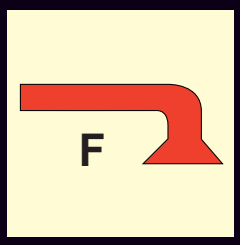

foam installation
aluminium 85-6225



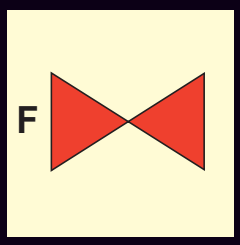

foam monitor (gun)
aluminium 85-6226



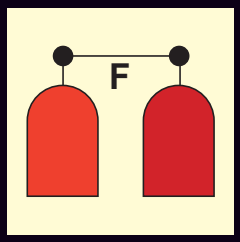

foam nozzle
aluminium 85-6227



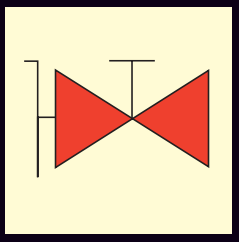

space protected by foam
aluminium 85-6228




foam valve
aluminium 85-6229

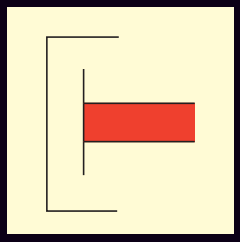



foam release station
aluminium 85-6230

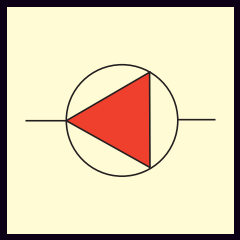


fire main with fire valves
aluminium 85-6231

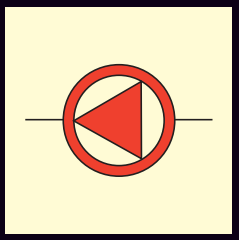
hose box with spray/ jet fire nozzle
aluminium 85-6232



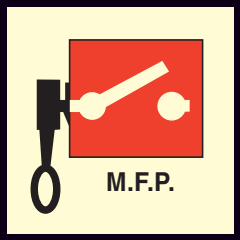
international shore connection
aluminium 85-6233



fire pump
aluminium 85-6234



emergency fire pump
aluminium 85-6235




remote controlled fire pumps/switches
aluminium 85-6236

***pictograms 150x150 mm***

## Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)

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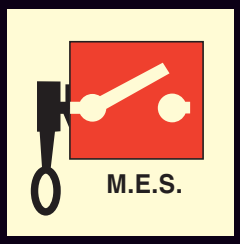
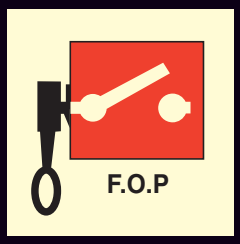
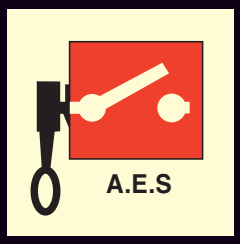
# YFESTOS PICTOGRAMS (IMO)



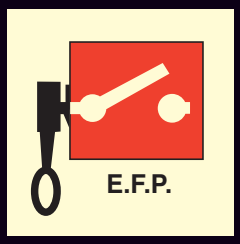

remote controlled
fire pumps/switches
aluminium 85-6237



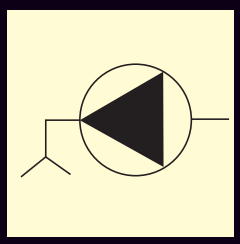

remote controlled
fire pumps/switches
aluminium 85-6238




remote controlled
fire pumps/switches
aluminium 85-6239

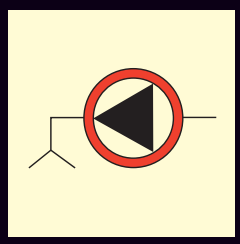



remote controlled
fire pumps/switches
aluminium 85-6295

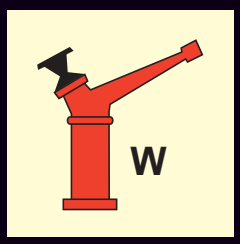


bilge pump

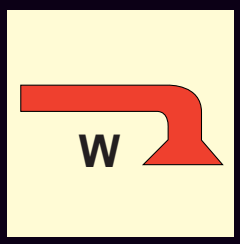
aluminium 85-6240



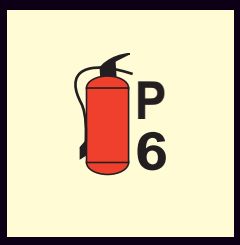
emergency
bilge pump
aluminium 85-6241




water monitor
(gun)
aluminium 85-6242




water fog
applicator
aluminium 85-6243

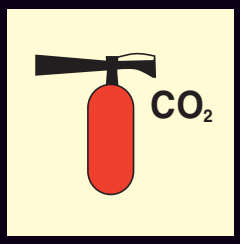



portable fire
extinguisher
aluminium 85-6244

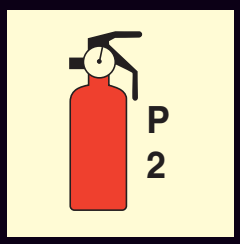

portable fire
extinguisher
aluminium 85-6306


portable fire
extinguisher
aluminium 85-6245

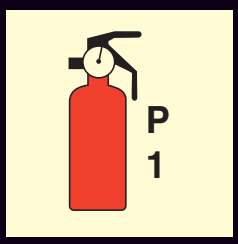

portable fire
extinguisher
aluminium 85-6246



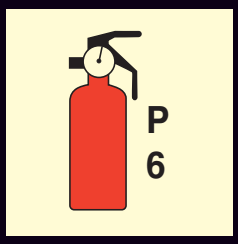

portable fire
extinguisher
aluminium 85-6247



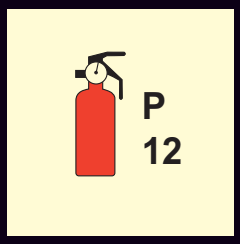

portable fire
extinguisher
aluminium 85-6248



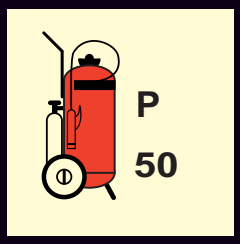

portable fire
extinguisher
aluminium 85-6249



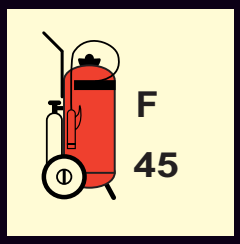

portable fire
extinguisher
aluminium 85-6300




portable fire
extinguisher
aluminium 85-6305




wheeled fire
extinguisher
aluminium 85-6250



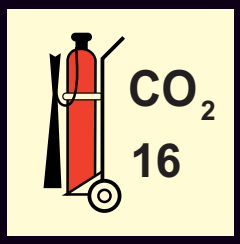

wheeled fire
extinguisher
aluminium 85-6251

***pictograms***
***150x150 mm***

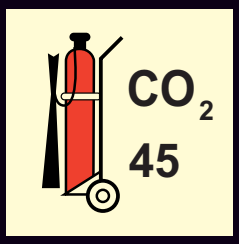
## Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)

*We recommend to use for the marking of emergency equipment, muster and embarkation stations only pictograms silk screen printed on aluminium. This because of the low melting point of stickers. The above listed pictograms can be supplied as sticker as well. The catalogue numbers are 85-4...*

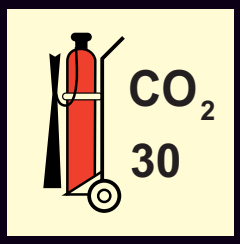
# YFESTOS PICTOGRAMS (IMO)



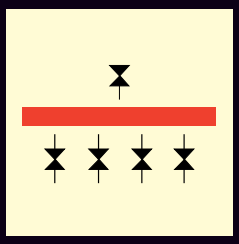

wheeled fire extinguisher aluminium 85-6304



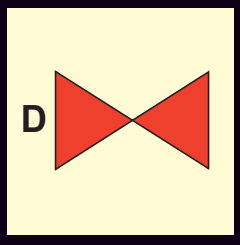

wheeled fire extinguisher aluminium 85-6252




wheeled fire extinguisher aluminium 85-6253



drenching installation aluminium 85-6254



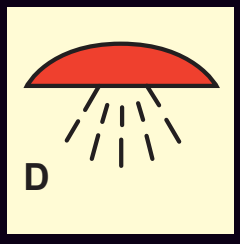

section valves drenching system aluminium 85-6299


fire station

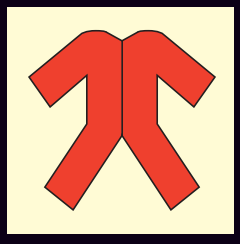
aluminium 85-6255


locker with firemen's outfit aluminium 85-6256

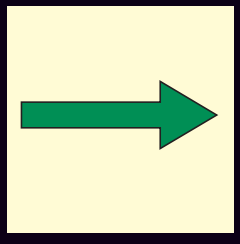
locker with additional breathing apparatus aluminium 85-6257



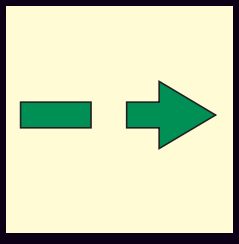

space protected by drenching system aluminium 85-6298



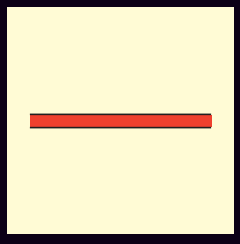
locker additional protective clothing aluminium 85-6258



primary means of escape aluminium 85-6259

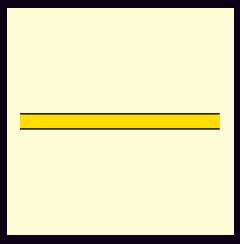


secondary means of escape aluminium 85-6260



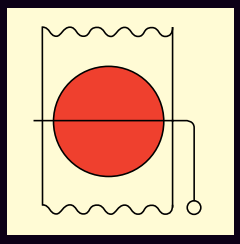
A class division

aluminium 85-6261

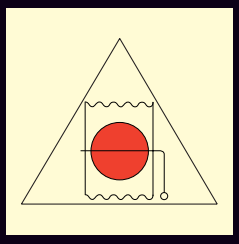


B class division

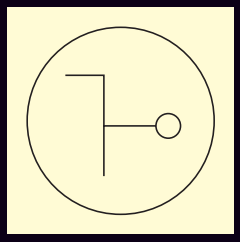
aluminium 85-6262



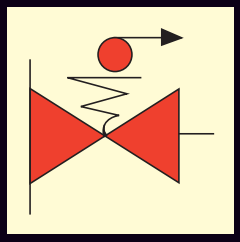
fire damper in vent duct aluminium 85-6263



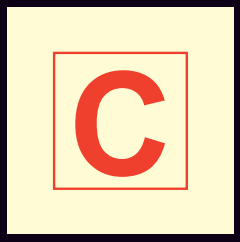
remote controlled fire damper aluminium 85-6302



remote controlled skylights aluminium 85-6264



remote controlled fuel/lubr. valves aluminium 85-6265




control station

aluminium 85-6266

***pictograms 150x150 mm***

## Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)

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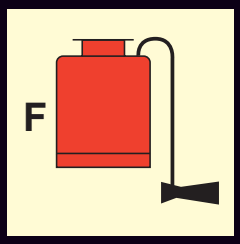
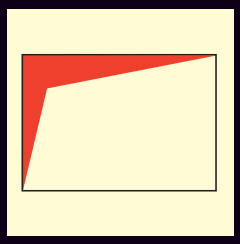
# YFESTOS PICTOGRAMS (IMO)

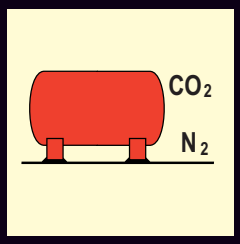



portable foam applicator
aluminium 85-6267


inert gas installation
aluminium 85-6268

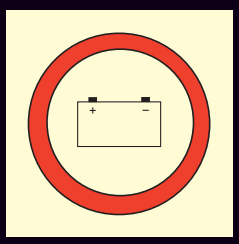


high expansion foam supply trunk
aluminium 85-6269

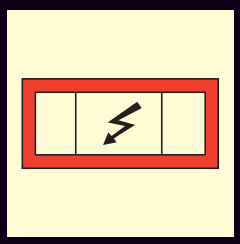



$CO_2$/nitrogen bulk installation
aluminium 85-6270

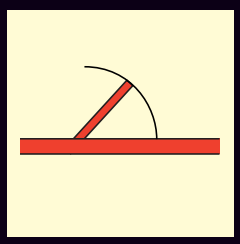

emergency generator
aluminium 85-6271



emergency battery
aluminium 85-6303

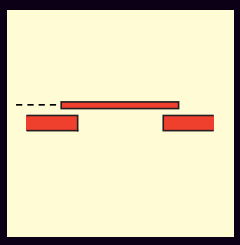


emergency switchboard
aluminium 85-6272



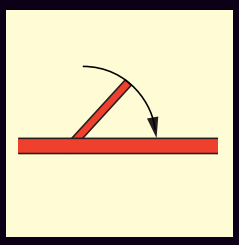
A class fire door

aluminium 85-6273

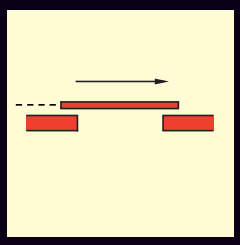


A class fire door

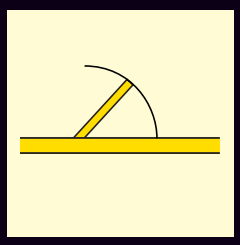
aluminium 85-6274



A class fire door self-closing
aluminium 85-6275

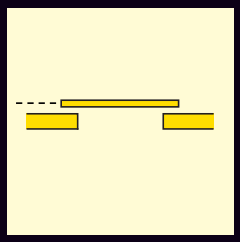


A class fire door self-closing
aluminium 85-6276



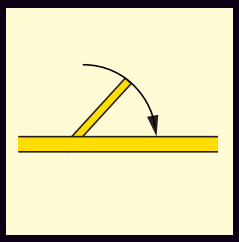
B class fire door

aluminium 85-6277

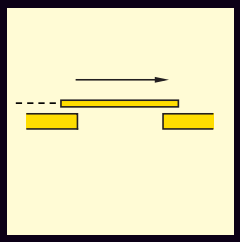


B class fire door

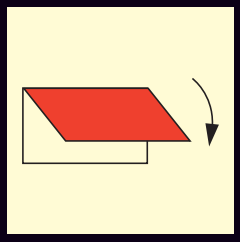
aluminium 85-6278



B class fire door self-closing
aluminium 85-6279



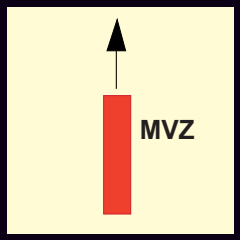
B class fire door self-closing
aluminium 85-6280



closing appliance exterior ventilation
aluminium 85-8281


remote ventilation shutoff
aluminium 85-6282


remote ventilation shutoff
aluminium 85-6283




main vertical zone

aluminium 85-6284

***pictograms 150x150 mm***

## Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)

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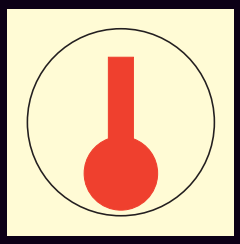
# YFESTOS PICTOGRAMS (IMO)

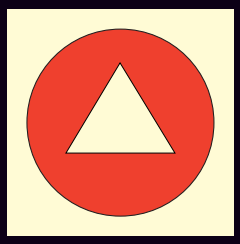
smoke detector

aluminium 85-6285



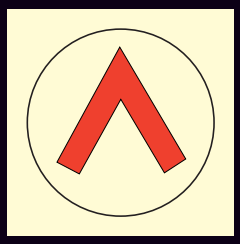
heat detector

aluminium 85-6286



gas detector

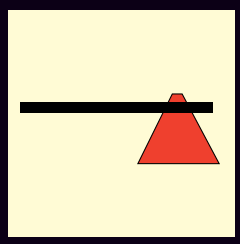
aluminium 85-6287



flame detector

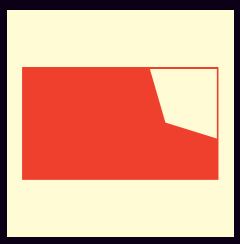
aluminium 85-6288

emergency
telephone station
aluminium 85-6289



fire axe

aluminium 85-6290

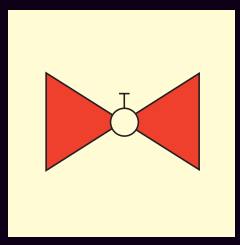


fire blanket

aluminium 85-6293

movable
extinguisher pump
aluminium 85-6294


foam applicator
and hose
aluminium 85-6296



$CO_2$ pneumatic
release valve
aluminium 85-6297

***pictograms***
***150x150 mm***

# *CERTIFIED BY:*

***American Bureau of Shipping***
***Bureau Veritas***
***Det Norske Veritas***
***Germanischer Lloyd***
***Lloyd's Register of Shipping***
***Registro Italiano Navale***

**Measured luminescence: 209.9/29.8 (min. required acc. IMO: 15/2)**

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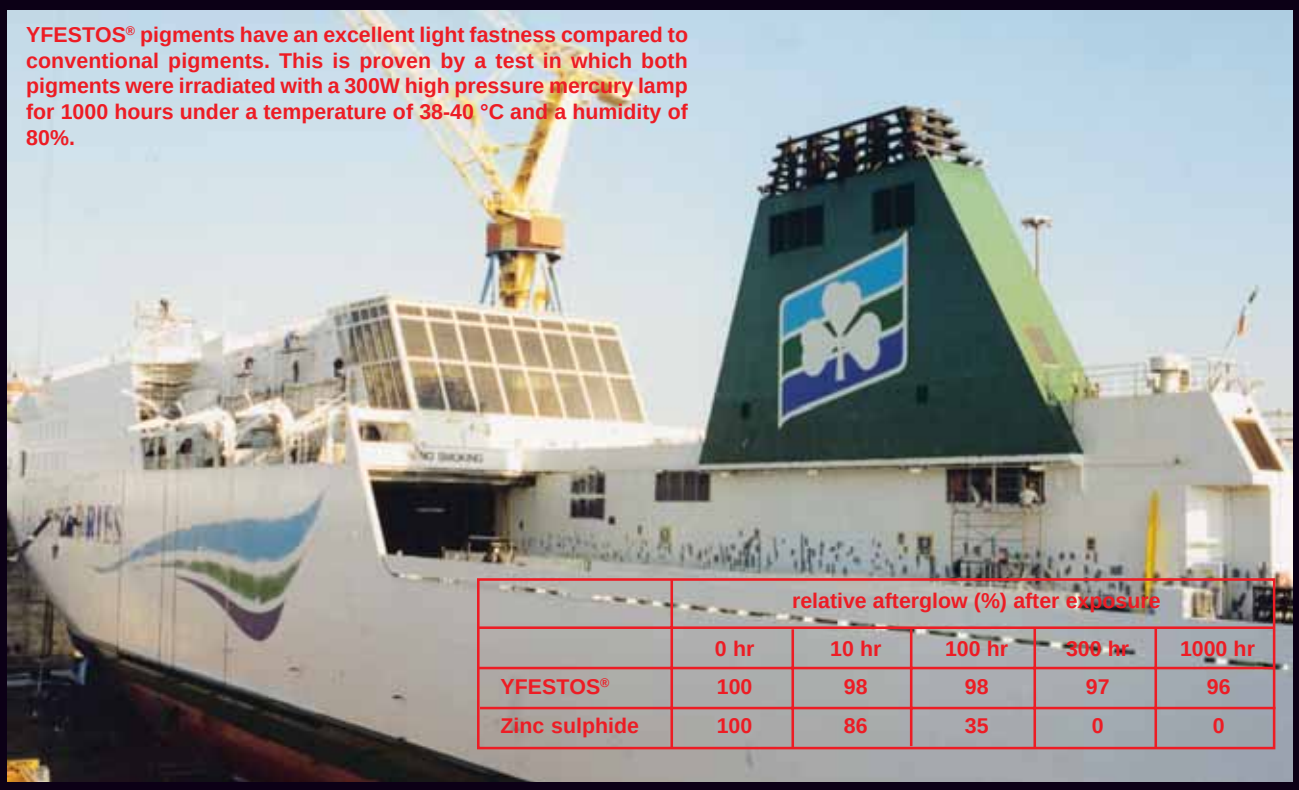
# AGING TESTS AN ABSOLUTE MUST!



YFESTOS® pigments have an excellent light fastness compared to conventional pigments. This is proven by a test in which both pigments were irradiated with a 300W high pressure mercury lamp for 1000 hours under a temperature of 38-40 °C and a humidity of 80%.

| | relative afterglow (%) after exposure | | | | |
|---|---|---|---|---|---|
| | 0 hr | 10 hr | 100 hr | 300 hr | 1000 hr |
| YFESTOS® | 100 | 98 | 98 | 97 | 96 |
| Zinc sulphide | 100 | 86 | 35 | 0 | 0 |

Luminescent escape routing systems should maintain their light emission for an extended period of time. It should not be the case that in an sudden disaster the systems emit insufficient light so that they have hardly any or no functionality at all for an evacuation in darkness. Measurements during maintenance on the ferry "Isle of Innesfree" showed that the installed zinc sulphide systems had hardly any light emission capacity left and that even the values as specified in the IMO A.752(18) were not reached. The vessel, however, has been sailing for just 5 years!

*Artificial aging tests for up to 20 years, carried out at the TNO laboratories, have proven that the YFESTOS® systems show no significant changes of their primary light emission.*

On the basis of this report Irish Ferries, the owner of the ferry, decided to replace the zinc sulphide systems with YFESTOS®. During installation light measurements have been performed to prove that even in poorly lighted areas YFESTOS® meets the requirements with ease.

measurements of the ambient light and the light emission of the installed YFESTOS® LLL-system were carried out at site according to DIN 67 510 part 2

# YFESTOS®: GREEN LIGHT FOR SAFETY

***All safety signs on board of TELKKÄ, a patrol vessel of the Finnish coastguard, are YFESTOS®***

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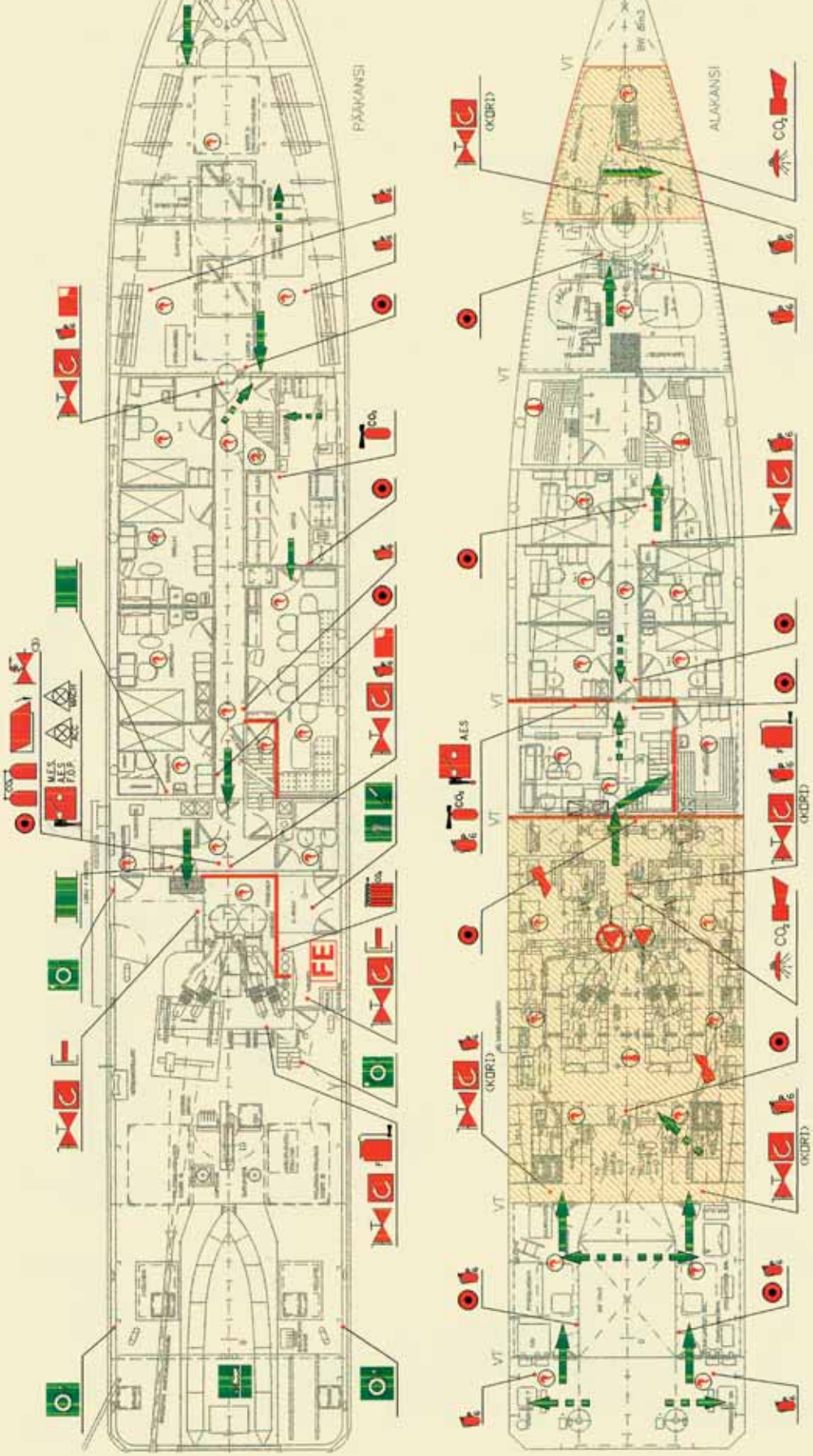


# SPECIAL APPLICATION

***The U.S. Navy - Aircraft Division, has identified a problem occurring during sensitive search and rescue missions by helicopters. These missions may take place at sea or on land, and may occur during hostile, wartime periods, or on peacetime missions as well. A member of the U.S. Navy did some research and identified the YFESTOS® product by BEELE Engineering as a possible solution to the problem.***

## PROBLEM

Often times, helicopters are used to rescue and recover people from many different situations. Some of these situations may include:

* Navy SEAL (special forces) recovery from land, water, or a ship's deck.
* Rescue of pilots, from water or land, that have been shot down or that have had to eject from their aircraft for any number of reasons.
* Rescue/recovery of sick or injured sailors from water, land or a ship.

These rescue and recovery missions may occur during storms, in complete darkness, and possibly under enemy fire. In many cases, it is not possible to provide auxiliary lighting of the rescue area, because to do so might provide a better target for the enemy. When these rescue missions occur, the helicopter hovers above the area where the rescue is taking place. A steel cable with a hook or harness attached to the end is then lowered down to the recovery area. The theory is that the cable is attached to the person, equipment, or basket, the cable is then hoisted back to the helicopter and the recovery is complete.

As previously mentioned, these missions may take place under worst conditions. Darkness, wind, rain, stormy seas, enemy fire and a host of other problems may be present at any time. The major problem is that it is very difficult, if not impossible, for the person on the ground to locate the end of the cable while it is being lowered from the helicopter. To make matters worse, if the conditions are windy, or the seas rough, the cable may be swinging wildly as it is lowered to the target. Situations have occurred where the hook has become tangled on equipment, personnel, and on some occasions has even caused injury. Furthermore, on a lot of these rescue missions, time is critical, seconds count, and any delay caused by difficulty finding the end of the cable could result in catastrophe. All of this because it is very difficult to see the end of the cable until it is right in front of the person.

## SOLUTION

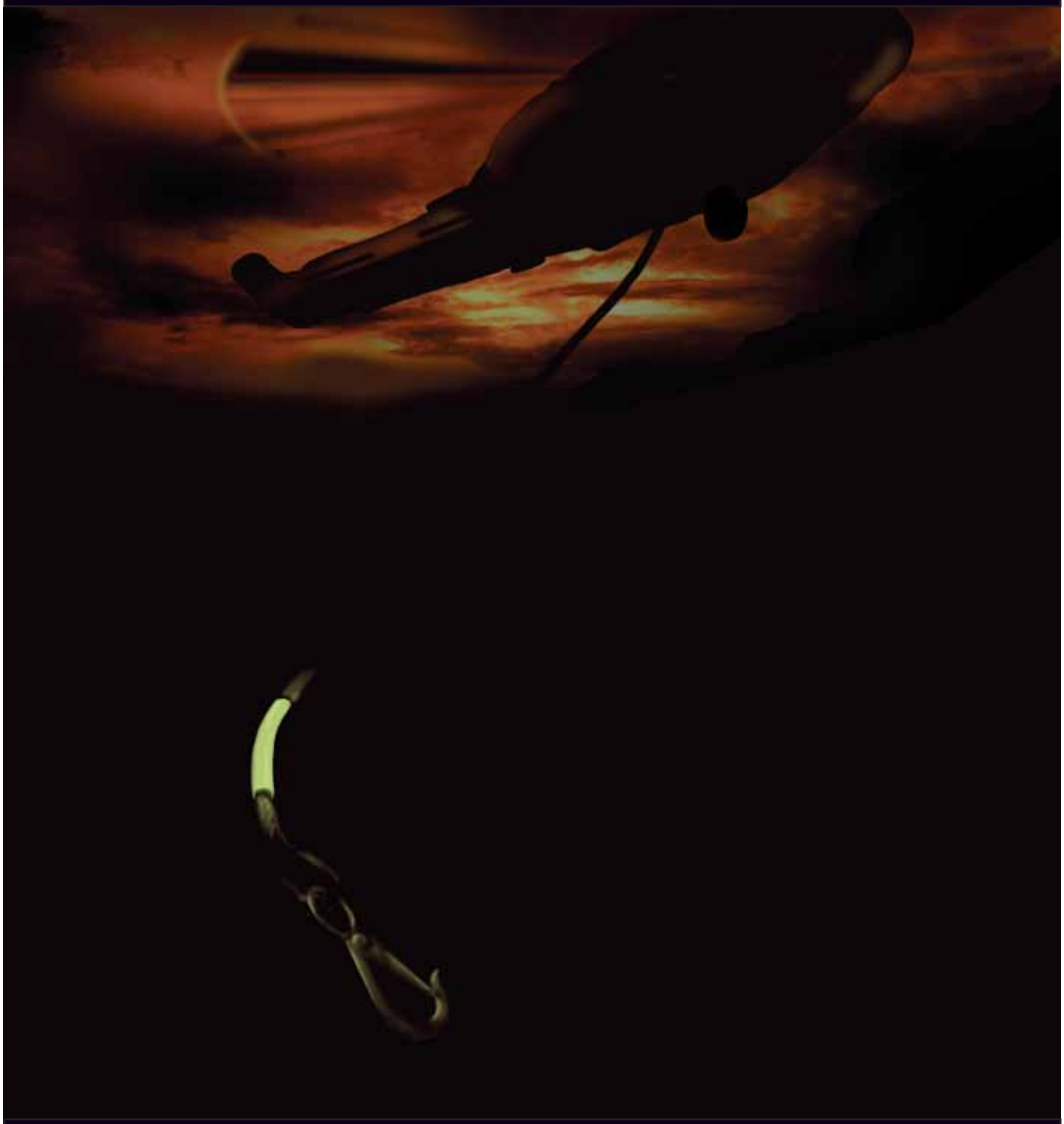
The idea was to apply some sort of luminescent material to the very end of the cable, which would provide sufficient light for the person on the ground to see, but not enough light for an enemy sniper to see. (They did not want a sniper to be able to see the rescue victim while he was being hoisted up to the helicopter). The search was on for the proper luminescent materials to solve the problem.

Several criteria had to be met: the material had to be extremely durable, easy to apply, easy to replace, and had to have long lasting light emission with very minimal charging times. When not in use, the cable is wound up in a coll and the end is secured to a point on the helicopter.

At this point, the navy plans to install a small halogen lamp, which will constantly charge the YFESTOS® hose until the cable is needed for the rescue mission.

# LUMINESCENCE: GREEN LIGHT FOR SAFETY

# APPLICATION OF LUMINESCENT HOSES



***The major problem which this kind of operations in darkness is that it is very difficult, if not impossible, for the person on the ground to locate the end of the cable while it is being lowered from the helicopter. To make matters worse, if the conditions are windy, or the seas rough, the cable may be swinging wildly as it is lowered to the target.***

## Materials that give light in the dark: helping to increase safety

# APPLICATION OF LUMINESCENT HOSES

**Rescue and recovery missions may occur during storms, in complete darkness, and possibly under enemy fire.**
**In many cases, it is not possible to provide auxiliary lighting of the rescue area.**
**YFESTOS® products offer a bright solution to this problem.**

# PRODUCT-INFORMATION


silicone putty

| | | |
|---|---|---|
| 01) | colour | transparant |
| 02) | specific gravity | 1,03 ± 0,03 g/cm³ |
| 03) | curing of top layer | ca. 30 min. |
| 04) | tensile strength | 0,80 MPa |
| 05) | elongation at break | 250% |
| 06) | hardness | 20 Shore A |
| 07) | elasticity | ca. 100% |
| 08) | resilience | 95% |
| 09) | good adhesion to | glass, tiles, concrete, wood, PVC,steel, zinc, copper, aluminium and a wide variety of plastics |
| 10) | supplied in | cartridges containing 310 ml |
| 11) | storage | to be stored cool and dry. min/max temperature +5/+30 °C |
| 12) | storage life | approx. 12 months |

SEBS elastic cords, tapes and hoses

| | | |
|---|---|---|
| 01) | colour | greenish transparant |
| 02) | specific gravity | 0.98 g/cm³ |
| 03) | peak temperature | 150 °C |
| 04) | tensile strength | 7.5 MPa |
| 05) | elongation at break | 500% |
| 06) | hardness | 60 Shore A |
| 07) | elasticity | ca. 100% |
| 08) | resilience | 53% |
| 09) | UV/ozon resistance | good |
| 10) | chemical resistance | excellent to water, acids and bases |
| 11) | limited oxygen index | 20 |

moulded silicone rubber products

| | | |
|---|---|---|
| 01) | colour | greenish transparant |
| 02) | specific gravity | 1.15 g/cm³ |
| 03) | peak temperature | 250 °C |
| 04) | tensile strength | 7.5 MPa |
| 05) | elongation at break | 410% |
| 06) | hardness | 62 Shore A |
| 07) | elasticity | ca. 100% |
| 08) | resilience | 58% |
| 09) | UV/ozon resistance | good |
| 10) | chemical resistance | excellent to water, acids and bases |
| 11) | limited oxygen index | 30 |

moulded SEBS polymers

| | | |
|---|---|---|
| 01) | colour | greenish transparant |
| 02) | specific gravity | 0.98 g/cm³ |
| 03) | peak temperature | 150 °C |
| 04) | tensile strength | 7.5 MPa |
| 05) | elongation at break | 375% |
| 06) | hardness | 70 Shore A |
| 07) | abbrasion | 100 mm³ |
| 08) | resilience | 50% |
| 09) | UV/ozon resistance | good |
| 10) | chemical resistance | excellent to water, acids and bases |
| 11) | limited oxygen index | 20 |

# SAFETY DATA SHEET

| | | |
|---|---|---|
| **Product name:** | | **YFESTOS® luminescent products** |
| 01) | chemical specification: | a) polydimethylsiloxanes<br>b) styrene-ethylene-butylene-styrene thermoplast<br>c) ethylene-propylene- and silicone rubber |
| 02) | form: | a): pasty - b) and c): moulded/extruded products |
| 03) | colour: | Greenish transparent |
| 04) | odour: | Charasteristic smell |

## Physical and safety data

| | | |
|---|---|---|
| 05) | density: | Approx. 1.03 - 1.30 g/cm$^3$ at 20 $^0$C |
| 06) | solubility in water: | Insoluble |
| 07) | pH value: | Not applicable |
| 08) | flash point: | Above 200 °C |
| 09) | ignition temperature: | Above 400 °C |
| 10) | limited oxygen index: | 20% |
| 11) | hazardous decompostion products: | In case of fire: CO, $CO_2$, oxides of silicone and oxides of nitrogen |
| 12) | hazardous reactions: | Will not occur |
| 13) | other data: | products contain no radio-active components |

## Protective measures, storage and handling

| | | |
|---|---|---|
| 14) | technical protective measures: | Keep away from foodstuffs, drinks and tobacco. |
| 15) | personal protective equipment: | No special measures required. |
| 16) | protection against fire and explosion | No special precautions required. |
| 17) | disposal | May be incinerated in a suitable facility provided local regulations are observed. |

## Toxicological information

| | | |
|---|---|---|
| 18) | acute effects of exposure: | none |

## Ecological information

| | | |
|---|---|---|
| 19) | general | As the product is practically insoluble in water, it is separated in almost any filtration and sedimentation process. |

## Transport

| | | |
|---|---|---|
| 20) | general: | Not dangerous cargo. Keep dry. Avoid heat above + 30 $^0$C. Avoid temperature below -5 $^0$C. Keep separated from foodstuffs. |
| 21) | mail: | Allowed for transport by mail. |
| 22) | ICAO/IATA-DGR: | Not restricted. |

## Regulations

| | | |
|---|---|---|
| 23) | general: | No labelling is required in accordance with the EEC directives 67/548 and 88/379. |

The data given here are based on current knowledge and experience. The data on this Safety Data Sheet relate only to the product in terms of safety requirements.

# SAFETY DATA SHEET

| | |
|---|---|
| **Product name:** | **YFESTOS® luminescent paint** |
| 01) chemical specification: | Paint with luminescent pigments based on a urethane dispersion (volatile) and a water based solvent (non volatile) |
| 02) colour: | Light yellowish |
| 03) odour: | Charasteristic smell |

## Physical and safety data

| | |
|---|---|
| 04) density: | Approx. 1.7 g/cm$^3$ at 20 °C. |
| 05) viscosity: | 34000 mPa.s Brookfield at 25 °C. |
| 06) vapour pressure: | 23 mbar at 20 °C as water. |
| 07) pH value: | 8.5 at 25 °C. |
| 08) boiling point: | As water. |
| 09) flash point: | Above 100 °C. |
| 10) flammability: | Not applicable. |
| 11) explosive limit: | Not applicable. |
| 12) fire fighting measures: | Not classed as flammable. In case of fire it may emit noxious and toxic fumes. Extinguish with foam, $CO_2$, dry powder, water spray. |
| 13) solubility: | Miscible in water. |
| 14) other data: | Product contains no radio-active components. |

## Protective measures, storage and handling

| | |
|---|---|
| 15) protective measures: | Keep away from foodstuffs, drinks and tobacco. |
| 16) personal precautions: | Avoid contact with eyes and skin. Avoid breathing vapours. |
| 17) fire precautions: | Water may be used to cool closed containers. |
| 18) disposal | May be incinerated in a suitable facility provided local regulations are observed. |

## Toxicological information

| | |
|---|---|
| 19) inhalation: | Irrittating to respiratory system. |
| 20) ingestion: | May be harmful if swallowed. |
| 21) contact: | Irritating to eyes and skin. |

## Ecological information

| | |
|---|---|
| 22) general | Do not release to the environment without chemical precipitation/flocculation. The precipitate is not hazardous. WGK 1: slightly hazardous to water. |

## Transport

| | |
|---|---|
| 23) general: | Not hazardous cargo. Avoid heat above + 30 °C. Avoid temperature below +5 °C. |

## Regulations

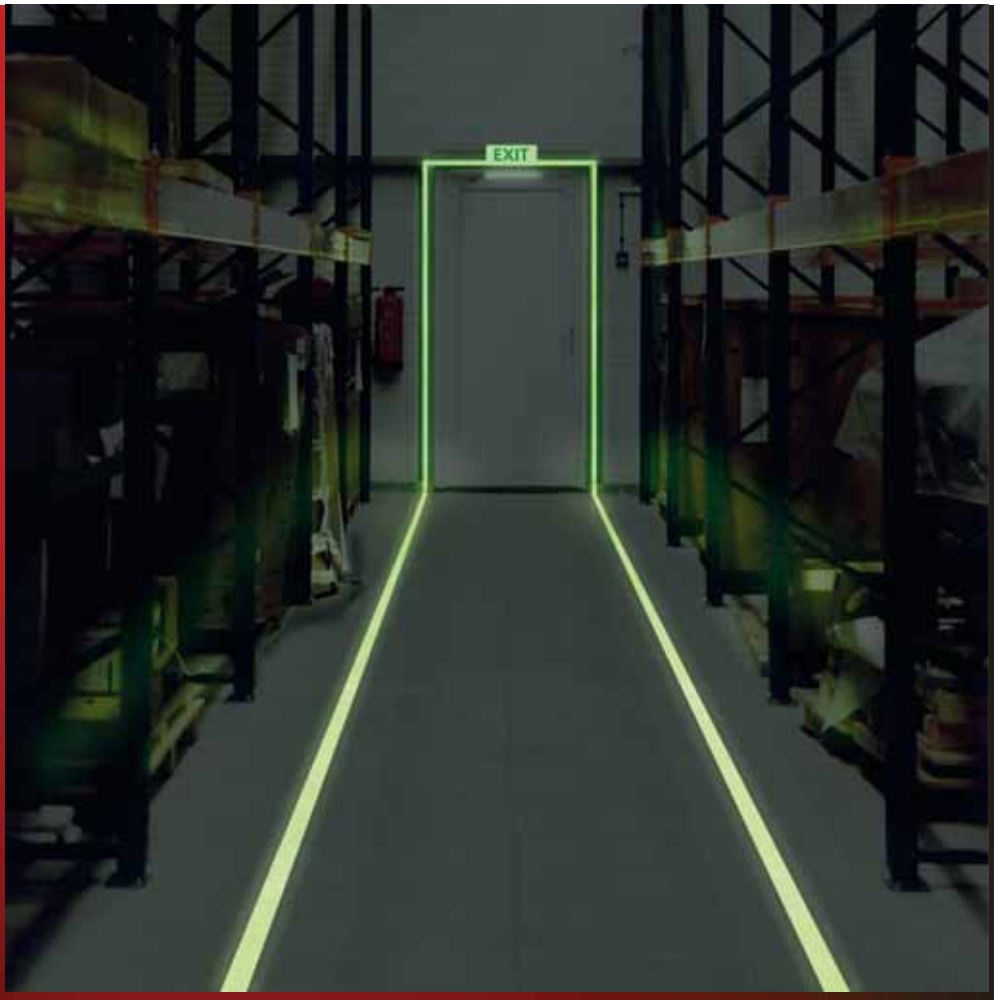
| | |
|---|---|
| 24) classification: | Xi IRRITANT |
| 25) risk phrases: | R36/37/38: irritating to eyes, respiratory system and skin. |
| 26) safety phrases: | S24/25: avoid contact with eyes and skin |
| 27) other information: | This data sheet was prepared in accordance with directive 91/155/EEG |

The data given here are based on current knowledge and experience. The data on this Safety Data Sheet relate only to the product in terms of safety requirements.

# YFESTOS

# THE BRIGHT SOLUTION

YFESTOS




YFESTOS

# GREEN LIGHT FOR SAFETY

***BEELE Engineering and CSD International have been involved with fire, water and gas tight sealing for 30 years. The YFESTOS® product range is complementary to our complete line of fire safety products. To receive the extensive YFESTOS® brochure and/or our civil construction and marine products catalogues, please contact your distributor or local representative.***

**distributed by:**

**CSD Sealing Systems - North America**
**21 Meadowbrook Lane**
**Gilford, NH 03249**
**Tel. (603) 293-0100 - Fax (603) 293-0200**
**www.csdsealingsystems.com E-mail: info@csdsealingsystems.com**