3F Filippi

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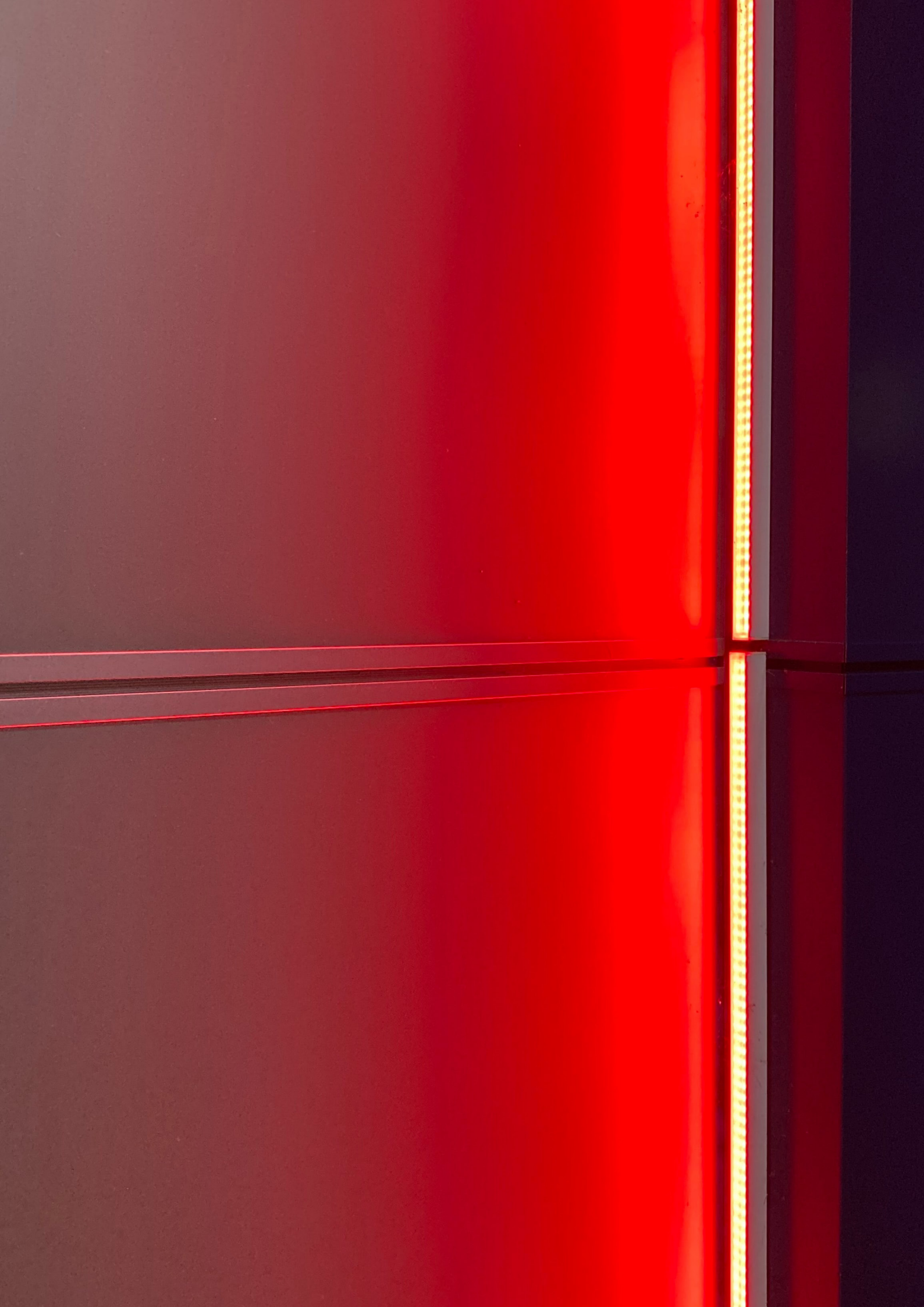
The real revolution is simplicity.

To create the new LED products, 3F Filippi has put more than 70 years of experience in the field at the side of designers.
And you can see the difference: in a market for efficient sources that is evolving and updating day by day, 3F Filippi has decided to equip its luminaires with sources made from the best possible components.

One of the most common problems among lighting designers is, unfortunately, the lack of a standardised way in which lighting companies declare performance: these ‘tricks’ make it difficult to understand and compare products.

Notes:
The original technical features of LED lighting will change according to the operating conditions of each luminaire, and as such, it is incorrect to assume that every LED has the same characteristics in terms of service life, decrease of luminous flux (L) life expectancy (B), etc.



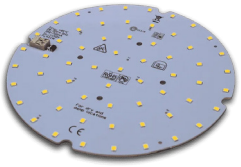
/ 3F LED Technology

Comparison chart between luminaires of the same length

	Total luminaire of luminaire	Total energy consumption	Annual saving
2x58W Fluorescent Wiring low-loss EEI=B2	141W	102 €	0%
2x58W Fluorescent Wiring EEI A2 electronic wiring	109W	78 €	24%
2x30W LED wiring ballast	70W	50 €	51%
2x22W LED electronic ballast	49W	35 €	66%

linear

COB



circular

square

The revolution is **SIMPLICITY.**

WHAT IS AN LED?
LEDs are electronic components which emit light when an electrical current passes through them – the name, indeed, is an acronym for Light Emitting Diode. This is possible thanks to the optical properties of some semiconductors which emit photons when current is passed through them.

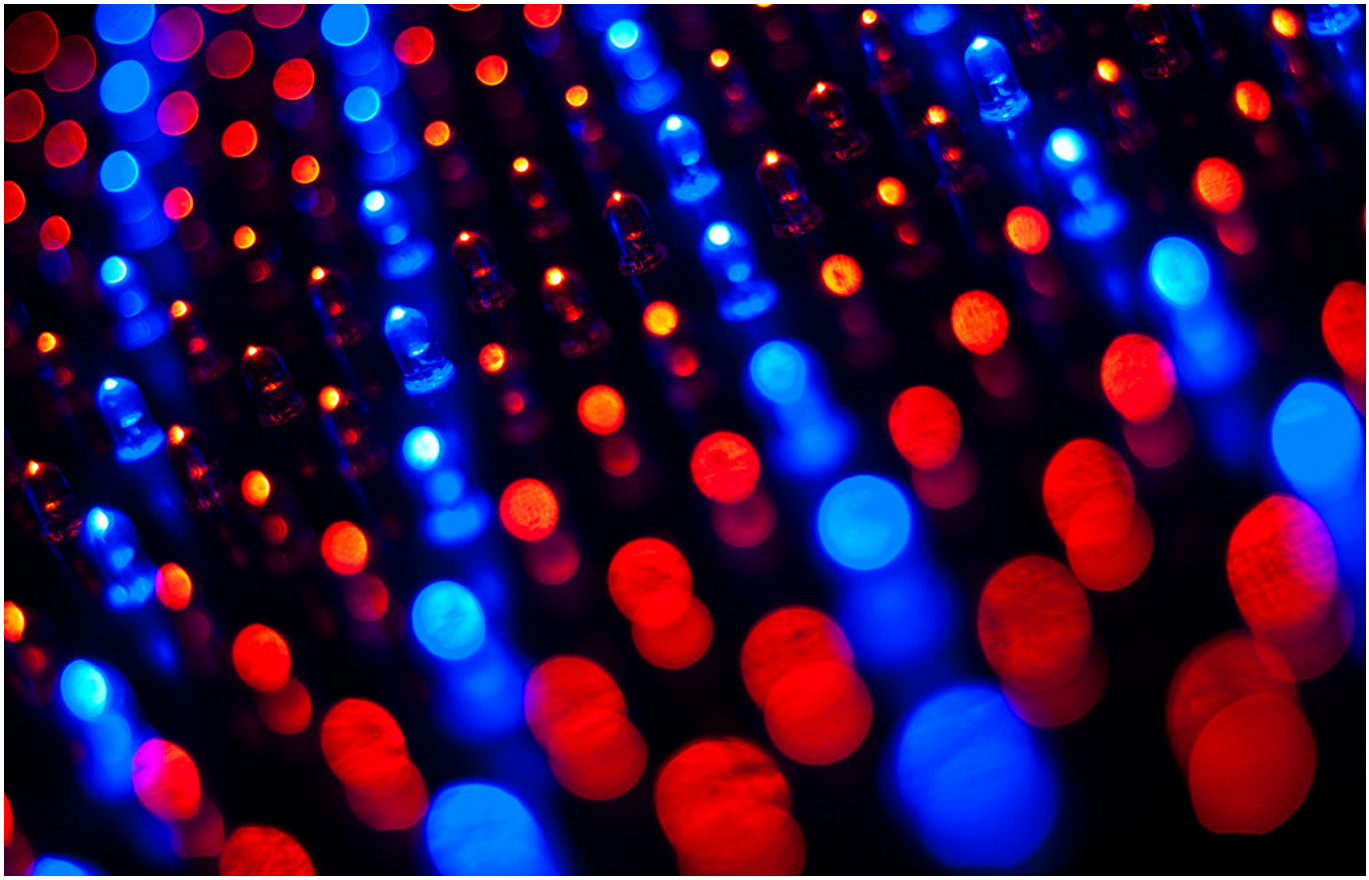
ADVANTAGES
Lighting:
- High luminous efficiency LED: up to 200 lm/W.
- Immediate light on.
- Control of the light flow, directed light.
- Absence of emission of IR and UV components.
- Very long lifetime, > 50,000 hours (professional range).
- Lower power than traditional light sources with equal light output.
- Increased brightness.
- Adjustment of luminous flux from as low as 1%.

Environmental:
- Mercury free.
- Lower CO2 emissions thanks to lower power.
- Less use of polluting materials in LED production.
- Less heat lost to the environment.

For the customer:
- Reduction of energy costs.
- Reduction of maintenance costs.
- Fast return on investment.

Note:
Table supposes electricity cost of €0.18 per kWh and total annual operation of 4,000 hours.

/ 3F LED Technology



HOW TO CHOOSE AN LED LUMINAIRE?

When studying and designing products, 3F Filippi refers to the most recent specific reference standards:

IEC 62722-2-1
Luminaire performance - Part 2-1: Particular requirements for LED luminaires.

IEC 62717
LED modules for general lighting - Performance requirements.

CIE 121
The Photometry and Goniophotometry of Luminaires.
IEC TR 62778
Application of IEC 62471 for the assestment of blue light hazard to light sources and luminaires.

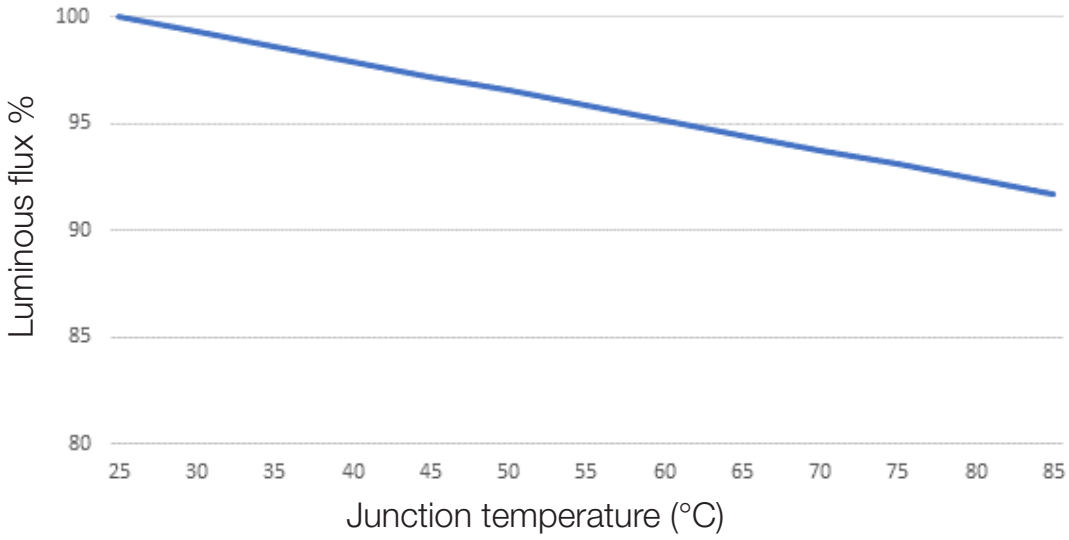
IEC EN 62471
Photobiological safety of lamps and lamp systems.

IEC EN 60598-1
Luminaires: General requirements and tests.

REGULATION (EU) No. 1194/2012 sets out the rules for the application of European Parliament and European Council Directive 2009/125/EC on the specifics of environmentally-friendly design of directional lamps, lamps with light-emitting diodes and other relevant equipment

IDEAL OPERATING TEMPERATURE

In order to ensure the correct operating temperature of the LEDs, 3F Filippi performs a series of thermal and lighting tests on its luminaires, which allow an optimal combination of thermal dissipation, luminous flux and power rating..



LED Junction temperature	Tj 25°C	Tj 60°C
Lumens	1000	950
System	178 lm/W	169 lm/W
Useful life (50.000h)	L 100	L 85
Life expectancy	B 0	B 10

AMBIENT PERFORMANCE TEMPERATURE "TQ"
(IEC 62722-2-1)
This value indicates the nominal ambient temperature recorded around the tested device.

IEC standard 62722-2-1 "Luminaire performance - Part 2-1: Particular requirements for LED luminaires", requires the manufacturer to declare the technical performance data relating to the ambient temperature (tq) of +25°C.

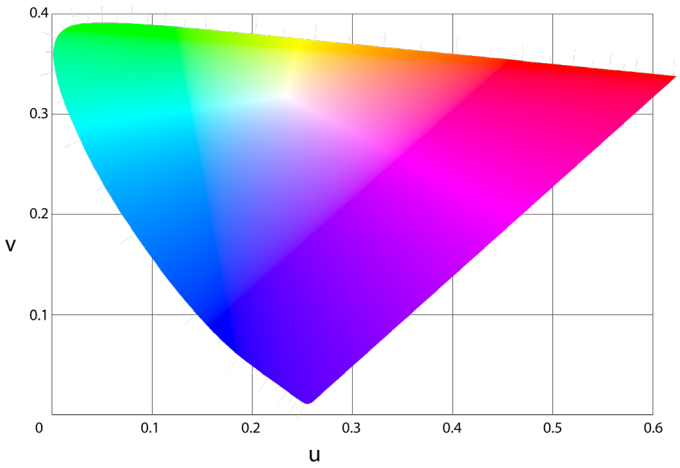
The luminous output, total power and the service life expectancy of fixtures indicated in official documents (web site, datasheets and photometric curves), therefore refer to the performance ambient temperature tq +25°C (according to EN13032 standard requirements by the 3F Filippi CTFs2 certified photometric laboratory).

In order for designers to evaluate the decays of different operating durations in advance and to set up maintenance programmes on the system 3F Filippi also includes the useful life (L) and life expectancy values (B) on the datasheet which refer to:
30,000 hours, at performance ambient temperature (tq+25°C);
50,000 hours, at performance ambient temperature (tq+25°C);
80,000 hours, at performance ambient temperature (tq+25°C);
100,000 hours, at performance ambient temperature (tq+25°C)
50,000 hours, at the maximum operating temperature (tmax) for luminaires with operating temperatures greater than tq + 25° C.

THERMAL MANAGEMENT
To increase LED luminaires' reliability to the maximum, correct thermal dissipation is essential. The temperature is fundamentally important as it influences the luminosity and lifetime of the LED component.
3F Filippi pays great attention to this factor and as a result we develop luminaires which ensure optimum heat dissipation.

Note:
Graph correlating performance values at different junction temperatures Tj.

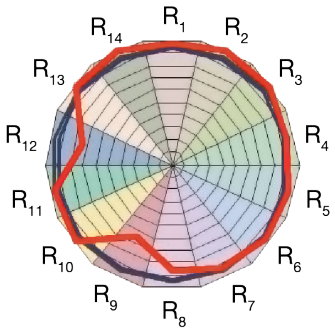
/ 3F LED Technology



Auto:
ref.illuminant -
Planckian radiator
CCT=4159 K

R_a=94

R_e=91



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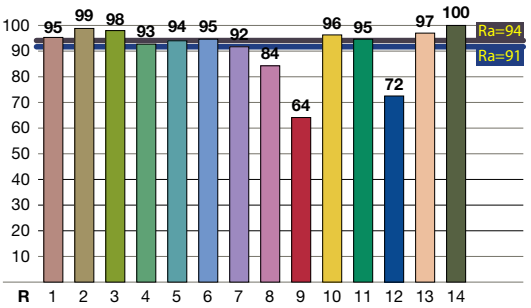


CRI. Colour rendering index.

The CRI index of 100 has always been attributed to traditional incandescent sources, with a continuous spectrum but poor in shades of blue (therefore not very suitable for the enhancement of objects with dominant blue).
The LED sources, despite having a continuous spectrum with peaks on specific colors, have a maximum CRI of 98.

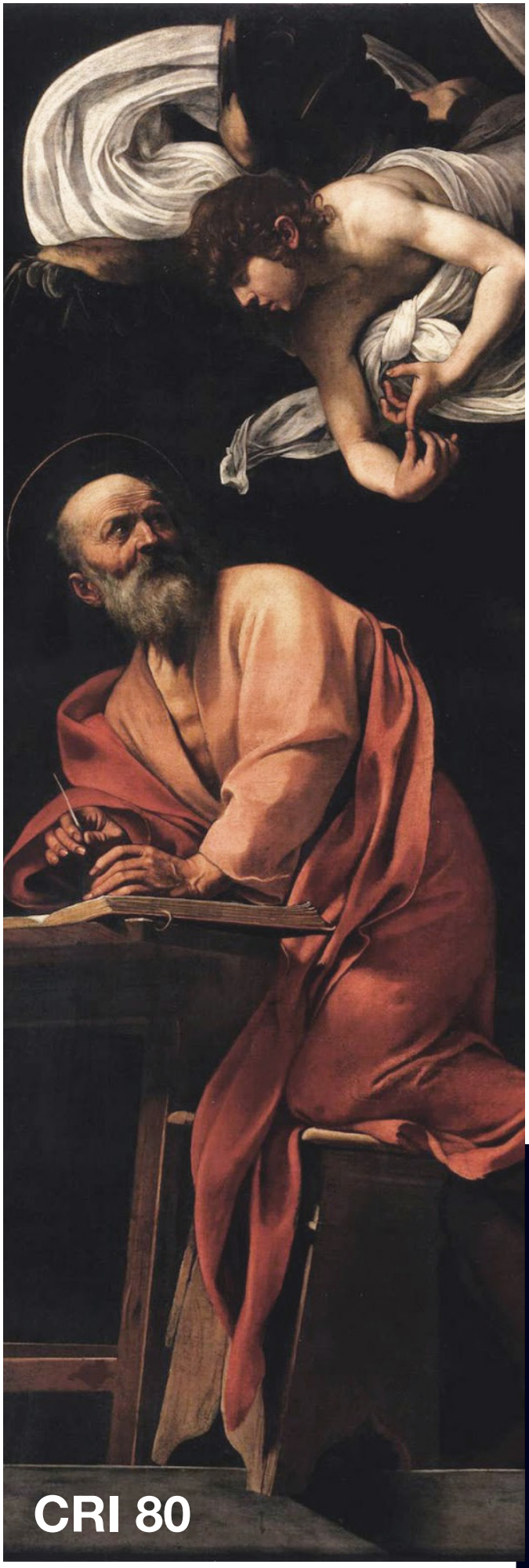
In the product documentation, the colorimetric characteristics are expressed both through the CRI method and through the TM30 method in order to provide the designer with all the information necessary for choosing the best light according to the specific need in the application to be illuminated.

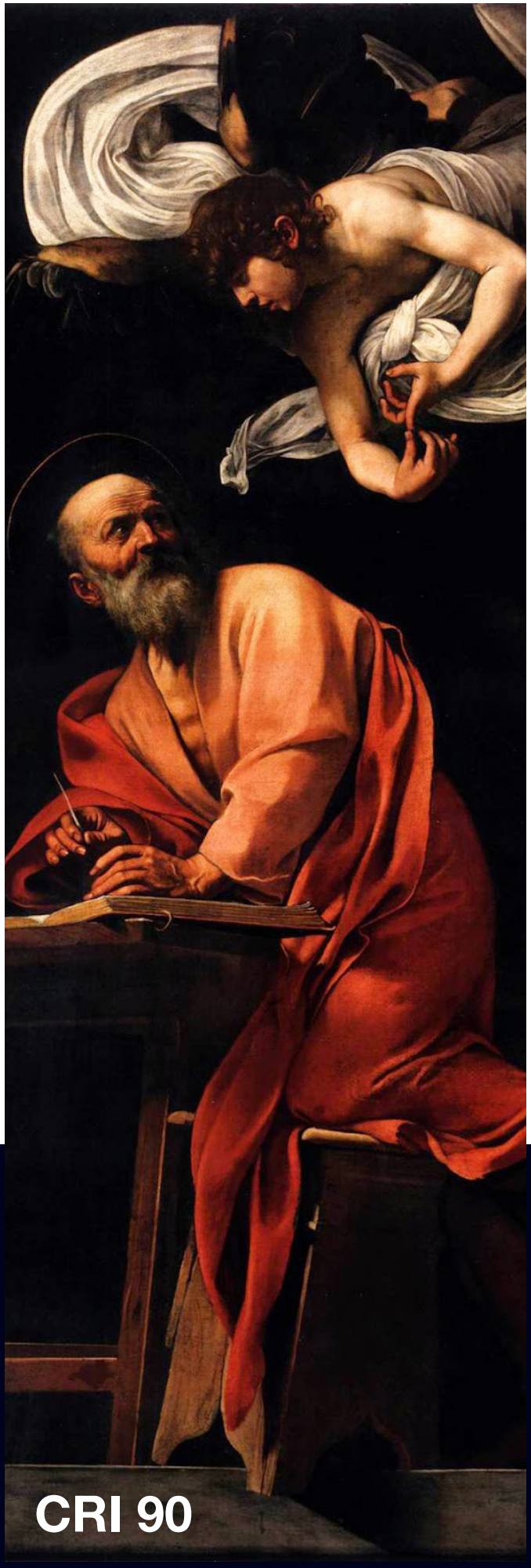
CRI METHOD
CRI (Color Rendering Index) is a measurement method for assessing the ability to recognize a color, developed by CIE 13.3.

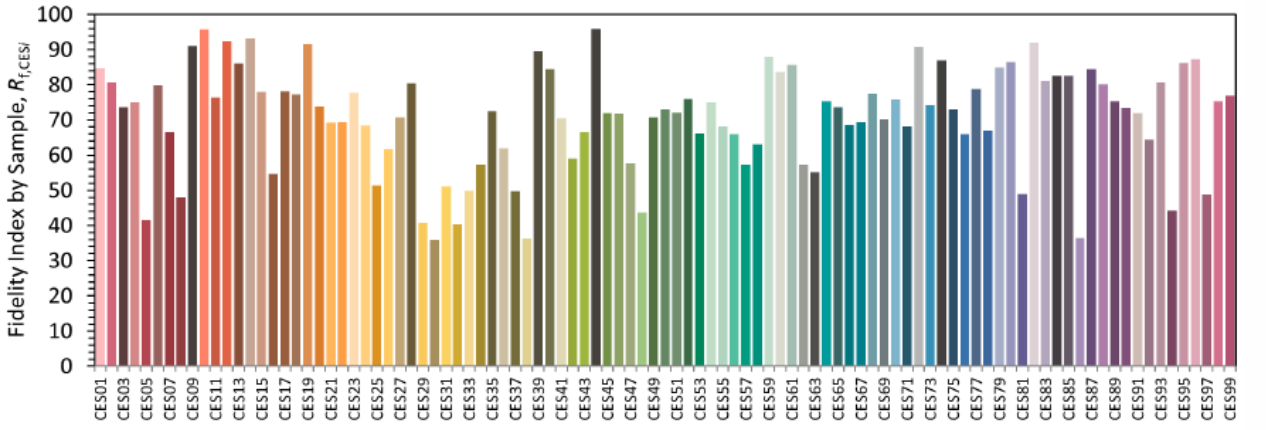
The Ra parameter provides an average indication over the entire light spectrum and is obtained from the average of the colour rendering indexes of 8 unsaturated colors (normally individually referred to as R1 to R8).

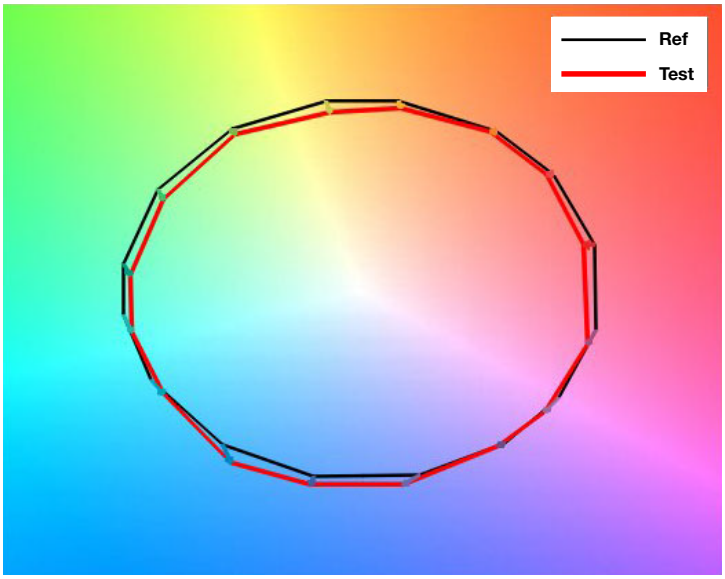
The less used parameter Re, on the other hand, provides a more precise average indication of the entire light spectrum obtained in fact from the average of the color rendering indexes of 14 colors (normally called individually from R1 to R14).
The added reference colors are the 6 most common typologies in daily life.
Index 100 means that the exposed color is recognized in a perfect way, as in sunlight, while lower indices indicate a greater growing difficulty in recognizing that particular color.

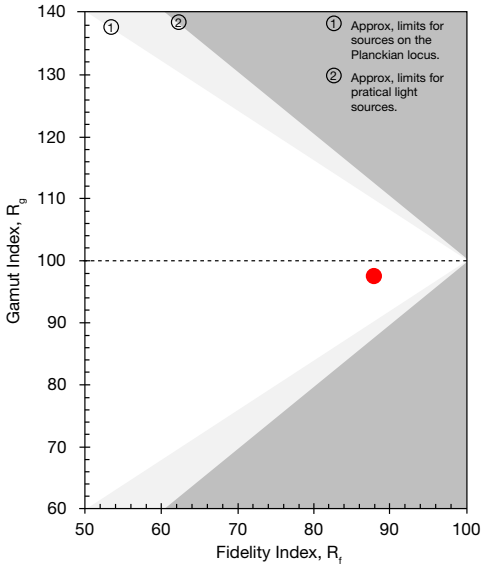
Note:
All 3F Filippi LEDs have an average colour rendering index Ra of 85. it is possible to request high colour rendering index Ra>90 on some products.


CRI 80


CRI 90







TM 30 METHOD

Very precise measurement method developed by the American IES (Illuminating Engineering Society), according to the TM30 as it is based on the color rendering comparison of 99 sample colors (Color Evaluation Samples - CES).

The spectroradiometric measurement provides the evaluation of two quantities:

- Rf Loyalty index.
- Rg Saturation index (Gamut).

It also introduces important indications on the ability of the various sources to restore the fidelity of the materials and the color distortion diagram that represents the variations in hue and saturation of each source.

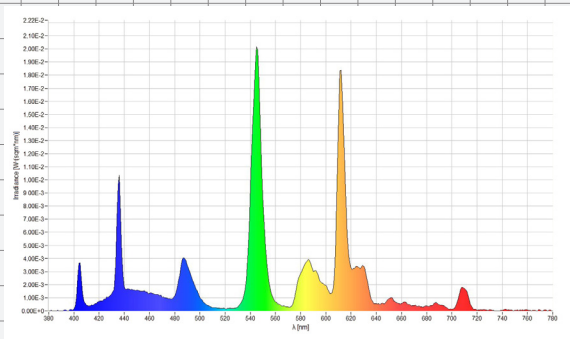
Rf (Fidelity) is similar to CRI but more precise and provides indications about the fidelity of color rendering.
Its maximum value is 100.

Rg (Gamut) provides an indication of the source's ability to reproduce color saturation (amplitude of the color gamut).
A value of 100 indicates that, on average, the test source does not change the hue and saturation of the ESCs, compared with the sample source.
A value> 100 indicates an increase in color saturation and therefore more vivid colors.
A value <100 indicates a decrease in saturation.

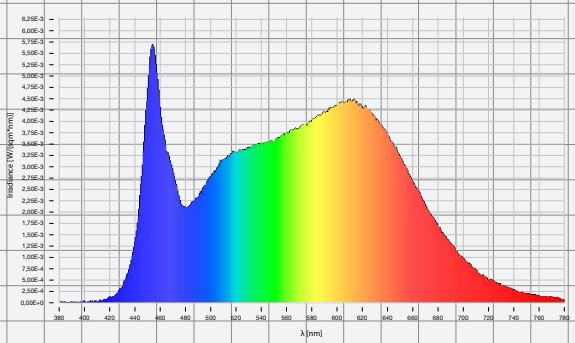
CORRELATED COLOR TEMPERATURE (CCT)

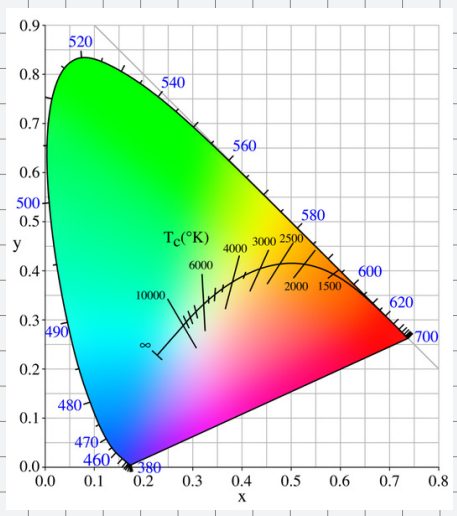
The CCT correlated color temperature is expressed in Kelvin and is defined on the basis of comparison with the light emitted by an ideal black body of reference at the different temperatures. A source will therefore have a color temperature of 4,000K, when the light emitted will have the same hue as that of the black body brought to the reference temperature of 4,000K.
It is important to specify that CCT is totally independent of the color rendering of the source and does not provide any information on it.

Typical light spectrum of fluorescence



Typical light spectrum of LED





A warm light normally hovers around 3,000K, a neutral white hovers around 4,000K while a cold white hovers around 6,000K.

Note:
Combined with each other, “Rf” and “Rg” allow you to define the color rendering of a light source in a differentiated but more complete way.

/ Glossary

Luminous flux
The luminous flux, or light flow, coming from the luminaire represents the quantity of light actually coming out of the device, as its value is defined having already taken into account the luminous efficiency of the luminaire.

Luminous efficacy of the luminaire
The luminous efficacy of the luminaire is the most useful parameter for the designer to determine the right lighting luminaire because provides the practical data between the light emission and the overall absorption of the lighting luminaire.

Relative humidity UR
For correct maintenance and operation of traditional LED modules over time, the maximum permissible humidity on the component is 85%.
For specific applications, UR95 LED modules may be required, guaranteeing correct operation at humidity values of up to 95%.

Lifetime (L value)
As previously mentioned, LED sources, unlike traditional lighting, do not tend to suddenly blow at the end of their lifetime; LEDs rather have a gradual reduction of their luminous output overtime before completely running out after a very long time.
The percentage decline of the luminous flux with reference to the useful number of operating hours (usually 50,000 hours) is therefore determined with the parameter “L”.
L85:50000h therefore means that, having reached 50,000 h of operation, the LED module still provides 85% of its initial luminous flux.

LED life expectancy (B value)
In LED ratings the value B, followed by a value normally between 10 and 50, indicates the quality of the component used as it defines the percentage of components which, after the normal 50,000 h has elapsed, maintain their rated luminous flux.

An LED with declared values of L85/B10=50,000h indicates that on reaching 50,000h, 90% (B10) of the components will have a residual luminous flux of at least 85% of the initial value (L85).
If, in the listed characteristics of the LED luminaire, the value B is not indicated, this is considered to be a B50 device - or in other words, 50% of the LEDs do not guarantee the average useful life value indicated.
We should clarify that this parameter is strongly influenced by the operating conditions of the LED inside the luminaire, and the result is therefore a combination of the quality of the component and good research.

LED failure rate (C value)
This value indicates the percentage of LEDs which are no longer operational at the end of their lifetime.
This value can be indicated with two combinations:
- L85/B10/C0: 50,000 hours - indicates that after 50,000 hours, the percentage of LEDs no longer working is 0%.
- L85/B10: 50,000 hours - L0/C10: 200,000 hours - indicates that after 200,000 hours, the percentage of LEDs no longer working is 10%.

All LEDs used by 3F Filippi have a failure rate C0 after 50,000 hours. If this value is not indicated, it should be considered C0.

Colour tolerance (MacAdam ellipses) - SDCM
Measurement of the chromatic co-ordinates performed during production of the LED allows selection (known as Binning) to classify the LEDs on the basis of their chromatic differences.
This classification, performed via analysis of the so-called MacAdam ellipses (which express colour deviations on the XY axes), allows constant tonality to be obtained among the individual LEDs in the same group and an SDCM (Standard Deviation of Colour Matching) which can be classified as:
- With the value 1 there is no chromatic difference between the individual LEDs.
- With values 2 and 3 the difference is not visible to the human eye and the LEDs are considered of good quality.
- With a value of 4, the difference begins to become visible to the human eye.
- As the value increases, the difference is increasingly noticeable, and the type of application will dictate whether these differences in colouration in the LED group used are acceptable or not.

3F Filippi provides both the initial value and the value over time. Indeed, due to the consumption of phosphors present in the LEDs, the colour tolerance can change over time.
All LEDs used by 3F Filippi always have an initial colour tolerance value of less than 3 MacAdams SDCM, and a colour tolerance value over time of less than 3.

/ 3F LED Technology

FLICKER is defined as “the rapid variation of the intensity of a light source over time”; in particular that relating to the frequency range between 0-80Hz.

When fluctuations on the other hand belong to the interval between 80Hz-2KHz this are called “Stroboscopic effects” in which light fluctuation produces an incorrect perception of the movement of objects lit by the same source by a static observer.

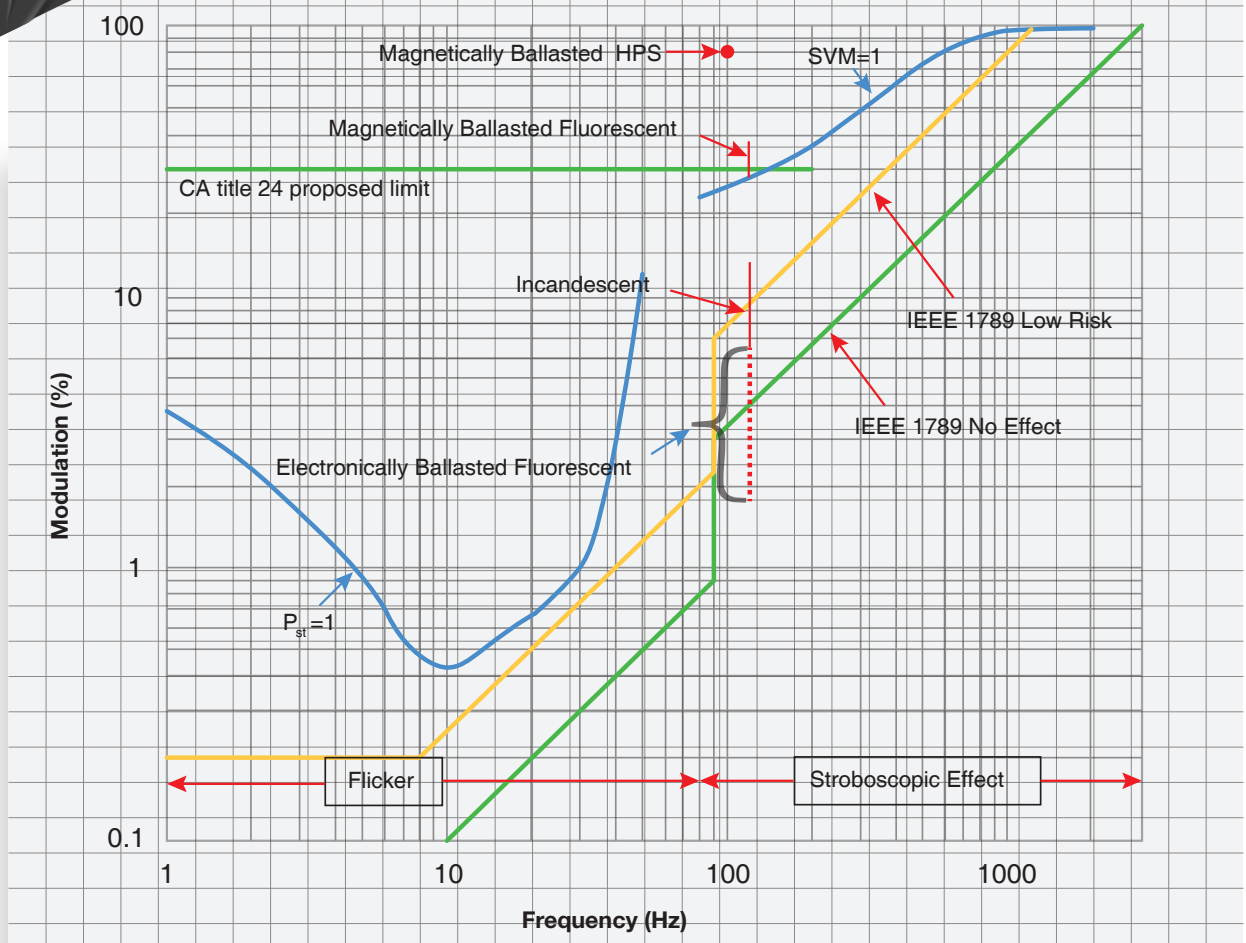
This phenomenon became increasingly important following the introduction of LED light sources for general lighting given the combination of the following aspects:

- LED sources are characterised by a high speed response to fluctuations in the power supply which translate into variations of the light emitted.
- Unwanted residual fluctuations of the driving current of LED sources generated by the electronic power supplies used.
- Modulation of the driving current of LED sources for example PWM (Pulse Width Modulation), necessary to adjust the emission level.
- Any instability in the operation of dimmers connected externally to the LED source power supplies.

This fluctuation in light intensity, according to the frequency, intensity, viewing angle, level of light in the environment, age of the observer and their sensitivity level, can be perceptible on a conscious and/or unconscious level and generate a series of side effects depending on the sensitivity level such as: headaches, visual fatigue, distraction etc.

In order to mitigate the risks on health in lighting contexts using LED sources, recommendations have been developed for the American market (see: IEEE Std 1789™- 015), and the European market with Technical Reports IEC TR 61547-1 and IEC TR 63158.

Note:
The graph on the opposite page summarises the limits set by the two different ‘regulatory’ frameworks, based on different evaluation mechanisms, for determining when a device is ‘SAFE’ for the observer.



Fixtures with the **"SAFE FLICKER"** logo have parameters of **Pst LM=1 and SVM≤0,4, in compliance with regulations IEC TR 61547-1 and IEC TR 63158**, to ensure a more comfortable and safe light.

Pst LM (Short-Term flicker) Quantifies visible Flicker that is harmful to human health caused by the modulation of light in the frequency range between 0.3Hz and 80Hz. **The recommended threshold is Pst LM =1.**
Note – This value was determined based on a representative test group of people and identifies the average perception threshold of visible flicker.

SVM (Stroboscopic Visibility Measure) Quantifies stroboscopic effects that can occur in situations relating to objects in movement in the presence of modulation of light in the frequency range between 80Hz and 20KHz. **SVM=0,4 represents the visibility threshold in a test group of people that quantifies the stroboscopic effect in defined laboratory conditions.**

Fixtures that do not bear the "SAFE FLICKER" logo on the other hand show the flicker value declared by the driver manufacturer which is not determined according to IEC criteria.
Constant renewal of drivers will bring about the introduction of new models in line with IEC requirements.
For more details and/or specific needs please contact our technical department.

/ Emergency

EP LED PERMANENT EMERGENCY LIGHTING
When power is on, EP luminaires operate like normal luminaires.
The LED module connected to the emergency kit turns on or remains on automatically in the absence of mains voltage.
The luminous flux declared on the datasheets are the minimum required for the entire duration of nominal autonomy as required by the regulation CEI EN 60598-2-22 and are those to be considered in the design phase. The luminous flux indicated are the OUTPUT ratio of the fixture.

ENP NON-PERMANENT EMERGENCY LED LIGHTING
In ENP luminaires, the LED module switches on only in emergency mode, when there is a power cut.
The luminous flux declared on the datasheets are the minimum required for the entire duration of nominal autonomy as required by the regulation CEI EN 60598-2-22 and are those to be considered in the design phase. The luminous flux indicated are the OUTPUT ratio of the fixture.

On request:
- Emergency mode with 3 hours duration, 24 hours recharge, or 1.5 hours duration and 12 hours recharge (according to feasibility), maintaining the same percentage of the standard luminous flux.
- Emergency lighting with 2 hours battery life and 12 hours charging (according to feasibility), for the emergency lighting luminous flux percentage contact our Sales team or our technical department.
- Wiring with intelligent control systems and centralised or local self-diagnostics of emergency lighting.

CENTRALISED EMERGENCY LIGHTING POWER SUPPLY
Fixtures in compliance with EN 60598-2-22 to power a centralised emergency system CPSS (Central Power Supply System), not integrated into the fixture – excluding high risk areas.

230Vdc Centralised power supply (As an example and subject to change without notice)
Normally when the centralised source is in 230Vdc direct current (nominal), in emergency lighting the following functions occur:

- Fixtures equipped with DALI drivers by default reduce their power and as a consequence their output flow by 15%.
- Fixtures equipped with NON ADJUSTABLE drivers maintain their power and as a result their output flow at a maximum level.

230Vac Centralised power supply (As an example and subject to change without notice)
When the centralised source is in 230Vac alternating current, in emergency lighting the following functions occur:

- Fixtures equipped with DALI drivers by default increase their power and as a result their output flow at a maximum level (100%) (when the DALI system fails).
- Fixtures equipped with NON ADJUSTABLE drivers maintain their power and as a result their output flow at a maximum level.

To check compliance with EN 60598-2-22 and AC/DC operating see the datasheets that can be downloaded from the website.
Assessment of compatibility between the centralised source and drivers as well as compliance with switching times between normal and emergency power supplies and battery life is the exclusive responsibility of the electrical systems designer.
For more information please do not hesitate to contact our Sales Network or Technical Department.

/ Lighting engineering

DIALUX LIGHTING CALCULATION
3F Filippi provides its customers with a free lighting design service thanks to the Dialux calculation software by means of which it is possible to process and calculate in detail the illuminance level and uniformity on horizontal and vertical working planes, and to carry out the calculation on irregularly shaped rooms.
This is possible thanks to a 2D and 3D simulation of the reference environment.

The advantages of this system are:
- To make the calculations more precise and create very realistic environments, architectural and furnishing elements can be placed inside the program's simulation environment.
- The software and the 3F Filippi plug-in are available free to designers, installers and electrical distributors.
- Updates of photometric files and of the lighting engineering software can be downloaded free of charge from our website.
- For further information, contact our technical consultants.

3F Filippi is UNI EN ISO 9001 certified for lighting engineering design too.
The photometric tests are performed by procedures in accordance with the UNI EN 13032 and CIE 121 standards.
3F Filippi has the most advanced computer programs for research and optimisation of louvres and flow recuperators in order to achieve maximum efficiency and suitable light distribution for the most widely varying applications.
This commitment has been recognised and certified by the CSQ (Italian Company Quality Systems Certification) also for the entire phase of lighting engineering design, thus allowing operation under a Quality Assurance system that also covers interior lighting design in accordance with good engineering practice.

Note:
3F Filippi, as further guarantee of the quality of its products and care to meet the strictest standards, is a sustainer of the most lighting engineering associations in the world.

Standards - Indoor lighting

EN 12464-1: 2011
Illumination of interior workplaces

This European standard for illumination of interior workplaces replaces the previous one from 2011, with an increase in the importance of illumination to allow workers to perform their visual tasks efficiently and accurately.

Lighting values are unchanged: the design must include calculation of a maintenance factor that considers both decrease of luminous flux of lamps and level of dust accumulation in the room.

Three calculation areas are defined:

1) TASK AREA

Task area where mean and maintained illuminances (Em) are required as minimum values and for normal visual conditions.
If the task area cannot be determined, the whole area of the room at an illuminance specified by the designer shall be considered and the uniformity shall be as indicated in the table of values, always not less than Uo≥ 0.40.

NB: When more than one task is carried out in the area, the requirements for all individual tasks must be met.

Illuminance scale:

5	7,5	10	15	20	30	50	75	100	150	200	300	500	750	1000	1500	2000	3000	5000	7500	10000

Context modifiers for increase of maintained illuminance:
- visual work is critical;
- errors are costly to rectify;
- accuracy, higher productivity or increased concentration is of great importance;
- task details are of unusually small size or low contrast;
- the task is undertaken for an unusually long time;
- the task area or activity area has a low daylight provision;
- the visual capacity of the worker is below normal.

Context modifiers for decrease of required maintained illuminance:
- task details are of an unusually large size or high contrast;
- the task is undertaken for an unusually short time.

2) IMMEDIATE SURROUNDING AREA

Area of at least 50 cm around the task area requiring minimal lighting changes to avoid visual stress and discomfort.
The size and position of the immediate surrounding area must be stated and documented.

The illuminance of the immediate surrounding area may be lower than the illuminance on the task area, but shall be not less than the values given below for each illuminance scale.

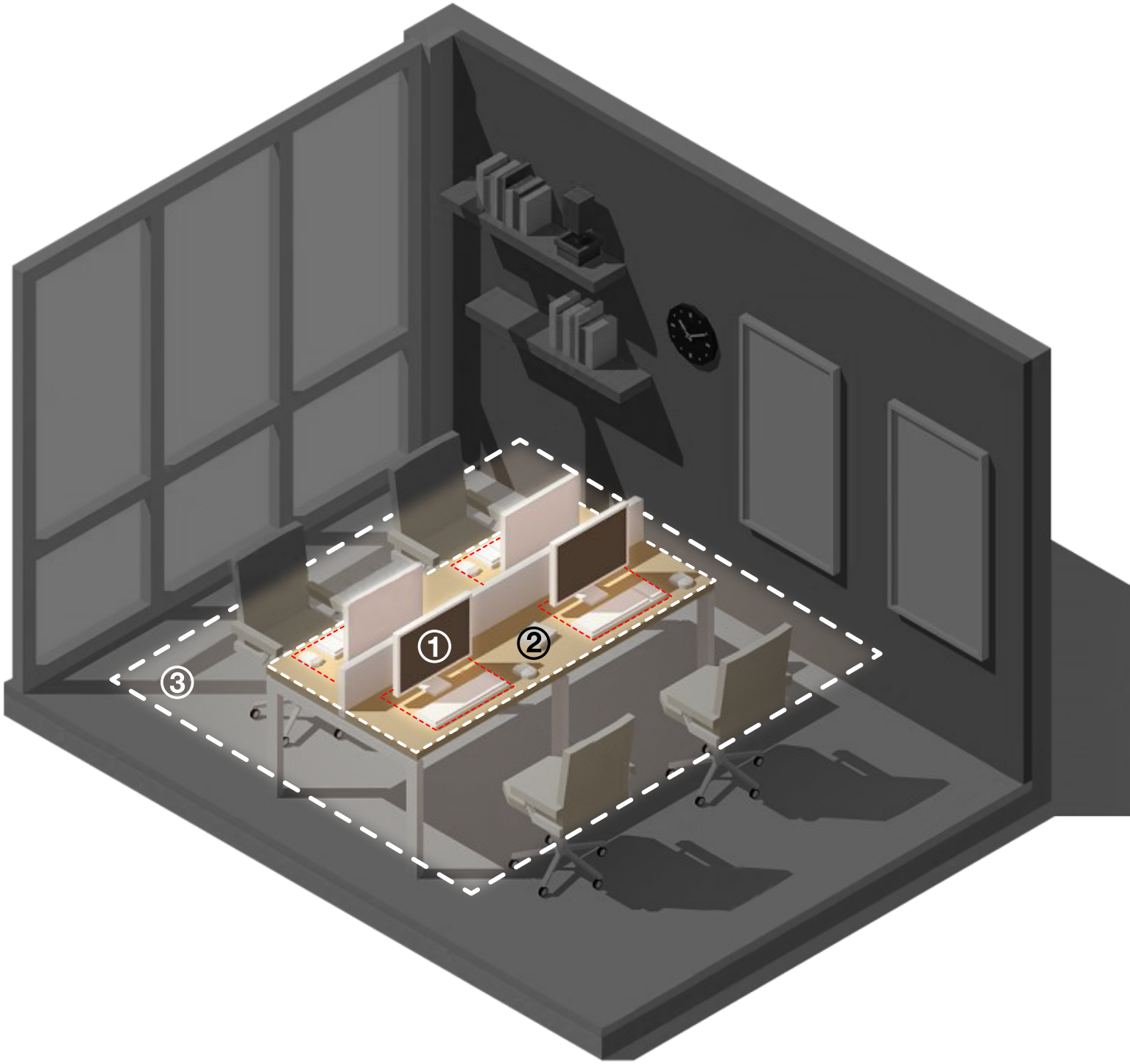
The uniformity of the area must always be at least U ≥ 0,40.

Task Area	Immediate surrounding area
≥ 750 lx	500 lx
500 lx	300 lx
300 lx	200 lx
200 lx	150 lx
≤ 150 lx	same as task area

3) BACKGROUND AREA

The background area is a horizontal area on floor level and it is adjacent to the immediate surrounding area within the limits of space. For larger rooms the band shall be at least 3 m wide. To avoid high impact on uniformity from calculation points near the wall, a band next to the wall can be excluded from the calculation except when the task area is in or extends into this border area. The width of this band is specified as 15 % of the smallest dimension of the area under consideration or 0,5 m (whichever of the two is smaller).

The required maintained illuminance shall be at least 1/3 of the value of the immediate surrounding area and the illuminance uniformity must always be at least Uo ≥ 0,10.
The size and position of the background area shall be stated and documented.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Standards - Indoor lighting

CYLINDRICAL ILLUMINANCE AND MODELLING

For a good visual communication and recognition of objects it becomes very important to assess the volume of space occupied by people, highlight objects, reveal texture and improve the appearance of people within the space.
The terms that describe this lighting conditions are:
• Cylindrical illuminance;
• Modelling.

Cylindrical illuminance
The cylindrical illuminance $\bar{E}z$ is calculated from the average of the vertical illuminances around the measuring point.
Special attention is given to those spaces where visual recognition and communication is of higher importance.
The required maintained average cylindrical illuminance ($\bar{E}m,z$) to be determined on a horizontal plane. The height of the horizontal plane shall be 1,2 m for seated people and 1,6 m for standing people above the floor.
The uniformity of the average cylindrical illuminance shall be Uo ≥ 0,10.

Modelling
The lighting should not be too directional or it will produce harsh shadows, neither should it be too diffuse or the modelling effect will be lost entirely, resulting in a very dull luminous environment.
Modelling describes the balance between diffuse and directed light and should be considered as ratio of cylindrical to horizontal illuminance at a point is an indicator of modelling. Good modelling is achieved with a value between 0,3 and 0,6.
Daylight has a large impact on modelling. For this reason, the benefits can compensate the above values.

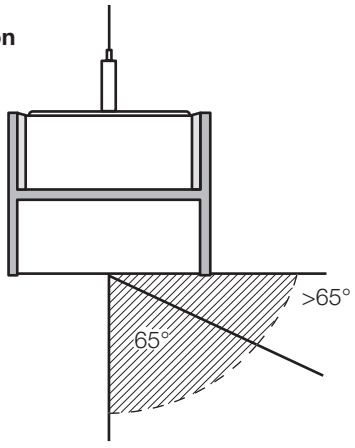
Surfaces illuminance
Illuminance on walls and ceilings (Em wall e Em ceiling), together with surface reflection factors, contribute to the illuminance value of the task and to the perception of room brightness.
I valori minimi di illuminamento medio sono riportati dalla norma in tabella e le uniformità delle singole superfici dovrà essere sempre almeno Uo ≥ 0,10.
In areas with high distance to the ceiling or where the surfaces do not contribute to the perception of brightness (e.g. industrial halls) the illuminance levels can be accepted with reduced values or exclude the high parts of walls and ceiling.

LIMITS OF THE LUMINAIRE LUMINANCE

The average luminance limits of luminaires required by EN 12464-1: 2021 to avoid disturbing reflections on computer screens:

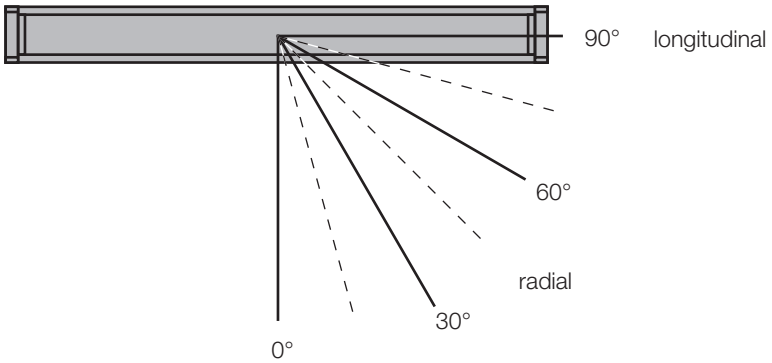
Limits for the average luminaire luminance for radial angles >65°		
Screen high state luminance	High luminance screen L > 200 cd·m^{-2}	Medium luminance screen L ≤ 200 cd·m^{-2}
Case **A** (positive polarity and normal requirements concerning colour and details of the shown information, as used in office, education, etc.)	≤ 3000 cd.m^{-2}	≤ 1500 cd·m^{-2}
Case **B** (negative polarity and/or higher requirements concerning colour and details of the shown information, as used for CAD, colour inspection, etc.)	≤ 1500 cd·m^{-2}	≤ 1000 cd·m^{-2}

Section



Luminance <1000/1500/3000 cd/m²
for angles> 65°

View from top



U.G.R. - Unified Glare Rating

EN 12464-1 requires for each individual application/activity a UGR limit value (RUGL) which can only be determined from the UGR table provided by the manufacturer of the luminaire for standard reference conditions such as regular room, one type of luminaire and symmetrical arrangement.

In case these conditions are not applicable it is possible:
- Consider possible practices for implementing the calculation (see Appendix A of the standard).
- Consider, only if the observer's position and viewing direction are known, determining the value using the point UGR formula for analysis purposes only. In this case, the values resulting from the formula must be considered as a reference only, and not obligatory for compliance with the limits required by the standard, and may be useful to the designer for evaluating the optimal position of the operator inside the room.

It should be noted that the UGR value required by the standard for compliance with the individual application is an installation value obtained from various factors (room dimensions, reflections, characteristics and installation orientation of the luminaire, etc.) and therefore must be calculated for each project.

UGR is a unified international index developed by CIE (Commission Internationale de l'Eclairage) in publication 117 of 1995, to **evaluate direct glare** in every specific application based on the position of luminaires, room characteristics (dimensions, reflections), and on the observation point of workers.
UGR reference values on CIE tables range between 10 and 30 in steps of 3 units (10, 13, 16, 19, 22, 25 and 28) and apply to both directions of view (transverse and longitudinal) to the luminaire: the lower the value, the less direct glare.
European standard EN 12464-1 for the lighting of indoor workplaces requires a UGR value for every application.
Respecting the UGR value in workplaces with VDTs is a necessary but not sufficient condition because the average luminance requirement for luminaires (1000-3000 cd/m^2) is still in effect (see the tables on the previous pages for specific values).

Example of calculation
office with 15W OCW luminaire
EN 12464-1 requires a UGR value of ≤19 for this application.
Data for room and installation:

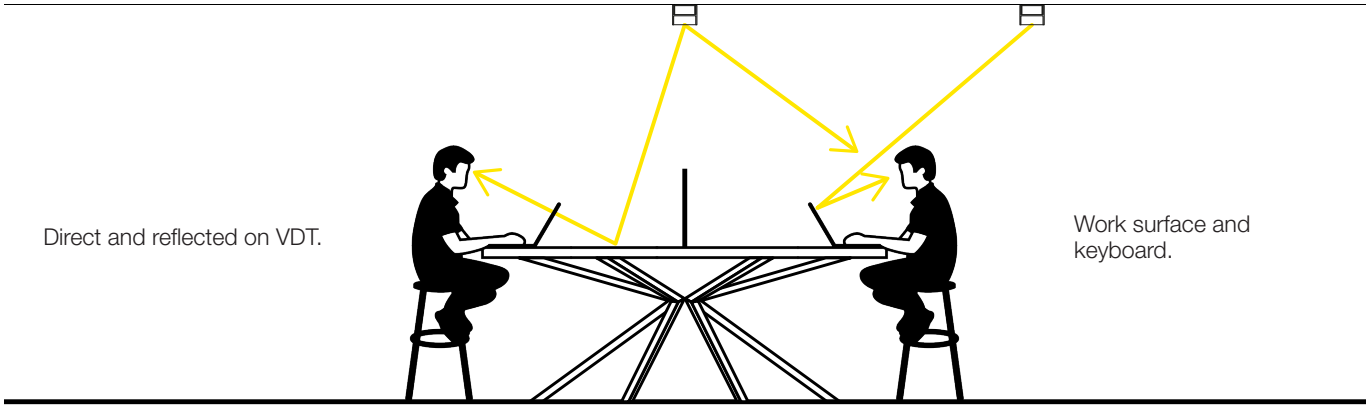
- Room height: 3.2 m
- Height from worker's eye to luminaire H: 3.2-1.2= 2 m
- Transverse distance: 8.0 m ÷ 2 m = 4H
- Longitudinal distance: 16.0 m ÷ 2 m = 8H
- Reflection index: Ceiling 70%; Walls 50%; Floor 20%.

Calculations
- Transverse UGR: 15.2 Value in direction of observation transverse to luminaires.
- Longitudinal UGR: 11.6 Value in direction of observation longitudinal to luminaires.

UGR Table - office luminaire 15W OCW

Ceiling		70	70	50	50	30	70	70	50	50	30
Walls		50	30	50	30	30	50	30	50	30	30
Floor		20	20	20	20	20	20	20	20	20	20
Enviroments		**Transverse view of luminaire**					**Longitudinal view of luminaire**				
X	**Y**										
2H	2H	14.9	15.6	15.1	15.8	16.0	09.4	10.1	09.7	10.3	10.5
	3H	14.9	15.6	15.2	15.8	16.0	10.1	10.7	10.3	11.0	11.2
	4H	15.0	15.6	15.3	15.8	16.1	104	11.0	10.7	11.3	11.5
	6H	15.0	15.6	15.3	15.9	16.2	10.7	11.3	110.	11.5	11.8
	8H	15.0	15.6	15.4	15.9	16.2	10.8	11.3	11.1	11.6	11.9
	12H	15.0	15.6	15.4	15.9	16.2	10.8	11.3	11.2	11.6	12.0
4H	2H	14.7	15.4	15.0	15.6	15.9	09.6	10.2	09.9	10.5	10.7
	3H	14.9	15.4	15.7	15.7	16.0	10.5	11.0	10.9	11.3	11.6
	4H	15.0	15.5	15.8	15.8	16.1	11.0	11.4	11.4	11.8	12.1
	6H	15.1	15.5	15.9	15.9	16.3	11.4	11.8	11.8	12.2	12.5
	8H	15.2	15.5	15.9	15.9	16.3	11.6	11.9	12.0	12.3	12.7
	12H	15.2	15.5	15.9	15.9	16.3	11.6	11.9	12.1	12.3	12.8
8H	4H	15.0	15.3	15.4	15.7	16.1	11.2	11.6	11.6	11.9	12.3
	6H	15.2	15.5	15.6	15.9	16.3	11.8	12.0	12.2	12.4	12.9
	8H	15.3	15.5	15.7	15.9	16.4	12.0	12.2	12.4	12.6	13.1
	12H	15.3	15.5	15.8	16.0	16.5	12.1	12.3	12.6	12.7	13.2
12H	4H	15.0	15.3	15.4	15.7	16.1	11.2	11.5	11.7	11.9	12.3
	6H	15.2	15.4	15.6	15.8	16.3	11.8	12.0	12.3	12.5	12.9
	8H	15.3	15.5	15.8	15.9	16.4	12.1	12.2	12.5	12.7	13.2

GLARE



Reflection coefficients to use for lighting calculations

Reflections in % of painted surfaces and materials (ceiling max 85%; walls max 50%; floor max 30%).

White	75 ÷ 85
Light cream	70 ÷ 80
Yellow	60 ÷ 70
Light grey	45 ÷ 65
Pink	45 ÷ 55
Light red	20 ÷ 30
Medium grey	20 ÷ 40
Light blue, green	35 ÷ 55
Dark grey, green, red	10 ÷ 20
Black	03 ÷ 05

Panels in light-coloured mineral fibre	75 ÷ 85
Panels in light-coloured wood	50 ÷ 60
Plaster	70 ÷ 80
White paper	70 ÷ 80
Window panes	06 ÷ 08
Light-coloured curtains with narrow mesh	65 ÷ 70
Light-coloured curtains with wide mesh	35 ÷ 40
Cement, rough concrete	20 ÷ 30
Light-coloured marble	40 ÷ 60
Granite	15 ÷ 20

Maintenance factors to use for lighting calculations

The lighting of a room is the result of the interaction between the luminaires, their condition of use, the aging of the sources and the environment in which they are installed.

The reference standard is certainly ISO/CIE TS 22012 "Light and lighting - Maintenance factor determination - Way of working" which provides the designer with various information attachments with examples and reference values to be considered during the design phase.

The maintenance factor f_m is determined by the following formula:

$$f_M = f_{LF} \cdot f_S \cdot f_{LM} \cdot f_{SM}$$

f_{LF} (Luminous flux factor) is the decay factor of the luminous flux of the source over time (for LEDs it is the declared factor Lx).
The luminous flux (lumen) of an operating source gradually decreases over time.
This reduction depends on the type of light source and on the operating conditions related to the thermal management of the lighting luminaire.
This factor is defined on the basis of the drop in luminous flux before performing maintenance (changing the lamp or luminaire).
In the case of CLO (Constant light output) drivers the factor to be considered is 1.

f_S (Survival factor) represents the mortality rate of the light sources.
After a certain period of time the light sources can go out. This phenomenon suddenly reduces the level of lighting inside the rooms.
In the case of sources that do not have mortality due to their technology (for example the LED), this factor must be considered equal to 1.

f_{LM} (Luminaire maintenance factor) represents the reduction of the luminous flux of the luminaire due to dirt.
Dirt and dust present in almost all environments accumulate on the lamp, considerably reducing the amount of light emitted.
When they accumulate on the surfaces of the luminaire, the amount of light reflected or transmitted by these surfaces is also reduced.
This factor depends on the environment where the lighting luminaire is located, on the type of construction characteristics (for example: luminaire with or without screen, indirect lighting with greater dust deposit, degree of protection, any chimney effect that removes dust from the surfaces reflective), expected cleaning cycle (every 1-2-3-… years).

f_{SM} (Surface maintenance factor) represents the reduction of reflections on the surfaces of the room due to dirt.
Dirt on the surfaces of rooms tends to reduce the amount of reflected light.
Clean surfaces maintain the ambient lighting level more.
This factor depends on the type of activity carried out and the type of processing, for example in an office with weekly cleaning and repainting at regular intervals, this maintenance factor will be higher than in a factory with monthly cleaning intervals and repainting to be carried out only in case of real need.

Average illuminations maintained by EN 12464-1: 2021 (**indoor environments**)

Main tasks and activities	Ēm lx	Uo	Ra	R UGL	Ēm,z lx	Ēm, wall lx Uo≥0,10	Ēm, ceiling lx
TRANSIT AREAS AND ROOMS FOR GENERAL USE IN BUILDINGS							
Circulation areas and corridors (Illumination on the floor.)	100	0,4	40	28	50	50	30
Stairs, escalators, moving walkways, lifts, hoists (Illumination on the floor.)	100	0,4	40	25	50	50	30
Area in front of lifts, lifts and escalators (Illumination on the floor.)	200	0,4	40	25	75	75	50
Loading ramps/bays	150	0,4	40	25	50	50	-
Building entrance with canopy	30	0,4	-	-	-	-	-
COMMON SPACES IN BUILDINGS							
Canteens and break areas	200	0,4	80	22	75	75	50
Rest rooms	100	0,4	80	22	50	50	30
Exercise rooms	300	0,4	80	22	100	100	75
Cloakrooms, toilets, bathrooms, changing rooms, lockers, showers, washbasins and toilets	200	0,4	80	25	75	75	50
General cleaning	100	0,4	-	-	50	50	30
OFFICES							
Filing and copying	300	0,4	80	19	100	100	100
Writing, typing, reading, data processing, CAD workstations, conference and meeting rooms	500	0,6	80	19	150	150	100
Technical drawing	750	0,7	80	16	150	150	100
Reception desk	300	0,6	80	22	100	100	75
Archives	200	0,4	80	25	75	75	50
SCHOOLS							
Nurseries: Playroom and crèche	300	0,4	80	22	100	100	75
Kindergartens: classrooms for handicrafts	300	0,6	80	19	100	100	75
Classrooms - general activities, auditorium, reading rooms	500	0,6	80	19	150	150	100
Classrooms used by young children - general activities	300	0,6	80	19	150	150	100
Seating areas in auditoriums and training rooms	200	0,6	80	19	75	75	50
Blackboards and screens (Vertical illuminance.)	500	0,7	80	19	-	-	-
Display board (Vertical illuminance.)	200	0,6	80	19	-	-	-
Computer room	300	0,6	80	19	100	100	75
Art education classrooms in art schools (4 000 K ≤ Tcp ≤ 6 500 K)	750	0,7	90	19	150	150	100
Technical drawing rooms	750	0,6	80	19	150	150	100
Classrooms for technical education and handicraft workshops	500	0,6	80	19	150	150	100
Preparation rooms and workshops	500	0,6	80	22	150	150	100
Entrances	200	0,4	80	22	75	75	50
Circulation areas, corridors, storage of teaching materials (Illumination on the floor.)	100	0,4	80	25	50	50	30
Stairs (Illumination on the floor.)	150	0,4	80	25	50	50	30
Common rooms for students and lecture hall	200	0,4	80	22	75	75	50
Teachers' rooms	300	0,6	80	19	100	100	50
Buildings, gyms, swimming pools (See also EN 12193.)	300	0,6	80	22	100	75	30
Canteen	200	0,4	80	22	75	75	50
Kitchen	500	0,6	80	22	100	100	75

Average illuminations maintained by EN 12464-1: 2021 (**indoor environments**)

Main tasks and activities	Ēm lx	Uo	Ra	R UGL	Ēm,z lx	Ēm, wall lx Uo≥0,10	Ēm, ceiling lx
LIBRARIES							
Shelves (Vertical illumination on shelves.)	200	0,4	80	19	-	-	-
Reading areas	500	0,6	80	19	100	100	50
Public service areas	500	0,6	80	19	150	150	50
General lighting	300	0,4	80	22	75	75	50
COMMON SPACES IN PUBLIC PLACES							
Inputs	100	0,4	80	22	50	50	30
Wardrobe	200	0,4	80	25	75	75	50
Waiting rooms	200	0,4	80	22	75	75	50
Ticket offices	300	0,6	80	22	75	75	50
RESTAURANTS AND HOTELS							
Reception desk, cashier's desk, doorman's desk	300	0,6	80	22	100	100	75
Kitchen	500	0,6	80	22	100	100	75
Self-service restaurants	200	0,4	80	22	75	75	50
Buffet	300	0,6	80	22	75	75	50
Conference rooms	500	0,6	80	19	150	150	100
Corridors (Illumination on the floor.)	100	0,4	80	25	50	50	30
THEATRES, CONCERT HALLS, CINEMAS, PLACES OF ENTERTAINMENT							
Test rooms	300	0,6	80	22	100	100	75
fitting rooms	300	0,6	90	22	100	100	75
Spectator seats - maintenance, cleaning (Illumination on the floor.)	200	0,5	80	22	50	50	30
Stage area - facilities (Illumination on the floor.)	300	0,4	80	25	75	75	30
INDOOR PARKING							
Entrance/exit ramps (day) (Illumination on the floor.)	300	0,4	40	25	75	75	50
Traffic lanes, internal ramps, pedestrian paths, entrance/exit ramps (at night) (Illumination on the floor.)	75	0,4	40	25	50	50	30
Parking areas - not open to the public (Illumination on the floor.)	75	0,25	40	-	50	30	15
Parking areas - open to the public with a large number of users (shopping centres, etc.) (Illumination on the floor.)	150	0,4	40	-	50	50	15
Ticket office	300	0,6	80	19	75	75	50
COMMERCIAL AND/OR EXHIBITION AREAS							
Sales areas	300	0,4	80	22	75	75	30
Cash desks	500	0,6	80	19	100	75	30
Packaging desk	500	0,6	80	22	100	-	50
Storage area	300	0,4	80	25	50	-	-
Changing room / dressing room	300	0,4	90	-	-	-	-
Trade fairs, exhibition halls (general lighting)	300	0,4	80	22	50	50	30
CONTROL ROOMS							
Plant rooms, switch room	200	0,4	80	25	50	50	30
Mail sorting, control panels	500	0,6	80	19	150	150	100
Surveillance station	300	0,6	80	19	100	100	75

Average illuminations maintained by EN 12464-1: 2021 (**indoor environments**)

Main tasks and activities	Ēm lx	Uo	Ra	R UGL	Ēm,z lx	Ēm, wall lx Uo≥0,10	Ēm, ceiling lx
INDUSTRIAL AND CRAFT ENVIRONMENTS							
Refrigerated warehouses							
Warehouses, storage areas (200 lx if continuously occupied)	100	0,4	80	25	50	50	30
Handling, packaging, shipping areas	300	0,6	80	25	100	50	30
Handout	200	0,4	80	25	-	-	-
Logistics and warehouses							
Loading/unloading area	200	0,4	80	25	50	50	30
Packing and grouping area	300	0,5	80	25	100	100	30
Configuration and editing	750	0,6	80	22	150	150	30
Open goods depot	200	0,4	80	25	50	50	30
Warehouse aisles: with staff and storage shelves (Illumination on the floor.)	150	0,5	80	25		-	30
Storage shelves - front (On the shelf side of the corridor.)	75	0,4	80	-	-	-	-
Central logistic corridor (heavy traffic)	300	0,6	80	25	100	100	30
Automated areas (unmanned)	75	0,4	80	25			
Agriculture							
Loading and handling of goods, moving equipment	200	0,4	80	25	50	50	-
Livestock buildings	50	0,4	40	-	-	-	-
Preparation of fodder, dairies, tool washing, sick animal areas, farrowing cells	200	0,6	80	25	50	50	-
Ovens, bakeries and pastry shops							
Preparation, baking	300	0,6	80	22	100	100	50
Finishing, glazing, decorating	500	0,7	80	22	150	150	75
Cement, concrete and brick industry							
Drying	50	0,4	20	28	-	-	-
Preparation of materials, oven and mixer work	200	0,4	40	28	50	50	-
General machining, coarse shaping	300	0,6	80	25	100	100	-
Ceramic, tile and glass industry							
Drying	50	0,4	20	28	-	-	-
Preparation, general machining, enamelling, laminating, moulding, forming of simple parts, assembly, glassblowing	300	0,6	80	25	100	100	-
Glass grinding, engraving, polishing, precision forming, glass instrument manufacture	750	0,7	80	19	150	150	100
Optical glass and crystal grinding, hand grinding and engraving	750	0,7	80	16	150	150	100
Precision work, e.g. decorative grinding, hand-painting (4 000 K ≤ Tcp ≤ 6 500 K)	1 000	0,7	90	16	150	150	100
Manufacture of synthetic precious stones (4 000 K ≤ Tcp ≤ 6 500 K)	1 500	0,7	90	16	150	150	100
Chemical, plastic and rubber industry							
Remote controlled process plant	50	0,4	20	-	-	-	-
Process plant with limited manual intervention	150	0,4	40	28	50	50	30
Workstations in process plants with continuous staff presence	300	0,6	80	25	100	100	50
Precision measurement environments, laboratories	500	0,6	80	19	150	150	75
Pharmaceutical and tyre production	500	0,6	80	22	150	150	75
Colour control (4 000 K ≤ Tcp ≤ 6 500 K)	1 000	0,7	90	19	150	150	100
Cutting, finishing, inspection	750	0,7	80	19	150	150	100

Average illuminations maintained by EN 12464-1: 2021 (**indoor environments**)

Main tasks and activities	Ēm lx	Uo	Ra	R UGL	Ēm,z lx	Ēm, wall lx Uo≥0,10	Ēm, ceiling lx
INDUSTRIAL AND CRAFT ENVIRONMENTS							
Electrical and electronics industry							
Large coil winding, cable and wire manufacture, coil impregnation and galvanising, coarse assembly (e.g. large transformers)	300	0,6	80	25	100	100	50
Medium-sized coil winding, medium assembly (e.g. electrical panels)	500	0,6	80	22	150	150	75
Winding small reels, fine assembly (e.g. telephones, radios and IT equipment such as computers)	750	0,7	80	19	150	150	100
Precision assembly (e.g. measuring instruments, printed circuit boards)	1 000	0,7	80	16	150	150	100
Electronic laboratory, testing, fine-tuning	1 500	0,7	80	16	150	150	100
Food industries							
Workplaces in breweries, malt fermentation, sugar factories, tobacco fermentation and drying, fermentation cellars, washing, barrel filling, cleaning, sieving, peeling, cooking in canning and chocolate factories	200	0,4	80	25	50	50	30
Sorting and washing products, chopping, mixing, packaging, Vegetable and fruit cutting and sorting	300	0,6	80	25	100	100	50
Workstations and critical areas in slaughterhouses, butchers, dairies, mills, filtering in sugar refineries	500	0,6	80	25	150	150	75
Gastronomic production, kitchen work, cigar and cigarette production, glass and bottle control, product control, garnishing, sorting	500	0,6	80	22	150	150	75
Laboratories (4 000 K ≤ Tcp ≤ 6 500 K)	500	0,6	80	19	150	150	100
Colour inspection	1 000	0,7	90	19	150	150	100
Foundries							
Maintenance tunnels, basements, etc.	50	0,4	20	-	-	-	-
Platforms	100	0,4	40	25	50	50	30
Sand preparation, changing rooms, workstations at the cupola and mixer, casting area, detaching area, machine moulding	200	0,4	80	25	50	50	30
Manual core moulding	300	0,6	80	25	100	100	50
Die-casting	300	0,6	80	25	100	100	50
Model construction	500	0,6	80	22	150	150	75
Laundries and dry cleaners							
Garment collection, marking and sorting, dry cleaning and washing, Ironing, steam ironing	300	0,6	80	25	100	100	50
Inspection and repair	750	0,7	80	19	150	150	100
Leather industry							
Interior work, tank, pit	200	0,4	80	25	75	75	30
Fleshing, fulling, pulling, polishing of skins	300	0,4	80	25	100	100	50
Saddlery work, shoe manufacture: stitching, polishing, shaping, cutting, drilling, leather dyeing (by machine), shoe and glove manufacture	500	0,6	80	22	150	150	100
Selection (4 000 K ≤ Tcp ≤ 6 500 K)	500	0,6	90	22	150	150	100
Quality control	1 000	0,7	80	19	150	150	100
Colour inspection (4 000 K ≤ Tcp ≤ 6 500 K)	1 000	0,7	90	19	150	150	100

Average illuminations maintained by EN 12464-1: 2021 (**indoor environments**)

Main tasks and activities	Ēm lx	Uo	Ra	R UGL	Ēm,z lx	Ēm, wall lx Uo≥0,10	Ēm, ceiling lx
INDUSTRIAL AND CRAFT ENVIRONMENTS							
Metal working and transformation							
Welding, die forging, drawing workshop, tube construction, cold forming, galvanising	300	0,6	80	25	75	75	30
Machining: coarse and medium: tolerance ≥ 0.1 mm, sheet processing: thickness <5mm	300	0,6	80	22	75	75	30
Precision machining; grinding; tolerances < 0.1 mm	500	0,7	80	19	150	150	75
Coarse assembly, free forging and laminate processing: thickness ≥ 5 mm	200	0,6	80	25	50	50	30
Medium assembly	300	0,6	80	25	75	75	30
Fine assembly	500	0,6	80	22	150	150	75
Precision assembly, scribing, inspection, tool making and cutting tools	750	0,7	80	19	150	150	100
Surface preparation and painting	750	0,7	80	25	150	150	100
Equipment, preparation of templates and gauges, precision mechanics, micromechanics	1 000	0,7	80	19	150	150	100
Paper industry and paper objects							
Dough preparation and refining	200	0,4	80	25	50	50	30
Paper manufacturing and converting, paper and corrugated board machinery, paperboard manufacture	300	0,6	80	25	75	75	50
Binding work, e.g. folding, sorting, gluing, cutting, embossing, sewing	500	0,6	80	22	150	150	100
Power plants							
Fuel supply system	50	0,4	20	-	-	-	-
Boiler rooms	100	0,4	40	28	50	50	30
Annexed rooms, e.g.: pump rooms, condenser rooms, internal control panels, machine rooms	200	0,4	80	25	50	50	30
Control stations	500	0,7	80	19	150	150	100
Printworks							
Cutting, gilding, relief printing, stone engraving, stone and plate work, printing machines, matrix construction, sheet sorting and hand printing	500	0,6	80	19	150	150	75
Character editing, retouching, lithography	1 000	0,7	80	19	150	150	100
Colour control in polychrome prints (4 000 K ≤ Tcp ≤ 6 500 K)	1 500	0,7	90	16	150	150	100
Engraving on steel and copper	2 000	0,7	80	16	150	150	100
Rolling mills, iron and steel processing							
Production systems without manual intervention	50	0,4	20	-	-	-	-
Production plants with occasional manual intervention	150	0,4	40	28	50	50	30
Production equipment with continuous manual intervention, furnace	200	0,6	80	25	50	50	30
Rolling stock, maintenance tunnels, belt section, underground, etc.	50	0,4	20	-	-	-	-
Rolling train, winders, cutting line	300	0,6	40	25	75	75	30
Control platforms, control panels	300	0,6	80	22	75	75	30
Testing, measurement and control	500	0,6	80	22	150	150	100

Average illuminations maintained by EN 12464-1: 2021 (**indoor environments**)

Main tasks and activities	Ēm lx	Uo	Ra	R UGL	Ēm,z lx	Ēm, wall lx Uo≥0,10	Ēm, ceiling lx
INDUSTRIAL AND CRAFT ENVIRONMENTS							
Textile processing and manufacturing							
Workstations at the side of the washing tanks, opening of bales	200	0,6	60	25	50	50	30
Carding, washing, ironing, drawing, combing, sizing, gluing, punching cartons, pre-spinning, spinning jute and hemp	300	0,6	40	22	100	100	50
Warping, weaving, braiding, knitting, spinning, twisting, reeling, bobbinage	500	0,6	60	22	150	150	75
Sewing, fine knitting, linking, darning	750	0,7	80	22	150	150	100
Hand drawing, weft drawing (4 000 K ≤ Tcp ≤ 6 500 K)	750	0,7	90	22	150	150	100
Finishing, dyeing, manufacturing hair	500	0,6	80	22	150	150	100
Drying chamber	100	0,4	60	28	50	50	30
Automatic fabric printing	500	0,6	90	25	100	100	50
Knotting, weft control, trimmings	1 000	0,7	80	19	150	150	100
Colour control, fabric control (4 000 K ≤ Tcp ≤ 6 500 K)	1 000	0,7	90	19	150	150	100
Invisible mending (4 000 K ≤ Tcp ≤ 6 500 K)	1 500	0,7	90	19	150	150	100
Automotive							
Bodywork and assembly (automatic line), Large parts printing department	300	0,6	80	25	100	50	30
Bodywork and assembly (manual welding), Printing department visual inspection	500	0,6	80	22	150	50	30
Painting, spraying chamber, polishing chamber	750	0,7	80	22	150	150	30
Painting, inspection, touching up and polishing, final inspection (4 000 K ≤ Tcp ≤ 6 500 K)	1 000	0,7	90	19	150	150	30
Upholstery production (manual)	1 000	0,7	80	19	150	50	30
Assembly of sub-parts (doors, dashboard, upholstery, chassis), engine and mechanical assembly, transport line final assembly	750	0,7	80	22	150	50	30
Working with electronics (4 000 K ≤ Tcp ≤ 6 500 K)	750	0,6	90	22	150	50	30
General vehicle services, repair and testing	500	0,6	80	22	100	50	30
Lavorazione e manifattura del legno							
Processi automatici, per esempio: essiccatura, fabbricazione compensato	50	0,4	40	28	-	-	-
Camere del vapore	150	0,4	40	28	50	50	30
Lavori al banco di falegnameria, incollaggio, assemblaggio, sega	300	0,6	80	25	100	100	50
Lucidatura, verniciatura, falegnameria di fantasia	750	0,7	80	22	150	150	100
Lavorazioni su macchine per lavorazione del legno, per esempio: tornitura, scannellatura, sgrossatura, ribassatura, taglio, segatura, cavatura	500	0,6	80	19	150	150	75
Selezione legno per impiallacciatura, intarsio, lavoro di intarsio (4 000 K ≤ Tcp ≤ 6 500 K)	750	0,7	90	22	150	150	100
Verifica e controllo di qualità (4 000 K ≤ Tcp ≤ 6 500 K)	1 000	0,7	90	19	150	150	100

Average illuminations maintained by EN 12464-1: 2021 (**indoor environments**)

Main tasks and activities	Ēm lx	Uo	Ra	R UGL	Ēm,z lx	Ēm, wall lx Uo≥0,10	Ēm, ceiling lx
HEALTHCARE STRUCTURES							
General use rooms							
Waiting rooms and service lifts	200	0,4	80	22	75	75	30
Corridors: during the day and cleaning (Illumination on the floor.)	100	0,4	80	22	50	50	30
Corridors: during the night (Illumination on the floor.)	50	0,4	80	22	-	-	-
Multi-purpose corridors (e.g. pre-examinations of patients) (Illumination at task level.)	200	0,6	80	22	75	75	50
Day rooms	300	0,6	80	22	75	75	50
Lifts, passenger and visitor lifts (Illumination on the floor.)	100	0,6	80	22	50	50	30
Staff rooms	300	0,6	80	19	100	100	50
Night light, surveillance light (Illumination on the floor. 2 200 K ≤ Tcp ≤ 3 000 K)	5	-	80	-	-	-	-
Toilets, patient toilets	200	0,4	90	22	75	75	50
Maternity wards							
Lanes (General lighting) (Illumination on the floor.)	100	0,4	80	19	50	50	30
Simple visit and reading light	300	0,6	80	19	100	100	75
Delivery rooms (General lighting)	300	0,6	90	19	100	100	75
Diagnostic and examination rooms							
Infirmary	500	0,6	80	19	150	150	100
General lighting (4 000 K ≤ Tcp ≤ 5 000 K)	500	0,6	90	19	150	150	100
Examination and treatment (4 000 K ≤ Tcp ≤ 5 000 K)	1 000	0,7	90	19	150	150	100
Analysis rooms							
General lighting	300	0,6	80	19	100	100	75
Analysis with image amplifiers and television systems	50	-	80	19	-	-	-
Treatment rooms (general)							
Dialysis, plaster cast	500	0,6	80	19	150	150	100
Dermatology	500	0,6	90	19	150	150	100
Endoscopy, medical baths, massage and radiotherapy	300	0,6	80	19	100	100	75
Sterilisation and disinfection	500	0,6	80	22	100	100	75
Operating theatres							
Pre-operative local and recovery	500	0,6	90	19	150	150	100
Area surrounding the operating zone	1 000	0,6	90	19	150	150	100
Operating theatre	1 000	0,6	90	19	-	-	-
Autopsy and dissection table	5 000	0,7	90	-	150	150	100
Resuscitation and intensive care							
General lighting (Illumination on the floor.)	300	0,6	90	19	50	50	30
Simple visit (Illumination at bed level)	500	0,6	90	19	100	100	75
Examination and treatment (Illumination at bed level)	1 000	0,7	90	19	150	150	100
Night surveillance	20	-	90	19	-	-	-
Laboratories and pharmacies							
General lighting	500	0,6	80	19	150	150	100
Colour control (4 000 K ≤ Tcp ≤ 6 500 K)	1 000	0,7	90	19	150	150	100

Average illuminations maintained by EN 12464-1: 2021 (**indoor environments**)

Main tasks and activities	Ēm lx	Uo	Ra	R UGL	Ēm,z lx	Ēm, wall lx Uo≥0,10	Ēm, ceiling lx
TRANSPORT							
Airports							
Arrival and departure halls, baggage claim areas	200	0,4	80	22	75	75	30
Connecting zones	150	0,4	80	22	50	50	30
Information desks, reception	500	0,7	80	19	150	150	100
Customs and passport control	500	0,7	80	19	150	150	100
Waiting rooms	200	0,4	80	22	50	50	30
Luggage storage	200	0,4	80	25	50	50	30
Security control zones	300	0,6	80	19	100	100	75
Air traffic control tower	500	0,6	80	16	50	-	-
Hangar: Repair and testing, Motor control zones, Measurement zones	500	0,6	80	22	50	50	30
Railway installations							
Subways, platforms, stairs and escalators with small number of passengers (Illumination on the floor.)	50	0,3	80	-	-	-	-
Subways, platforms, stairs and escalators with medium number of passengers (Illumination on the floor.)	100	0,4	80	-	-	-	-
Subways, platforms, stairs and escalators with large numbers of passengers (Illumination on the floor.)	200	0,5	80	-	-	-	-
Atria and counters (Illumination on the floor.)	200	0,5	80	28	75	75	50
Ticket offices and luggage storage	300	0,5	80	19	100	100	75
Waiting rooms	200	0,4	80	22	75	75	30
Entrances, station halls	200	0,4	80	-	75	75	30
Switch rooms and installations	200	0,5	80	28	50	50	30
Railway control centre (dispatch area)	200	0,5	80	16	-	-	-
Access tunnels (Illumination on the floor.)	50	0,4	20	-	-	-	-
Coarse assembly work in maintenance halls	200	0,4	80	-	-	-	-
Medium assembly work in maintenance halls	300	0,5	80	-	-	-	-
Fine assembly work in maintenance halls	500	0,6	80	-	-	-	-
Precision assembly work in maintenance halls	750	0,7	80	-	-	-	-
Traffic zones in railway vehicle maintenance halls (without vehicle traffic)	100	0,25	80	-	-	-	-
Traffic zones in railway vehicle maintenance halls (with vehicle traffic)	150	0,4	80	-	-	-	-

LEGEND

Ēm Average illuminance maintained on the task plane, if not specified, generally referred to a height of 0.85 m from the floor for civil work areas and 1 m industrial and floor for transit areas.

Uo Illuminance uniformity in the reference plane.

Ra Minimum colour rendering index of the light source (see page <?> and <?>).

Tcp Correlated colour temperature of the light source.

RUGL Unified “limit” value of glare within the room based on installation characteristics (room size and reflections, luminaire type, operator viewing direction, luminaire layout) developed by the CIE and required by European standard EN 12464-1 (See page <?>).

Ēm z Average illuminance maintained cylindrical (see page <?>).

Ēm wall Average illuminance maintained on the walls of the room.

Ēm ceiling Average illuminance maintained on the ceiling of the room.

Emergency lighting EN 1838 : 2013 (**indoor environments**)

Main tasks and activities	Ēm lx	Uo	Ra	R UGL	Ēm,z lx	Ēm, wall lx Uo≥0,10	Ēm, ceiling lx
EMERGENCY LIGHTING (EN 1838 : 2013)							
General lighting (minimum value) (Illumination on the floor.)	0,5	-	80	-	-	-	-
Escape routes (minimum value in the middle of the route) (Illumination on the floor. Escape route width 2m.)	1	-	80	-	-	-	-
Exit routes in public places such as theatres, cinemas, concert halls, entertainment (minimum value D.M.) (Illuminance 1m above the floor.)	2	-	80	-	-	-	-
Stairs and proximity to emergency exits (minimum value D.M.) (Illuminance 1m above the floor.)	5	-	80	-	-	-	-
High-risk task area (minimum value) (Illuminance on the floor. Illuminance >10% expected under standard power conditions.)	15	0,1	80	-	-	-	-
Fire-fighting equipment, call point and first aid point (minimum value) (Vertical illuminance.)	5	-	-	-	-	-	-
For all calculations the light contribution from ambient inter-reflections must be ignored. In the case of indirect or upward directed luminaires only the first surface reflection may be considered.							

Illuminations in indoor sports environments (EN 12193 : 2019)

Activities	Reference area	Category	Horizontal illuminance (PA)		Vertical illuminance		Ra
			Ēm (lx)	Uo	Ēm (lx)	Uo	
Bowls	PA 13,7-40 x 1,8-4,5 m	III	300	0,50	--	--	60
		II	500	0,80	--	--	60
		I	500	0,80	--	--	80
School sports competitions (physical education)	PA 10 x 10 m TA 17 x 17 m	III	200	0,50	--	--	60
		II	500	0,70	--	--	60
		I	750	0,70	--	--	80
Judo	PA 10 x 10 m TA 17 x 17 m	III	200	0,50	--	--	60
		II	500	0,70	--	--	60
		I	750	0,70	--	--	80
Freestyle wrestling	PA 9 x 9 m TA 12x 12 m	III	200	0,50	1000	0,80	60
		II	500	0,70	1000	0,80	60
		I	750	0,70	1000	0,80	80
Swim	PA 25-50 x 15-22 m	III	200	0,50	--	--	60
		II	300	0,70	--	--	60
		I	500	0,70	--	--	80
Basketball	PA 28 x 15 m TA 32 x 19 m	III	200	0,50	--	--	60
		II	500	0,70	--	--	60
		I	750	0,70	--	--	80
Volleyball	PA 24 x 15 m	III	200	0,50	--	--	60
		II	500	0,70	--	--	60
		I	750	0,70	--	--	80
Boxing (300 lx for training in all categories.)	PA 7,1 x 11,1 m	III	500	0,50	--	--	60
		II	1000	0,80	--	--	60
		I	2000	0,80	--	--	80
Tennis	PA 30 x15 m TA 36 x18 m	III	300	0,50	--	--	60
		II	500	0,70	--	--	60
		I	750	0,70	--	--	80
Fencing (Vertical illuminance at 1.5m from floor level)	PA 14 x 2 m TA 18 x 5 m	III	300	0,70	200	0,70	60
		II	500	0,70	300	0,70	60
		I	750	0,70	500	0,70	80
Weight lifting	PA 4 x 4 m TA 6 x 6 m	III	200	0,50	--	--	60
		II	500	0,70	--	--	60
		I	750	0,70	--	--	80
Table tennis	PA 9 x 4,5 m	III	300	0,70	--	--	60
		II	500	0,70	--	--	60
		I	750	0,70	--	--	80
Archery (Vertical illuminance based on 25 m distance (for 50 m distance, doubled illuminance levels))	PA 18-30 x 1,3 m	III	200	0,50	1000	0,80	60
		II	200	0,50	1000	0,80	60
		I	200	0,50	1000	0,80	80

LEGEND

PA: Actual playing area for the performance of a given sport.

TA: Area generally comprising the main area (PA) plus an additional safety area outside the main area. The illuminance and uniformity of this area should be >75% of that of the main area (PA).

Categories according to the level of competition carried out
Category I : Very high level competition (international and national competitions with many spectators and long viewing distances.
Category II : Intermediate level competition (regional or local competitions with medium spectators and medium viewing distances. Suitable for high level training.
Category III : Low level competition (local competitions with low presence or absence of spectators. Suitable for general training, physical education, school sports competitions or recreational activities.

Luminaire installation: No luminaires should be positioned on the part of the ceiling above the main area.

Average illuminations maintained by EN 12464-2: 2012 (**outdoor environments**)

Outdoor activities, task and activities	Ēm (lx)	Uo	R UGL	Ra
GENERAL AREAS AND CLEANING OF WORKPLACES				
Pavements	5	0,25	50	20
Circulation areas with slow vehicles (max. 10 km/h)	10	0,25	50	20
Movement of vehicles (max 40 km/h)	20	0,40	45	20
Pedestrian crossings and loading/unloading from vehicles	50	0,40	50	20
AIRPORTS				
Hangar parking	20	0,10	55	20
Terminal parking	20	0,25	50	20
Loading Zone	20	0,25	50	20
Aircraft maintenance area	200	0,50	45	60
INDUSTRIAL SITES AND WAREHOUSES				
Loading and unloading of large solid goods	20	0,25	55	20
Loading and unloading of goods, lifting and descending areas for cranes	50	0,40	50	20
Covered loading areas, information reading, use of tools	100	0,50	45	20
Demanding installations and inspections	200	0,50	45	60
PARKING AREAS				
Light traffic (parking of shops and homes, bicycle parks)	5	0,25	56	20
Medium traffic (parking of supermarkets, offices, industrial plants, sports and multipurpose complexes)	10	0,25	50	20
Heavy traffic (parking in large shopping centers and complexes of sports and multipurpose buildings)	20	0,25	50	20
RAILWAYS AND TRAMWAYS				
Open areas, train stops	5	0,20	55	20
Open areas, small number of passengers (e.g. rural and local trains)	10	0,25	50	20
Open areas, average number of passengers (e.g. suburban or regional trains or intercity services)	20	0,30	45	20
Open areas, large number of passengers (e.g. intercity services)	50	0,40	45	20
Open areas, freight areas	20	0,40	50	20
Covered areas, small number of passengers (e.g. suburban or regional trains or intercity services)	50	0,40	45	40
Covered areas, large number of passengers (e.g. intercity services)	100	0,50	45	40
Covered areas, goods areas, short-term service	50	0,40	45	20
Covered areas, goods areas, continuous service	100	0,50	45	40
Tracks in passenger station areas, including parking areas	10	0,25	50	20
Sidewalks in railway areas, open pedestrian bridges	10	0,25	50	20
Level crossings	20	0,40	45	20
Maintenance areas for trains and locomotives	20	0,40	50	40
Maintenance areas for railway yards	30	0,40	50	20
Stairways, small number of passengers	50	0,40	45	40
Stairways, large number of passengers	100	0,50	45	40
Inspection pit	100	0,50	40	40

LEGEND

Ēm: Average horizontal illuminances maintained referring to the reference surface of the application.

Uo: Minimum uniformity of illumination on the reference plane.

Ra: Minimum color rendering indexes for sources (see pages <?> and <?>).

RUGL: Limit value of the glare Rg (Glare Rating) based on the observation characteristics and the layout of the luminaires, developed by the CIE and required by the European standard EN 12464-2.

/ Electrical engineering and electronics

*

	Main features of the material	Safety precautions voltage	Symbols
Classe 0	No earthing protection device	Environment without earth	
Classe I	Earthing protection device provided	Connection to protective earth	
Classe II	Additional insulation but no earthing protection device	No precaution necessary	
Classe III	Intended for very low safety voltage	Connection to very low safety voltage	

Marks and standards.

The single European mark ENEC (European Norms Electrical Certification) certifies that a luminaire conforms to EN European standards. IMQ is one of the European certification bodies belonging to ENEC. Luminaires approved by IMQ on the basis of European standards are therefore ENEC-certified.

All 3F Filippi luminaires bear the CE marking. This marking attests to be fact that the luminaires conform to the requirements set out in Community Directives for electrical materials and that they may be freely marketed throughout the European Union.
Directives applicable to lighting products are:

- The 2014/35/UE low-voltage directive.
- The 2014/30/UE electromagnetic compatibility directive.
- The 2014/34/UE ATEX “ATmosphere EXplosive” directive.
- The RoHS 2011/65/EU directive.
- The Ecodesign directive 2009/125/EC.
- The 2017/2102/EU directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
- The 2012/19/EU directive on waste electrical and electronic equipment (WEEE).
- The 2019/2020/EU directive, setting eco-design requirements for light sources and separate ballasts.

The acronym EN refers to the European standards issued by CENELEC (European Committee for Electrotechnical Standardisation).

These must be adopted by all EU member states by means of national regulatory bodies (in Italy, the CEI).
For luminaires, the reference standards are EN IEC 60598-1 and IEC 60598-2-22 (luminaires for emergency lighting).
Compliance with these standards ensures that the luminaires are properly manufactured and can be used to build electrical systems that conform to the requirements stipulated by the applicable legislation (for example, Italian Decree Law no. 37 of 22 January 2008).

*** Protection against electric shock**
Standard EN IEC 60598-1.
Luminaires are divided into four classes according to the type of protection provided against electric shock.


Kawasaki

/ Electrical engineering and electronics

EXPLOSIVE ATMOSPHERES **(ATEX).**

EXPLOSIVE ATMOSPHERES (ATEX)
ATEX is the French acronym for “ATmosphères EXplosives”, which means “explosive atmospheres”. The ATEX 2014/34/EU Directive (relating to protective equipment and systems intended to be used in potentially explosive atmospheres), published by the Official Journal of the European Union (n° OJ EU L96) on 29th of March 2014 and implemented on the 30 March 2014, pursuant to article 43, ratified the repeal of the previous Directive 94/9/CE with effect from the 20 April 2016, without a transitional period. This applies to all electrical and mechanical products intended for potentially dangerous places.

Example of certification

ATEX: Ⓔx II 3D Ex Tc IIIC T85 ° C Dc

Legend:

Ⓔx = Specific mark of explosion protection.
II = Group II: equipment for surface work belongs to this group.
3D = Category 3 - equipment or protective systems that guarantee a normal level of protection - D: Dust.
Ex tc = Protection method by means of “t“ enclosures in the presence of combustible dusts.
IIIC = Conductive dust.
T85°C = Maximum allowed surface temperature of the equipment.
Dc = Level of protection (EPL Dc): equipment for explosive atmospheres due to the presence of dust, with an “increased” level of protection which does not constitute a source of ignition during normal operation and which may have additional protections to ensure that it remains inactive how ignition source in the event of regular and expected failures.

Directive 2014/34/EU classifies and divides ATEX equipment into two groups:

Group I: equipment for work in mines with the presence of mine gas and/or combustible dust is included in this group. Group I in turn is divided into 2 categories:

- M1 - equipment or systems of protection that guarantee a very high level of protection; they must remain operational in the presence of explosive atmospheres.
- M2 - equipment or systems of protection that guarantee a high level of protection; they must be de-energised in the presence of gas.

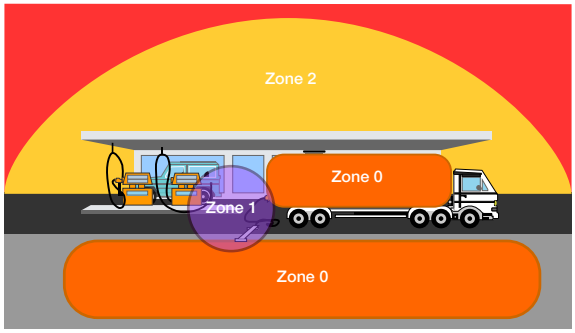
Group II: equipment for work on the surface is included in this group. Group II in turn is divided into 3 categories on the basis of the level of protection (area of use); the categories are identified as number 1, 2, 3 followed by the letter G (Gas) or D (Dust).

- Category 1 - equipment or systems of protection that guarantee a very high level of protection; for areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists or by air/dust mixtures are present continuously, for long periods or frequently. Equipment in this category must ensure the requisite level of protection, even in the event of rare incidents relating to equipment.
- Category 2 - equipment or systems of protection that guarantee a high level of protection; for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur occasionally. Equipment in this category must ensure the requisite level of protection, even in the event of frequently occurring disturbances or equipment faults which normally have to be taken into account.
- Category 3 - equipment or systems of protection that guarantee a normal level of protection; for use in areas in which explosive atmospheres caused by gases, vapours, mists, or air/dust mixtures are unlikely to occur or, if they do occur, are likely to do so only infrequently and for a short period only. Equipment in this category must ensure the requisite level of protection during normal operation.

To summarise:

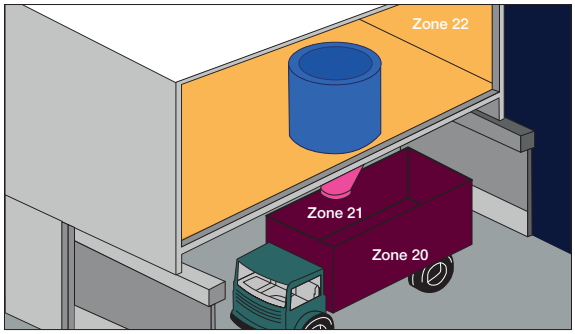
Dust	Gas
1D Suitability in zones 20, 21 and 22	**1G** Suitability in zones 0, 1 and 2
2D Suitability in zones 21 and 22	**2G** Suitability in zones 1 and 2
3D Suitability in zone 22	**3G** Suitability in zone 2

Areas classified for the presence of gas, mists or vapours on the basis of the probability of the existence of the explosive atmosphere are divided into three zones:



Zone 0	Zone 1	Zone 2
An area in which an explosive mixture of gas is continuously present or frequently present for long periods.	An area in which an explosive mixture is likely to occur occasionally in normal operation.	An area in which an explosive mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time.

In areas classified for the presence of dust the zones are identified on the basis of the frequency and duration of the formation of an explosive atmosphere:



Zone 20	Zone 21	Zone 22
An area in which an explosive mixture of dust in the form of a dust cloud is continuously present or frequently present for long periods .	An area in which an explosive mixture of dust in the form of a dust cloud, is likely to occur occasionally in normal operation.	An area in which an explosive mixture of dust in the form of a dust cloud, is not likely to occur in normal operation and if it occurs it will exist only for a short time.

COMPLIANCE procedures.

COMPLIANCE PROCEDURES
Per la marcatura degli apparecchi
For equipment to be marked there are various compliance procedures according to the product function and the category they belong to.

- All electrical equipment in Category 1 and Category 2 must mandatorily be certified by ATEX (Notified Bodies), or bodies to which the national authority has assigned the task of verifying conformity with the Directive. Companies that manufacture electrical equipment in Category 1 and Category 2 are obliged to report and audit the quality systems and the identification number of the body must be displayed on the data plate label alongside the CE marking.
- All electrical equipment in Category 3 can be self-certified by the manufacturer (CE marking), with internal manufacturing controls.

(1)
ATEX (G) for zones with GAS

(2)
ATEX (D) for zones with Dust

/ Electrical engineering and electronics

Electronic **WIRING.**

The main technical specifications of the typical LED drivers:

- 230Vac, 50-60Hz power supply, with tolerance+/- 10% of line voltage.
- 230Vdc power supply, with tolerance +/- 10%.
- Power factor greater than 0.95 (in general, with exceptions).
- Efficiency >90%.
- Suitable for centralised emergency lighting pursuant to EN 50172 and EN 60598-2-22.
- ENEC certification.
- Thermal and short-circuit protection against overloads and voltage surges.
- Protection against excess temperatures.
- Constant current LED power supply.
- Safe FLICKER (Pst LM≤1; SVM ≤0,4).

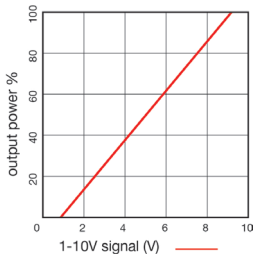
3F Filippi uses two constant current driver types, depending on the type of luminaire:

- SELV Safety Extra Low Voltage output, below 60Vdc. SELV Driver/LED devices can be used in total safety.
- NON SELV without output voltages greater than 60Vdc, which may represent a hazard if touched. NON SELV Driver/LED luminaires may only be opened by a qualified electrician with special tools.

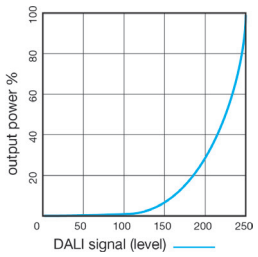
DIMMABLE ELECTRONIC WIRING

Adjustable electronic wiring can be realised with:

- Drivers with 1-10V interface, with dimming by means of an analogue signal ranging from 1V DC (minimum light) to 10V (maximum light). For signals <1V the device switches off.



- Drivers with DALI interface with digital dimming (Digital Addressable Lighting Interface protocol).



Note:
For further information and for use in harsh environments please contact our Technical Offices.

DALI - D2 (DALI-2) - D2D (DALI-2 DATI) - D4i

DALI® is the standard protocol for bi-directional digital communication between lighting control devices, standardised by the global standard IEC 65386.
It is evenly designated by the DALI Alliance (DiiA - Digital Illumination Interface Alliance) and applied globally.

NB: Luminaires containing DALI-certified drivers are identified by the abbreviation "**DALI**" or "**D**".

DALI-2™ is the latest version of the DALI protocol.
DALI-2™ guarantees interoperability through trademarked testing and certification.
DALI-2 certified drivers follow a standardised control curve and are fully compatible with DALI-1 systems.

NB: 3F Filippi's luminaires containing DALI-2 certified drivers are identified by the initials "**D2**".

- DATA

Within the DALI-2 certification programme there are drivers that can also include the following features:
Part 251 - Luminaire Data
Drivers can store luminaire information, e.g. ID code, light output, CCT and CRI, light distribution, etc.).
Part 252 - Energy Data Reporting
Drivers provide real time power.
Part 253 - Diagnostics Data
Drivers provide operational data, operating and fault conditions.

NB: 3F Filippi's luminaires containing DALI-2 certified drivers also with Parts 251, 252, 253 are identified by the abbreviation "**D2D**".

The luminaire, equipped with a **D4i** driver, in addition to being DALI-2 certified with Parts 251, 252, 253 makes power available on the DALI line (Part 250) and ensures interoperability between nodes and sensors with the same certification.

NB: 3F Filippi's luminaires containing those certified drivers are identified by the abbreviation "**D4i**".

WARNING!
Devices with DALI, D2 and D2D drivers can be used in systems without a control system (centralized and/or stand-alone) with provided that a "bridge" is made on the DA-DA terminals of the luminaire or on the DA-DA circuits of the supplied power cable (bridge prohibited in D4i equipment), if present. 3F Filippi however recommends connecting DALI, D2, D4i devices to control systems (centralized/stand-alone/DALI repeater). 3F Filippi shall therefore bear no responsibility for any "malfunctions" of DALI luminaires installed in systems without a regulation system, or with a poorly programmed one. Assessing compatibility between regulation systems and drivers, as well as finding the technical data required for lighting design, are the sole responsibility of the designer of the electrical system. To assist in this task, when requested 3F Filippi will provide the technical data sheets for the drivers used and specify the quantity for each luminaire. These indications relate to the bill of materials at the time of communication and thus may be subject to changes due to technical developments and/or provisioning and production requirements; data should therefore be checked before proceeding with the order.

/ Mechanics and Design

From the **DESIGN...**

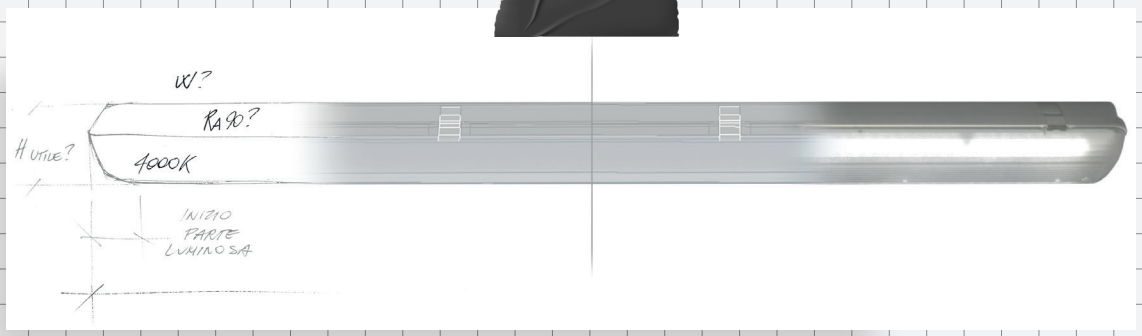
...TO THE FINISHED PRODUCT

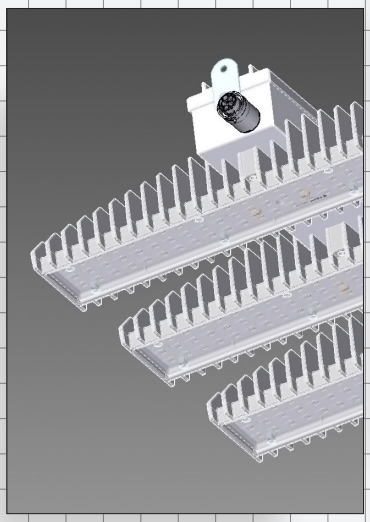
For 3F Filippi, attention to detail, the quality of the light and the reliability of our products are the starting point on the path we travel alongside our customers.
Efficiency is the culmination of our journey – we create a light that can show and give emotion, while hiding its technical soul, able to highlight what it illuminates.

The right product starts first with a discussion, to gain an understanding of the customer's needs and expectations.

Our products are made with a craftsman's passion and constant innovation, research and attention to design and details: they combine aesthetics and functionality, elements of precision and new technologies, maintenance and reliability facilities, and are excellent value for money.
3F Filippi's entire production is performed inside the headquarters in Pian di Macina (province of Bologna, Italy), from moulding of plastics and metals to machining and soldering and painting, all totally automated.
The thoroughness and precision of the checks throughout every phase of the company's processes guarantee constant quality of all our products over time.

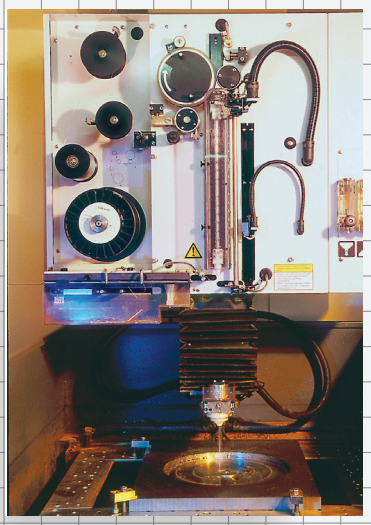
Our care for the environment goes hand-in-hand with our 0-mile production, whereby all our products are assembled in the same Bologna plant where they are produced.





3D modelling

Mould



EDM tool

BALL throw.

BALL THROW RESISTANCE CERTIFICATION (DIN 18032-3)
This certification ensures the suitability of the device in gyms, environments with gymnastic and sports activities.

3F LEM Sport luminaires (codes 59080 and 59081) are certified “Resistant to throwing the ball according to DIN 18032-3” CSI certification (IMQ group).

3F Filippi for the luminaires deriving from the standards issues an appropriate declaration of conformity and suitability following scrupulous tests laboratory.
The tests are performed in the 3F Filippi laboratories using a handball ball-gun.
The speed and launch angle of the gun is adjustable to meet the requirements of DIN 18032-3.

Test for ceiling luminaires
The device is hit 36 times by a handball (almost half a kilo) at a speed of 16.5 ± 0.8 m/s (~ 60 km/h). 12 times the ball must be thrown perpendicularly against the device and 12 times from two different directions (transversal and longitudinal) at an angle of 60°.

Test for wall luminaires
The device is hit 54 times by a handball (almost half a kilo) at a speed of 23.5 ± 1.2 m/s (~ 85 km/h). For 30 times the ball must be thrown at 90° perpendicularly against the device and for 12 times from two different directions (transverse and longitudinal) at an angle of 45°.

Note:
At the end of the tests, the luminaire must not show any alterations that limit its solidity, operation and safety.


3F Filippi
illuminazione

Marks and standards

Luminaires with electronic wiring bearing this mark are versions with **limited surface temperature** (EN 60598-2-24), and therefore suitable for installation in environments with greater risk in case of fire as per variant V3 of IEC 64-8.

Flame and ignition resistance
650°C, 850°C, 960°C. The materials in luminaires bearing this mark have passed the glow-wire test at these temperatures in compliance with EN 60598-1 (IEC 34-21).

Temperature class
Standard 50014 defines the temperature classes as the maximum temperature of the external surface of the housing of the luminaire in the case of abnormal operation (EN 60598-1 Appendix C):
T1 max 450°C, T2 max 300°C, T3 max 200°C, T4 max 135°C, T5 max 100°C, T6 max 85°C.

Luminaires not suitable for direct installation on normally flammable surfaces (suitable only for installation on non-flammable surfaces).

Note: the symbol is present in edition 9 of IEC EN 60598-1. Unless otherwise indicated by the above symbol, luminaires are suitable for installation on normally flammable surfaces. A surface is considered normally flammable if its ignition temperature is at least 200°C and if it does not deform or soften at such a temperature.

Mechanical strength
Luminaires must have adequate mechanical strength and be built to sustain stress deriving from any unprotected treatment during normal use.
Luminaires with a closing diffuser must pass a test with impact energy of 6.5J; impact is produced by letting a 50 mm diameter, 0.51 kg steel ball fall from a height of 1.3 metres, in compliance with IEC EN 60598-1 (CEI 34-21).
The IK Code designates the level of protection of electrical equipment housings against mechanical impact (EN 62262 and IEC 70-4).

Ingress protection of housing (IP rating)
As per IEC 60598-1.

1st number: protection against penetration by solid objects and against contact with live parts.

0	No special protection.
1	Protected against solid objects larger than 50 mm. E.g. hands.
2	Protected against solid objects larger than 12 mm. E.g. fingers.
3	Protected against solid objects larger than 2.5 mm. E.g. tools.
4	Protected against solid objects larger than 1 mm. E.g. threads or tapes.
5	Protected against dust penetration that could damage the luminaire.
6	Fully protected against dust.

2nd number: protection against penetration by liquids.

0	No special protection.
1	Protected against vertical water drips.
2	Protected against vertical water drips when tilted up to 15°.
3	Protected against rain when tilted up to 60°.
4	Protected against splashes of water from any direction.
5	Protected against jets of water coming from any direction.
6	Totally protected against sea waves or powerful jets of water.
7	Protected against the effects of temporary submersion in water.
8 m	Protected against the effects of continuous submersion for long periods with indications of the maximum depth in metres.
9 (80°C)	Protected against the effects of high pressure and high temperature water.
9 (15°C)	Protected against the effects of high pressure cold water.
9K	Protected against the effects of cleaning with high pressure water or steam. The standard "ISO 20653 Road vehicles (IP code)" introduces code “K” that describes the special requirements for road vehicles not covered by "EN 60529 (IP code)".

Protection of housing from impacts (IK rating)
Requirements as per IEC 34-139.
Luminaires - application of code IEC 62262 IK

0.2 J	Resistance to a blow from an object weighing 200 g dropped from a height of 10 cm.	IK02
0.5 J	Resistance to a blow from an object weighing 250 g dropped from a height of 20 cm.	IK04
1 J	Resistance to a blow from an object weighing 500 g dropped from a height f 20 cm.	IK06
2 J	Resistance to a blow from an object weighing 500 g dropped from a height of 40 cm.	IK07
5 J	Resistance to a blow from an object weighing 1.7 kg dropped from a height of 30 cm.	IK08
10 J	Resistance to a blow from an object weighing 5 kg dropped from a height of 20 cm.	IK09
20 J	Resistance to a blow from an object weighing 5 kg dropped from a height of 40 cm.	IK10

Coating and standard colours

1. Polyester-based paint, **white** or **grey Ral 9006**, UV stabilised, on hot galvanised steel sheet. Salt spray resistance over 500hrs.

2. Epoxy-polyester powder-coated in **white Ral 9010**, or **grey Ral 9006**, UV stabilised, applied with triboelectric system for constant and uniform thickness, oven polymerised at 180°C, with phosphate degreasing pretreatment using heavy iron salts. Salt spray resistance of 500h.

Resistance to corrosive substances

Chemical substance	Methacrylate	Polycarbonate	Glass	Aluminium	Steel	Stainless steel
Acetone	–	–	•	•	•	•
Acetic acid up to 10%	–	Δ	•	–	Δ	•
Arsenic acid up to 20%	•	•	Δ	–	Δ	
Citric acid up to 10%	•	•	•	Δ	Δ	Δ
Hydrochloric acid up to 20%	•	•	Δ	–	–	–
Chromic acid	Δ	Δ	Δ	Δ	Δ	Δ
Formic acid up to 30%	Δ	–	–	–	Δ	Δ
Nitric acid up to 20%	Δ	Δ	Δ	–	–	Δ
Sulphuric acid up to 30%	•	•	Δ	–	–	–
Seawater	•	•	Δ	Δ	Δ	Δ
Ethyl alcohol	–	•	•	•	Δ	Δ
Isopropyl alcohol	Δ	–	•	Δ	Δ	Δ
Ammonia	•	–	Δ	•	Δ	•
Aniline	–	–	•	•	•	•
Petrol	•	Δ	•	•	•	•
Benzole	–	–	•	Δ	Δ	Δ
Bromine	–	Δ	•	Δ		
White lime	•	Δ		–	•	•
Diesel oils	•	Δ		•	•	•
Sea climate	•	•	Δ	Δ	Δ	Δ
Liquid chlorine (fumes)	–	–	–	•	–	–
Chloroform	–	–	•	•	•	Δ
Calcium chloride	•	•	•	•	Δ	Δ
Ferric chloride	•	Δ		Δ	Δ	
Hexane	•	Δ	•	•	Δ	Δ
Ether	–	–		•	•	•
Petroleum ether	•	Δ		•	•	•
Ethyl ether	•	–	•	•	•	
Phenols	–	–	•	Δ	•	•
Glycerine	•	Δ	•	•	•	•
Hydrocarbons	–	–	•	•	•	•
Methanol	–	–	•	Δ	•	•
Silicone oils	Δ	•	•	•	•	
Food oils and fats	•	Δ	•	•	•	
Mineral oils	•	–	•	•	•	•
Vegetable oils	Δ	•	•			•
Diesel oil - naphtha	–	–	•	•	•	•
Ozone	•	–	•	•	Δ	•
Potassium permanganate	•	•	•	Δ	•	•
PVC with plasticizers	–	–	•	•	•	
Soda	•	•	–	–	–	Δ
Caustic soda	•	–	–	–		•
Zinc sulphate	•	•		•	Δ	Δ
Aluminium sulphate	•	•	•	•	Δ	Δ
Copper sulphate	•	•	•	•	Δ	Δ
Carbon tetrachloride	–	–	•	•	•	•
Toluene	–	Δ		•	•	•
Trichloroethylene	–	–		•	Δ	Δ

The table only provides a rough indication of the maximum amount of various chemical agents in different compositions.
When using these data, bear in mind that they are the results of laboratory tests and are therefore only valid under the same conditions in which the tests were performed; the data should therefore be considered indicative, and it is advisable to perform tests in their actual usage conditions if practical experience is not available.

It is not possible to talk about "compatibility" in general terms, since this depends on:
- Concentration.
- Temperature.
- Contact type.
- Contact duration.
- Mechanical action during contact.
- Simultaneous presence of multiple chemical compounds.
- The function of the potentially attacked material, mechanical stress to which it is exposed and numerous other factors, which are highly variable, making the indications given in this table truthful but general, and therefore not exhaustive.

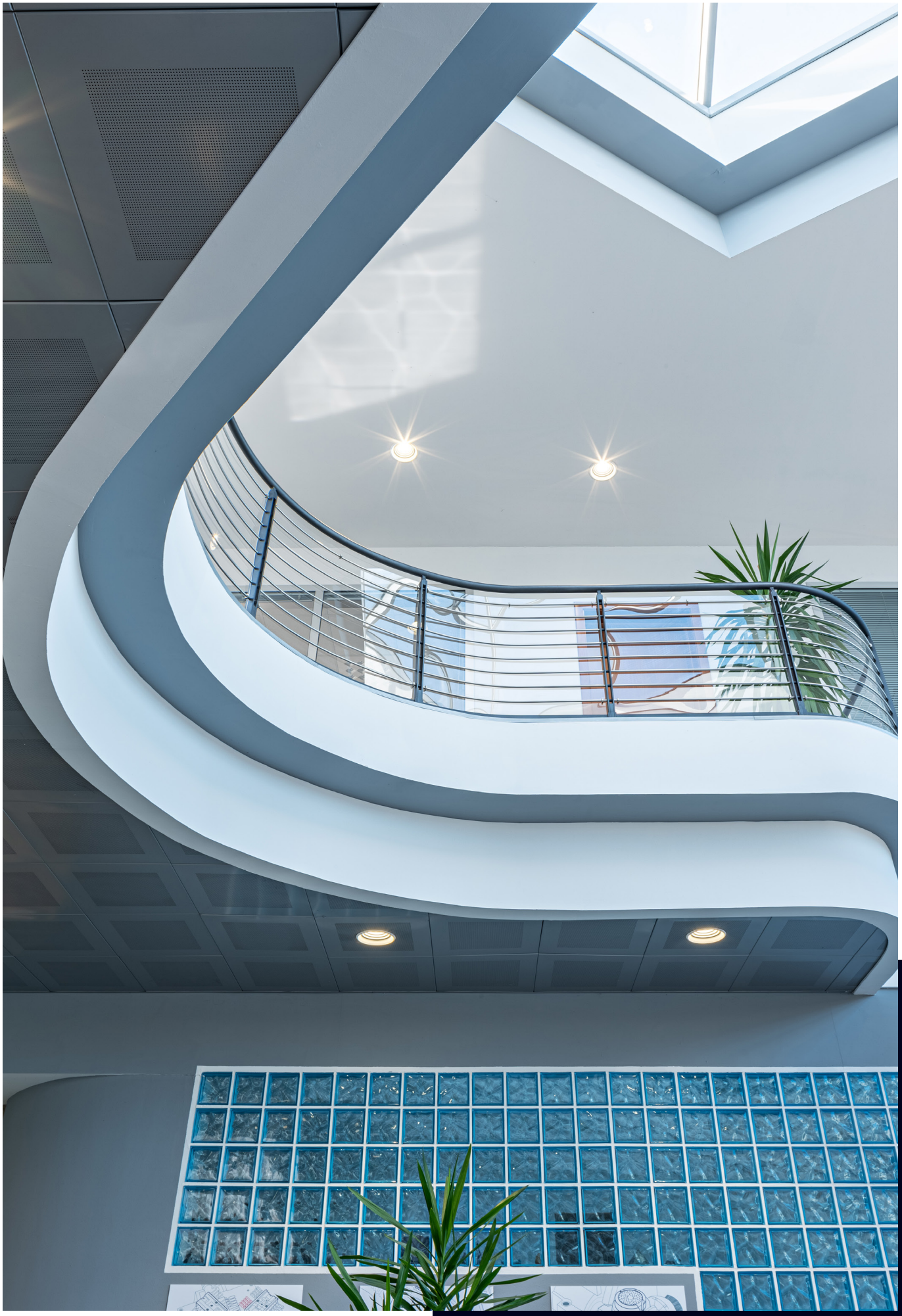
Some versions of 3F luminaires are also proposed with laminated glass which, in addition to being resistant to the substances listed above, allows for these to be used in environments with food products or with machines with moving parts, with sudden temperature changes and, in general, in all environments requiring total protection against falling fragments.

• = resistant
Δ = relatively resistant, suitability to be evaluated on basis of application
– = not resistant

/ Get the best
from 3F Filippi

Rules for the correct use of our products.

- 3F Filippi can only guarantee products exclusively when they are installed according to the installation instructions provided with the luminaires. We therefore recommend you do not install our products in any other way than those indicated. In the event that you have differing requirements, please contact our Sales Network or the 3F Filippi Headquarters to request a technical assessment.
- As with installation, maintenance of 3F Filippi products must also be performed according to the instructions: we therefore recommend keeping these safe so that you can consult them before performing any kind of work on the luminaire.
- 3F Filippi products must only be installed on supports which are not subject to vibrations and mechanical stress – this is critical for their correct operation. In the event that it is not possible to avoid this kind of installation, you are invited to contact our Sales Network or the 3F Filippi Headquarters to request a technical assessment.
- Turning on a luminaire leads to an environmental “load” which is often not justified. Despite 3F Filippi’s commitment to offering our customers the best energy-saving systems, using lighting only when strictly necessary is still the best way to save money and respect the environment.
- Correct and sensible lighting design can help save more money than you might think: 3F Filippi recommends that lighting projects are carried out by professional, reliable designers who can recommend the best solutions both for you and the environment. Lighting should only be used when necessary.
- 3F Filippi strongly believe in reusing raw materials, and for this reason we are constantly optimising our products to make them more environmentally-friendly. For example, we use a high percentage of recycled board in our packaging, and our luminaires are all produced in a single plant powered by solar panels: these simple measures allow us to limit transport and optimise resources. 3F Filippi invites users to do the same by recycling packaging after installation and correctly disposing of luminaires at the end of their life-cycle.



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