

UNIQUE ON A GLOBAL SCALE

THE PULSE METHOD ILLUMINATE FOR PLANTS

HORTI

PERFAND LED®



LUMINAIRES DEVELOPED IN COLLABORATION WITH THE INSTITUTE OF PLANT PHYSIOLOGY POLISH
ACADEMY OF SCIENCES
FIND OUT MORE AT PERFANDLED.PL



Who are we?

ABOUT PERFAND LED

OUR HISTORY

Perfand LED was founded in 2016, by Andrzej Trawinski, co-founder of the FM World group. The company is located in Trzebnica, near Wrocław, where the office, laboratory and production plant are located.

OUR MISSION

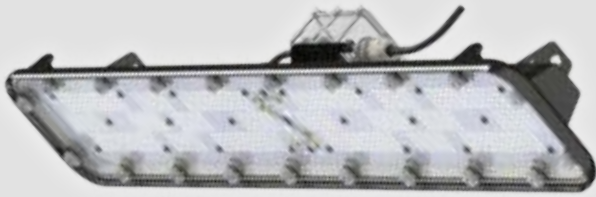
Our mission is to strive to increase the comfort of people's lives through the use and continuous improvement of modern and environmentally friendly LED lighting solutions.

AREA OF ACTIVITY

Perfand LED with its passion for the lighting industry and LED technology, is rapidly growing its business, constantly expanding offer with high-quality products. We comprehensively design, create and implement new luminaires and solutions to the production process.

Our products are made in Poland, so we have full control at every stage of production. We make sure that the manufactured lamps meet the expectations of our customers. The production range includes industrial, outdoor, office, specialty luminaires and HORTI 2 luminaires designed for growing plants. In the area of luminaires to support greenhouse or indoor crops, an innovative product using pulsed lighting has been developed and is secured by a worldwide patent.

DISCOVER THE UNIQUE HORTI 2 SERIES OF LUMINAIRES - FROM NATURE TO SOLUTIONS



HORTI 2

Horti 2 is a luminaire designed to illuminate greenhouse crops.

Power of a single luminaire: 200 W / 20 W.

Details on page 8-9



HORTI 2 LN

Horti 2 LN is a linear luminaire designed to illuminate Cannabis crops.

Thanks to its clever design, the luminaire is also available in a set of 4.

Power of a single luminaire: 200 W / 20 W.

Details on page 10-11



HORTI 2 SQ

Horti 2 SQ is a luminaire designed to illuminate greenhouse crops, growboxes and potted plants. The luminaire also comes in a set of 4 pieces.

Power of a single luminaire: 100 W / 20 W.

Details on page 12-13



HORTI 2 VT

Horti 2 VT is a luminaire designed for lighting for vertical crops. The set consists of 10 tubes.

Power of the set: 265 W / 35 W.

Details on page 14-15





How do we operate?

TRUST

For Perfand LED, quality service is paramount. We want to supply our customers with high-quality products. Therefore, we operate in accordance with the requirements of the implemented ISO 9001:2015 quality management system. It commits us to continuous improvement in the field: "Design and manufacture of lighting luminaires made with LED technology."

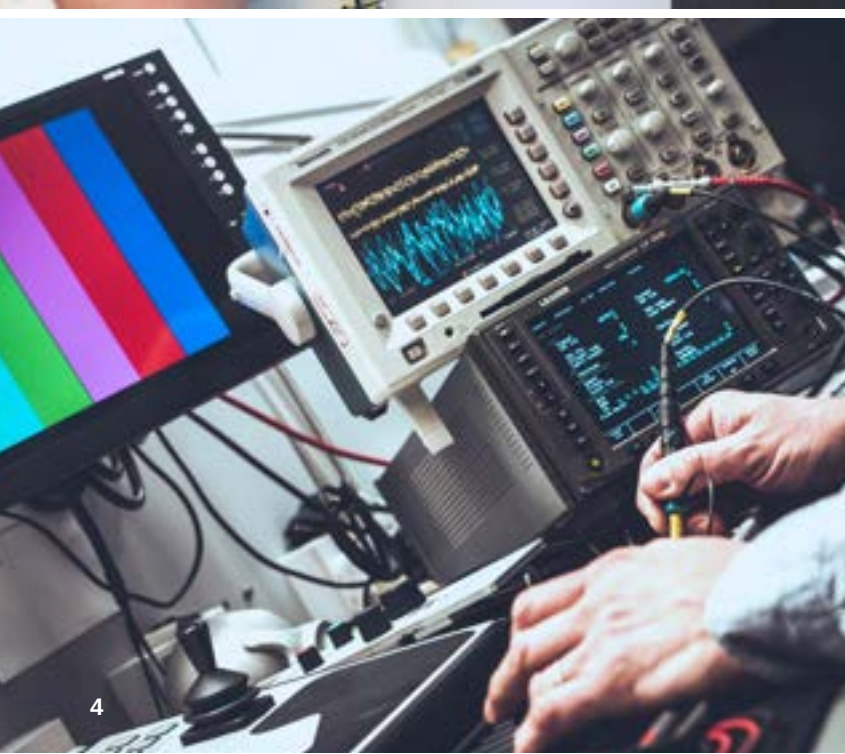


FROM CONCEPT TO IMPLEMENTATION

Our engineers and specialists constantly monitor trends in the lighting industry and analyze customer demand and suggestions. The R&D team designs housings, led modules and power supplies for our luminaires. It is involved in comprehensive planning, new product development and implementation, selection of key components and strict quality control. With experience and attention to detail, our Horti 2 series luminaires are designed with GMP standards in mind.

RESEARCH AND EXPERIENCE

We make sure that the technologies used are supported by reliable tests. Therefore, the solutions used in our luminaires have undergone many years of research at the Institute of Plant Physiology of the Polish Academy of Sciences in Krakow.



We cooperate with the best scientific units, perform internships (including specialists from the Delphy Institute) and greenhouse tests.

We strive to ensure that new products are researched and tested by lighting professionals as well as ordinary users. Opinions and reviews are an important source of information for us, which we thoroughly analyze. Our subsequent products and realizations are based on them.

Inspiration straight from nature!

Observation of the world around us, growing demand and costs in the crop sector, motivated us to create new LED luminaires to support farmers, growers and cultivators in their daily work.

The ideas that guided us were **ecology, energy efficiency and crop efficiency**.

THE POWER OF LIGHT

We are aware that light plays an important role in the life and development of all plants. Photosynthesis is a process that, with the help of light, produces organic compounds, which are the plant's main source of nutrition, directly released into the atmosphere.

Unfortunately, in autumn, winter, and spring the days are shorter, which translates into a shorter growing season due to less solar energy absorbed by the plant. The increase in the cost of crops means that previously used artificial light sources such as fluorescent, sodium, HPS or metal halide lamps are starting to generate very high costs due to electricity consumption. The solution lies in new technologies and innovations in crop lighting with LED lamps. These are efficient light sources that can be successfully used for various types of crops.

ORIGINAL METHOD

In nature, we can observe that light energy does not reach plants continuously. The amount and length of exposure is affected by many factors, such as the time of year and weather conditions - cloud cover. In addition, due to their structure, the plants themselves can limit the reception of sunlight - overlapping leaves and the location of individual plants.

Recognition of these phenomena and further observation of plant physiology in the wild has shown that the lack of constant, continuous sunlight is more beneficial to plant development.

With inspiration taken straight from nature, we have created our proprietary pulsed lighting system for growing plants, unique on a global scale. It is based on the modulation of light with a spectrum suitable for the crop.



Pulsed light beam technology

UNIQUE ON A GLOBAL SCALE

An innovation on a global scale and a rarity in the luminaire market, dedicated to lighting plants, is the use of Perfund LED's patented pulsed light beam technology. It provides a periodic reduction in light intensity, which allows the photosynthetic apparatus to regenerate. This makes it even better equipped to effectively use the next dose of light having a higher intensity. In this way the energy management of the plant becomes more efficient, closer to the natural phenomena that occur in nature. Importantly, the cost of operation is significantly lower compared to LED luminaires from other manufacturers and traditional light sources (HPS). For example, the 200 W Horti 2 luminaire, with pulse technology (200 W / 20 W), generates an average power consumption of about 100 W.

ADVANTAGES OF THE PULSED SYSTEM

An additional advantage of such a system is passive cooling. High temperatures have a significant impact on shortening the life of LEDs, as well as other electronic components and elements. The use of appropriate luminaire design and modulated illumination ensures that components operate at the right temperature. As a result, we do not need to use additional heat sinks and cooling fans, and the luminaire has a uniform surface resistant to contamination and easy to clean (GMP).



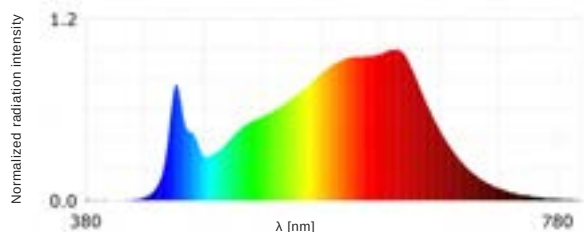
Spectrum

FREE CHOICE OF SPECTRUM DEPENDING ON THE INTENDED USE

Each of our luminaires has the option to select any spectrum depending on its intended use. Horti 2 luminaires provide visually white light that is safe for the eyes. However, they are enhanced with LEDs of different colours to suit the needs and ways of growing plants. For this purpose, we use diodes from reputable brands such as Osram, Samsung and Lumileds.

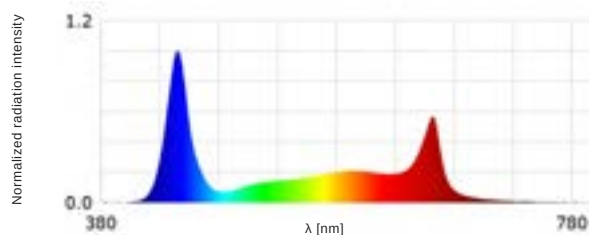
We have developed three types of spectrum based on the latest scientific research, and consultations with specialists.

SPECTRUM CB



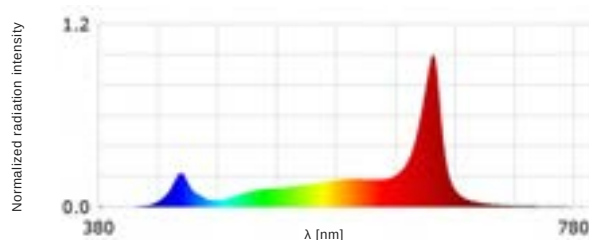
The CB spectrum is based on a spectrum composed, in effect, of white light. It is primarily dedicated to the cultivation of Cannabis.

SPECTRUM A



Spectrum A is based on the colours of the blue spectrum, which significantly influences development in the early stages of plant growth. Its application brings the best results in the cultivation of seedlings.

SPECTRUM B



Spectrum B is based on the colour of the red spectrum, brings the best results for plant growth - in greenhouse cultivation.



Horti 2



Horti 2 is a luminaire designed to illuminate greenhouse crops. The lamp has a lightweight, sturdy and slim form, thanks to its aluminum housing and a shutter made of PMMA. The Horti 2 lighting uses a patented pulsed plant illumination system that is unique on a global scale. Depending on the choice of spectrum, the luminaire can be used to illuminate different types of crops. Horti 2 was created with individual users' needs in mind, so you can choose a luminaire with different power outputs depending on your preferences. Available variants: 200 W, 160 W, and 120 W.

Each luminaire has an individual control system. In addition, with larger crops in mind, we designed a group control system. In addition the controller has a function for individual power adjustment - 10 levels each level allows power reduction / dimming by 10%.

VARIANTS AVAILABLE

MODEL	POWER	PPF	PROTECTION CLASS	IP	IK	AVERAGE POWER	APPLICATION
Horti 2 CB	200 W / 20 W	500 $\mu\text{mol} / \text{s}$	I	65	04	100 W	Cannabis crops
Horti 2 A	200 W / 20 W	510 $\mu\text{mol} / \text{s}$	I	65	04	100 W	Crops of seedlings
Horti 2 B	200 W / 20 W	560 $\mu\text{mol} / \text{s}$	I	65	04	100 W	Greenhouse crops

TECHNICAL PARAMETERS

Supply voltage: 230 V AC / 50-60Hz

Ambient temperature range: +5°C... +40°C

Lifetime L90B50: above 70 000 h

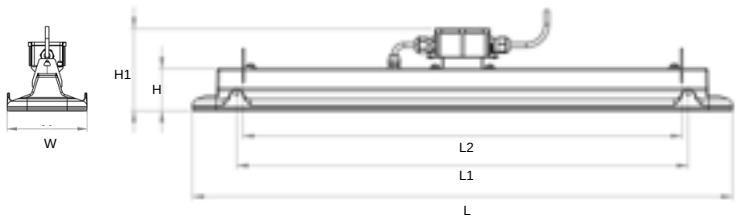
Power factor: >0,94 (full power)

Installation: suspended

Housing: aluminium, PMMA

Cooling system: passive

Warranty: 5 years



Name	L (mm)	L1 (mm)	L2 (mm)	W (mm)	H (mm)	H1 (mm)	Weight (kg)
Horti 2	790	660	643	140	61,5	124	3,65





Examples of lighting parameters for a single luminaire

LUMINAIRE MODEL	HEIGHT (cm) ►►	25	50	75	100	125	150	175
	PEAK POWER (W) ▼▼	PPFD ($\mu\text{mol} / \text{m}^2 / \text{s}$)						
Horti 2 luminaire Horti 2 luminaire (with O60 optics)	200	1282 1856	505 783	260 432	154 269	103 182	73 131	55,5 98,6
	160	1121 1560	421 670	211 369	128 230	83,5 155	60 113	45 85
	120	632 1223	314 524	153 289	95 180	63 121	44,5 87	33,3 66



Horti 2 LN



Horti 2 LN is a linear luminaire dedicated to illuminating Cannabis crops. The use of an aluminum housing makes the lamp's design durable and very good at dissipating heat. A single luminaire and a set of 4 are available. The Horti 2 LN lighting uses a patented pulsed plant illumination system that is unique on a global scale. Horti 2 was created with individual users' needs in mind, so you can choose a luminaire with different power outputs depending on your preferences. Available variants: 200 W, 160 W, 120 W, 80 W.

Each luminaire has an individual control system. In addition, with larger crops in mind, we designed a group control system. In addition the controller has a function for individual power adjustment - 10 levels each level allows power reduction / dimming by 10%.

VARIANTS AVAILABLE

MODEL	POWER	PPF	PROTECTION CLASS	IP	IK	AVERAGE POWER	APPLICATION
Horti 2 LN CB	200 W / 20 W	378 $\mu\text{mol} / \text{s}$	I	65	06	100 W	Cannabis crops
Horti 2 LNx4 CB	800 W / 80 W	1512 $\mu\text{mol} / \text{s}$	I	65	06	400 W	Cannabis crops

TECHNICAL PARAMETERS

Power supply: 230 V AC / 50-60Hz

Ambient temperature range: +5°C... +40°C

Lifetime L90B50: above 85 000 h

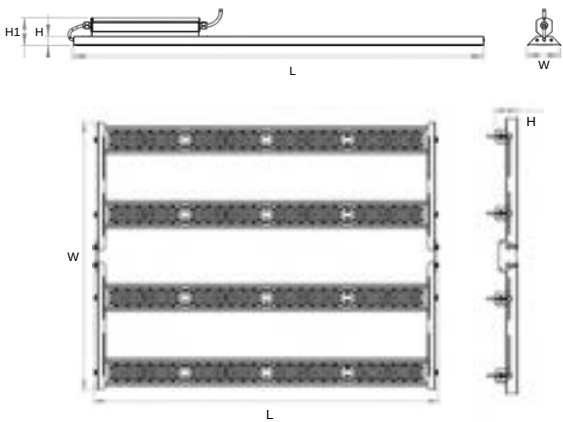
Power factor: >0,94 (full power)

Installation: suspended

Housing: aluminium, PC

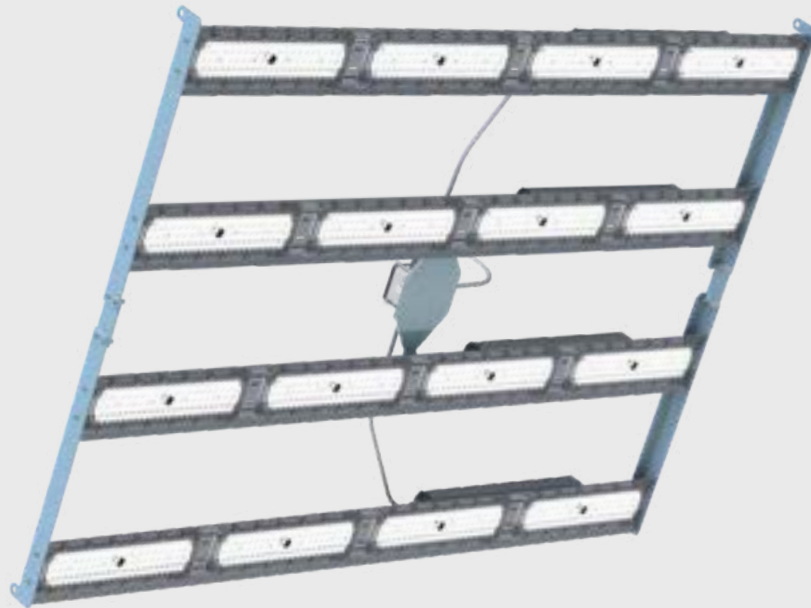
Cooling system: passive

Warranty: 5 years



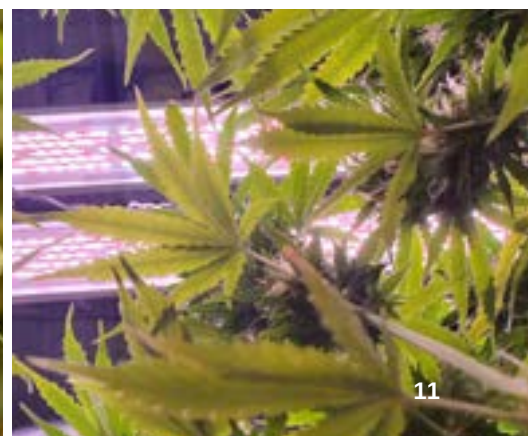
Name	L (mm)	W (mm)	H (mm)	H1 (mm)	Weight (kg)
Horti 2 LN	1158	93	25	78	2,25
Horti 2 LNx4	1220	943	943	79,5	9,30





Examples of lighting parameters for a single luminaire

LUMINAIRE MODEL	HEIGHT (cm) ►►	25	50	75	100	125	150	175
	PEAK POWER (W) ▼▼	PPFD ($\mu\text{mol} / \text{m}^2 / \text{s}$)						
Horti 2 LN luminaire (Optics O60)	200	1720	812	509	358	260	195	150
	160	1505	678	425	299	215	161,5	127
	120	1193	540	336	234	169	126	99
	80	800	361	233	164	118	89	69



Horti 2 SQ



Horti 2 SQ is a luminaire designed to illuminate greenhouse crops, growboxes and potted plants. The housing is made of square-shaped cast aluminum. Thoughtful design and form of the lamp makes it easy to adapt it to illuminate crops in a limited space. A single luminaire and a set of 4 are available. The Horti 2 SQ lighting, uses a patented plant illumination system that is unique on a global scale. Horti 2 SQ was created with individual user needs in mind, so depending on your preferences, the luminaire is available in power variants: 100 W, 80 W, 60 W, 40 W.

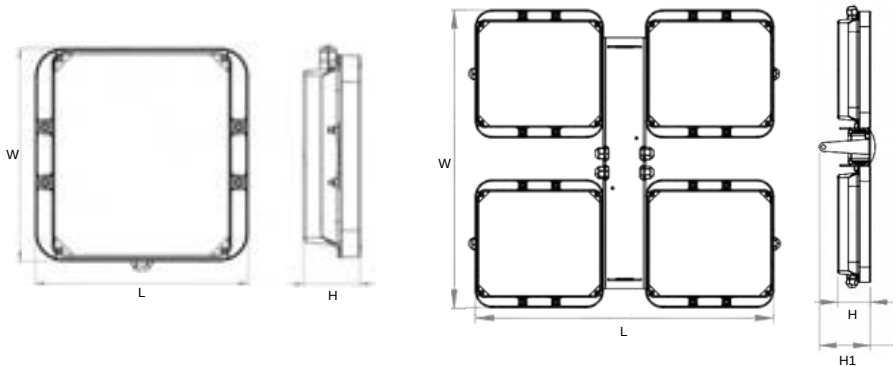
Each luminaire has an individual control system. In addition, with larger crops in mind, we designed a group control system. In addition the controller has a function for individual power adjustment - 10 levels each level allows power reduction / dimming by 10%.

VARIANTS AVAILABLE

MODEL	POWER	PPF	PROTECTION CLASS	IP	IK	AVERAGE POWER	APPLICATION
Horti 2 SQ CB	100 W / 20 W	210 $\mu\text{mol} / \text{s}$	I	65	08	54 W	Cannabis crops
Horti 2 SQx4 CB	400 W / 80 W	840 $\mu\text{mol} / \text{s}$	I	65	08	216 W	Cannabis crops

TECHNICAL PARAMETERS

Power supply: 230 V AC / 50-60Hz
Ambient temperature range: +5°C... +40°C
Lifetime L80B50: above 85 000 h
Power factor: >0,94 (full power)
Installation: suspended
Housing: aluminium, toughened glass
Cooling system: passive
Warranty: 5 years



Name	L (mm)	W (mm)	H (mm)	H1 (mm)	Weight (kg)
Horti 2 SQ	230	230	64	-	1,8
Horti 2 SQx4	536	536	64	100	8





Examples of lighting parameters for a single luminaire

LUMINAIRE MODEL	HEIGHT (cm) ►►	25	50	75	100	125	150	175
	PEAK POWER (W) ▼▼	PPFD ($\mu\text{mol} / \text{m}^2 / \text{s}$)						
Horti 2 SQ 23x23 luminaire (without optics) Horti 2 SQ 23x23 luminaire (Optics O60)	100	942 1660	267 523	123 254	71 147	46 96,5	32 67,6	24 42
	80	728 1352	215 443	99 216	59,4 125	38 81	27 57	20 42
	60	638 1064	169 356	80 170	46 99	30 64,5	21 45	16 33,7
	40	418 798	119 254	55,5 120	32 70	21 45	15 32	11 17,7



Horti 2 VT



Horti 2 VT is a luminaire designed to illuminate vertical crops. Its design is a set of 10 tubes made of PC and an external aluminum power supply/controller. The individual tubes are connected to each other linearly by a cable fitted with connectors for quick installation. In addition, the luminaires can be equipped with an on / off switch, which allows you to turn the lamps off or on as needed. The Horti 2 VT lighting, uses a patented plant illumination system that is unique on a global scale. Depending on the choice of spectrum, the luminaire can be used for different types of crops.

The complete set comes with an external power supply with integrated proprietary software. The controller adjusts the power of the set depending on the number of active luminaires. In addition, the controller has a function for individual power adjustment - 10 levels, each level allows power reduction / dimming by 10%.

VARIANTS AVAILABLE

MODEL	POWER	PPF	PROTECTION CLASS	IP	IK	AVERAGE POWER	APPLICATION
Horti 2 VT CB	300 W / 20 W	735 $\mu\text{mol} / \text{s}$	I	65	09	140 W	Vertical crops - Cannabis
Horti 2 VT A	265 W / 35 W	650 $\mu\text{mol} / \text{s}$	I	65	09	130 W	Vertical crops - seedlings, micro leaves
Horti 2 VT B	265 W / 35 W	750 $\mu\text{mol} / \text{s}$	I	65	09	130 W	Vertical crops - green plants

*The basic set consists of a power module and 10 beams of 26,5 watts each.

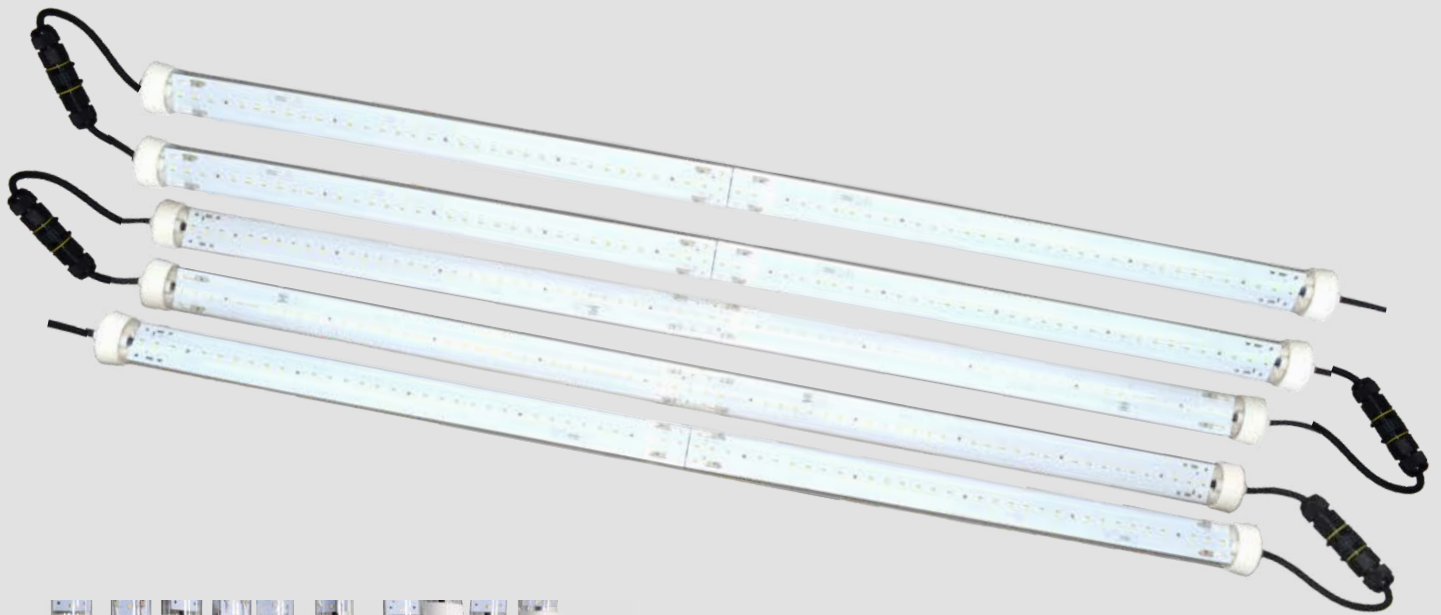
TECHNICAL PARAMETERS

Power supply: 230 V AC / 50-60 Hz
Ambient temperature range: +5°C... +40°C
Lifetime L90B50: above 70 000 h
Power factor: >0,90 (full power)
Installation: suspended
Housing: PC, aluminium (power module)
Cooling system: passive
Warranty: 5 years



Name	L (mm)	W (mm)	H (mm)	Weight (kg)
Horti 2 VT A i B	1050	46	54	0,70
Horti 2 VT CB	1200	46	54	0,80
Power supply	400	39	43	0,65





On/off switch (optional)



Power module



Connectors



Fixture





Luminaire suspension height

PLACE OF CULTIVATION

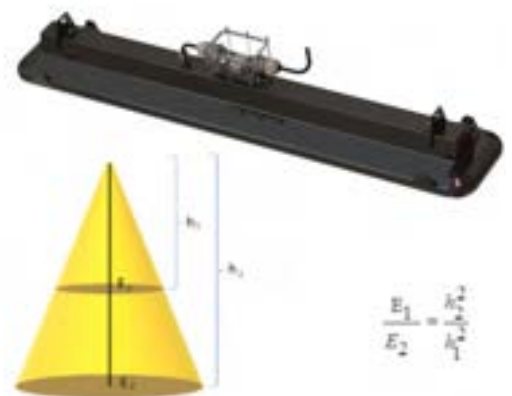
The kind of space we want to grow plants in is very important. The luminaires will vary depending on the intended location and stage of growth. There are specialized luminaires for illuminating greenhouse and indoor type crops, but also luminaires for lighting vertical or hydroponic crops.

Proper planning of luminaire spacing will have a direct impact on the effects of later crops.



THE IMPORTANCE OF SUSPENSION HEIGHT

There is a great deal of talk about the power of the lamp, rather than its suspension height relative to the plant. The correct spacing of light sources, taking into account the specifications and needs of the plants, is an important aspect in order for the plants to make 100 per cent use of their characteristics.



Every centimetre higher reduces the μmol value reaching the plant!

A luminaire hung at different heights has different peak power and PPFD values. This directly confirms the importance of the height at which the lamps are hung if we want to achieve optimum crop lighting.



Advantages of Horti luminaires

CROPS UNDER HORTI LUMINAIRES

In comparative tests conducted "side by side" with HPS (dual), CFL systems and LED luminaires from other manufacturers, plants grown under HORTI luminaires show:

- an increase in the density and volume of plants,
- a growth acceleration,
- no deficiency in the plant (throughout the growth phase),
- the elimination of the risk of overheating of leaf and flower surfaces, a common cause of stunted or abnormal development during the growth and flowering phase.

TECHNICAL VALUES OF THE LUMINAIRE

- All luminaires are manufactured at our factory in Trzebnica in accordance with the ISO 9001:2015 quality management system.
- Each product in our offer is covered by a 5-year warranty.
- The use of appropriate luminaire design and modulated illumination ensures the operation of components at the right temperature and proper heat dissipation.
- The well-thought-out design and the materials used result in the lamp having a high protection class (IP65).
- The luminaires have a surface that is uniform, resistant to contamination and easy to clean (GMP).





Real savings

SAMPLE CALCULATION OF COSTS

Return on investment under the assumptions: Lighting of the crop all year round 15 h a day (5475 h).

	Price kWh	Number of luminaires	Average luminaire power	Total power	Durability	Annual costs
LED luminaire* (power 200 W)	0,65 PLN	1000 pcs.	200 W	200 kW	50 000 h	711 750 PLN
Horti 2 (power 200 W / 20 W)	0,65 PLN	1000 pcs.	100 W	100 kW	70 000 h	355 875 PLN

* Competitors' luminaires with similar parameters, without a modulation system. Calculation made based on the data of the average price of electricity in Poland kWh in 2022.

EFFECTIVENESS OF THE PULSED SYSTEM

Horti 2 luminaires feature a patented light modulation system. The method of crop lighting used brings the benefits of better plant growth with lower operating costs.

The issue of energy efficiency has been and will continue to be an important issue in the coming years. When designing our luminaires, we took into account the increase in electricity prices. The use of modulation and proprietary control and power systems makes Horti 2 luminaires series more economical compared to lamps made with traditional LED technology.

Reference



"We have been able to work with Perfandled products for the growth of cannabis for over 2 years. Until then, we have tested several solutions dedicated to hemp, which turned out to be a very good choice. We especially recommend the latest Horti CB ++ solution, namely the newest Horti 2 CB model (new housing). We conducted the tests in total on an area of approx. 0.5 ha (as a lighting fixture and full indoor). Plants from under this led fixture they grow properly during the growing season. We noticed intensive tillering and a significant increase in the circumference of the stem, which should be considered a big plus. Large and fleshy leaves throughout the development cycle, evenly colored.

The generative (flowering) phase was also flawless. The flowers grow intensively, they are covered in a lot of resin. Flowers actually swell until the very end of their growth, which is important to us and should also be considered a big plus. The advantage is also the lack of a tendency to the formation of foxtails, which was confirmed by comparative tests on the same genetics, in a parallel growbox, on LED luminaires from a different manufacturer.

The advantage of the solutions with Perfandled modulation is also the low operating temperature of the luminaire, which translates into no problems with excess heat in the cultivation, which often appeared with classic LEDs, especially in tech. COB. This usually eliminates the problem of heat dissipation from the crop altogether.

However, the main advantage is the real energy savings of up to 50%, while providing the plant with a comparable amount of light in μmoles compared to other LED luminaires with a continuous beam of light. This is an extremely important aspect, especially with larger investments, because we get abundant crops comparable to the best LED hemp luminaires we use, at the same time, we save 50% of energy costs. We can certainly recommend the Horti 2 CB product to any cannabis grower, both amateurs and professionals with large-scale crops."



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Reference



F.H. NOWALIJKA Piotr Wychowalek

Horti B+ luminaires were selected after tests (comparative tests with other manufacturers of LED luminaires) on basil crops. Ultimately, replacement of luminaires on an area of 1.2 ha. Further cooperation will include the lettuce crops lighting.



Zbigniew Nowacki Farm

Horti B luminaires - application: roses.



Rozsadnik

Horti A luminaires - after very good test results, we are replacing the entire greenhouse lighting.



INSTITUTE OF PLANT PHYSIOLOGY; POLISH ACADEMY OF SCIENCES

In addition to the joint test luminaires, various types of Horti luminaires were purchased for own research.

Tests



Citronex Sp. z o.o.

Tests of luminaires on tomato crops (300 pieces of Horti B++ luminaires). Citronex is the largest greenhouse producer in Poland - 75 ha of crops.



Agricultural and Horticultural Farm Jan Zdunek

From test reports: "Plants reacted positively to LED lighting. Vegetative growth was better. Plants had intensely colored leaves. Luminaires light does not interfere with work" (tomato seedlings).



Gardening Paweł Pychyński

From test reports: "Plant lighting with light emitted by diodes resulted in a significant increase in yield compared to sodium light" (chrysanthemums).



SiejeSle

The tests include different types of spectrum applied to the green crops in vertical cultivation.

Tests



Agricultural and Horticultural Farm Ryszard Prus

From test reports: "(...) the operation of the Perfund LED luminaires in impulse mode allowed to obtain much greater economic savings in relation to permanent LED lighting" (raspberry tomato).



Agricultural and Horticultural Farm Klaudiusz Kordylasiński

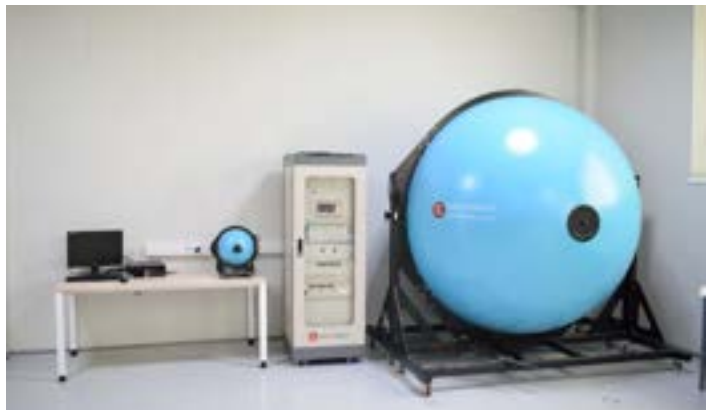
Horti B++ test covering the entire greenhouse. As part of the cooperation, over 1,800 luminaires were installed. The cultivation is controlled by a climate computer. The growing conditions are adjusted to the potential of LED luminaires.

Production



In our production plant we use state of the art machines, thanks to which we are able to produce the luminaires ourselves in Poland. Each lamp is individually created to the expectation of the target customer, and the detail is hand-fixed. Before approval, the product is thoroughly tested by quality control department. Our priority is to ensure safety in the use of lighting luminaires.

Laboratory



Among other things, our laboratory uses apparatus for electrical and photometric measurements: spectrophotometer, oscilloscope, integrating sphere and standardized lux meters. Our latest projects are always thoroughly researched and thought through, from the first assumptions, planning, 3D models to the first prototypes.



Cooperation

Cropp One (USA) – cooperation for almost a year with one of the largest greenhouse producers. Area of interest - lettuce, green plants.

Espiflot (Iceland) – gerbers. Tests and attempts to establish guidelines for lighting greenhouse crops in specific climatic conditions of Iceland.

Robbes (Finland) – green plants, basil. Testing of luminaires in comparison to the present vertical crop lighting system (work stopped due to Covid19).

Kabbarps (Sweden) – basil. Crops lighting- replacement of LED constant light for Horti modulated lighting system.

Cannabis crops – Poland, USA, Spain. Horti CB+ luminaires testing in comparison to other types of lighting. In Spain, additional tests on algae (PAN algae tests - doubling the algae mass).

PERFAND LED®

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