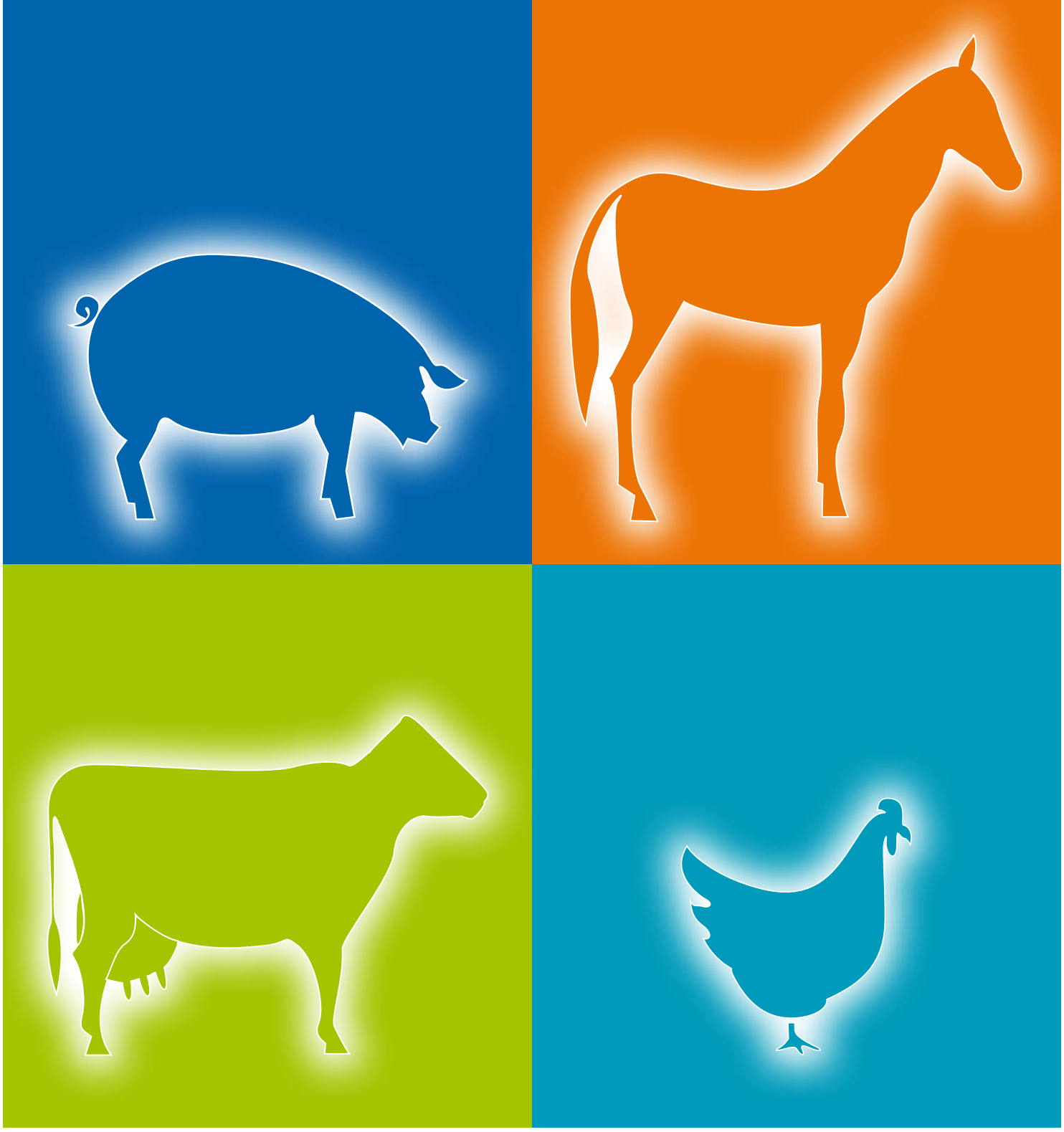


NORKA

LED LIGHTING FOR AGRICULTURE AND ANIMAL HUSBANDRY

2. Edition

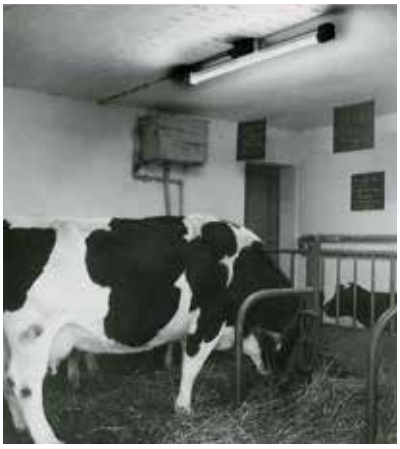
LED LIGHTING FOR AGRICULTURE AND ANIMAL HUSBANDRY

GENERAL SECTORS

> BERLIN LED
> BERN LED
> BERN LED EX
> BITBURG LED
> CENTAURUS
> COESFELD
> COESFELD PLUS
> ERFURT LED
> FULDA LED
> POLARIS
> SCHÖNEFELD LED
> TALON W
> TEGEL LED
> URANUS

DAIRY COWS / CATTLE

> BERN LED
> CENTAURUS
> COESFELD
> COESFELD PLUS
> URANUS
> POLARIS



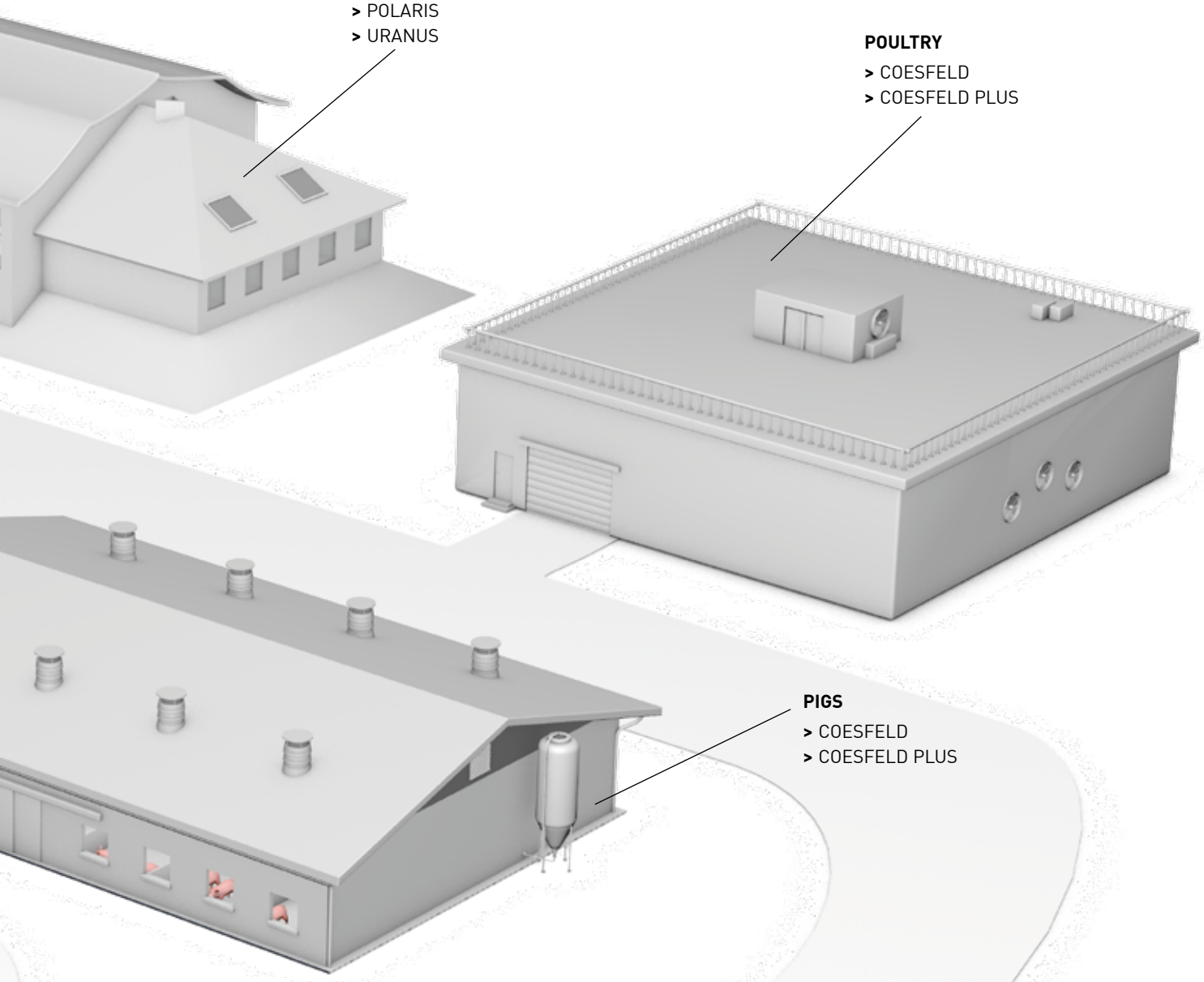
> The durable polymer luminaires "Made in Germany" were already used for illumination in cowsheds in the 1950s – such as the NORKA luminaire HAMBURG on the left.

HORSES

> COESFELD
> COESFELD PLUS
> CENTAURUS
> POLARIS
> URANUS

POULTRY

> COESFELD
> COESFELD PLUS



PIGS

> COESFELD
> COESFELD PLUS

MANY SECTORS – ONE SOLUTIONS PROVIDER

High technical requirements have to be met for the future-proof and sustainable operation of agricultural facilities. Coordinating health and safety, animal health and food safety is a great challenge.

Animal husbandry for food production is a special sector. Humans and animals depend on each other and practically share their workplace.

In addition to hygienic aspects such as cleanliness in the stables/sheds and of the air, lighting is a seal of quality for a harmonious work environment.

A good lighting concept is characterised by energy efficient illumination that complies with DIN standards.

Different studies from renowned institutions confirm a direct relationship between a lighting system with well balanced intensity and duration of illumination and the emotional state, the development and the productivity of the animals. The rearing and keeping of cattle, pigs, horses and poultry in modern facilities consequently uses finely graduated illumination programmes to support the natural habits of the animals.

In the sector of economically used animals, the luminaires are exposed to mechanical strain, caused e.g. by impact or intensive cleaning processes using high-pressure cleaners, as well as to chemical strain from disinfectants and cleaning agents, not in the least ammonia.

As a solutions provider with over 65 years of experience and competence, NORKA supports your various applications with reliable and durable luminaires.

GENERAL AREAS

An agricultural facility comprises many fields of activity and therefore has various requirements for lighting.
Areas for loading and unloading and for manoeuvring vehicles, entries and exits, storage areas, equipment washing areas or silage storage can form part of the requirements in the outside area. Indoors it might be workshops with work pits, equipment rooms, storage rooms, personnel rooms and animal sheds.

All rooms require the right illumination for carrying out the work. These can be indirect illumination, e.g. in work pits, or uniform illumination of large storage areas as well as glare-free illumination of offices. Some of these areas are frequented briefly several times a day and are therefore particularly suitable for motion controlled lighting solutions.

Outside facilities / yard illumination	Illumination level*	Special requirements	Suitable luminaires
Outside silo	15 - 20 lx	Pole mounting, motion-controlled, if required	POLARIS, URANUS (version for pole mounting)
Loading/unloading points	50 lx	Motion-controlled, if required	ERFURT LED, POLARIS, TALON W, URANUS
Entries and exits	15 lx	Motion-controlled, if required	ERFURT LED, POLARIS, TALON W, URANUS
Open tool sheds	50 lx	Motion-controlled, if required	ERFURT LED, POLARIS, TALON W, URANUS
Parking for vehicles	100 lx	Motion-controlled, if required	ERFURT LED, POLARIS, TALON W, URANUS
Traffic areas	10 lx	Motion-controlled, if required	ERFURT LED, POLARIS, TALON W, URANUS
Washing station (utility vehicles)	100 lx	Dirt-repellent housing, easy to clean, motion-controlled if required	BITBURG LED, COESFELD, COESFELD PLUS, ERFURT LED

* Average illuminance according to DIN EN 12464-1:2011 (D) or DIN EN 12464-1:2013 (D) and DIN EN 12464-2:2014-05

Covered areas			
Work pit	300 - 500 lx	Luminaire housing resistant to acid, lye and fuel	BERN LED, FULDA LED
Loading and operating of conveyors and machines	200 lx		ERFURT LED
Feed preparation, device cleaning	200 lx	Explosion protection, if required	BERN LED EX, COESFELD, ERFURT LED
Equipment and storage rooms with special equipment (shelves and cabinets)	100 lx	Motion-controlled, if required	ERFURT LED
Grain storage, hay and straw storage	100 lx	Explosion protection, if required, Motion-controlled, if required	BERN LED EX, COESFELD, ERFURT LED
Rough installation work	200 lx	Luminaire housing resistant to acid, lye and fuel	BERN LED, COESFELD, COESFELD PLUS, ERFURT LED, FULDA LED
Cooling and storage rooms	300 lx	Motion-controlled, if required	BERLIN LED, ERFURT LED
Barn, loft, shed	50 lx	Motion-controlled, if required	BERLIN LED, BERN LED EX, COESFELD, ERFURT LED
Workshop	300 lx		BERN LED, FULDA LED

Personnel areas			
General lighting	300 lx	Motion-controlled, if required	ERFURT LED
Common rooms, kitchens, operation centres	200 lx	Motion-controlled, if required	ERFURT LED
Duty rooms, break rooms	100 lx	Motion-controlled, if required	BERN LED, ERFURT LED
Office workplace	500 lx	Motion-controlled, if required	BERN LED, ERFURT LED
Escape routes		Permitted by VDE guidelines, sufficient light for orientation	COBURG LED, SCHÖNEFELD LED, TEGEL LED
Emergency light	1 - 5 lx		All luminaires emergency light compatible
Washrooms, showers, WC, changing rooms, drying rooms	200 lx	Motion-controlled, if required	BERLIN LED, BERN LED, ERFURT LED

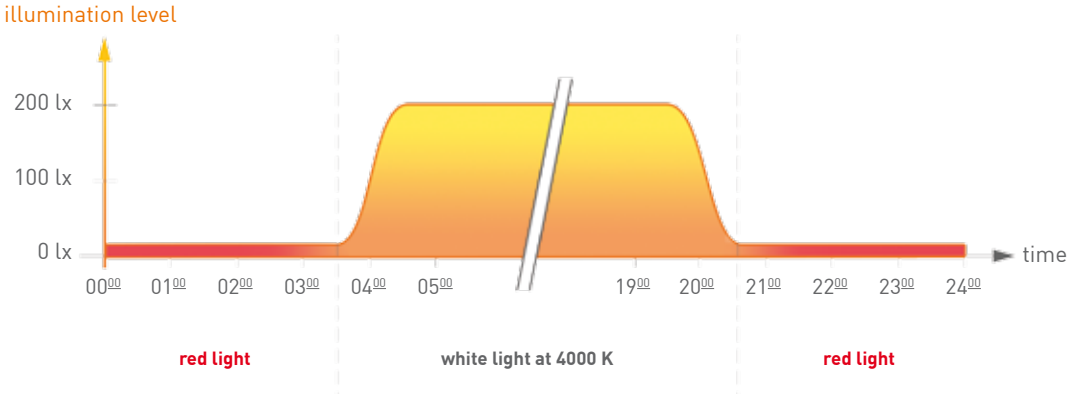
* Average illuminance according to DIN EN 12464-1:2011 (D) or DIN EN 12464-1:2013 (D) and DIN EN 12464-2:2014-05

DAIRY COWS / CATTLE

Animal welfare and sustainability are among the prevalent issues of modern animal husbandry in Europe in the last decade.
Finding the right balance between the two requirements is a continuing challenge. Quality of life for the animals includes different factors such as genetics, keeping, feeding and care. Modern cubicle barns for dairy cows, for example, provide freedom of movement and the option of freely selecting a comfortable resting place, contributing to animal welfare. Another component of good keeping of livestock is thermal comfort which surely also includes appropriate lighting.
Unlike human eyes, cows have difficulty seeing red light. Good illumination can draw advantages from this fact. During the day, neutral to cold white colour temperatures can support the animals' natural vision. During the night rest times, red light will not disturb the animals while allowing the farmer to carry out simply tasks in the sheds.
Sudden, hectic movements or abrupt changes in illumination levels from dark to light can be unnerving for cows. They take four to five times longer than the human eye to adapt to light. A dimmable lighting system can have a positive influence here, supporting the animals' habitual vision.

Milk production	Illumination level*	Special requirements	Suitable luminaires
Device cleaning	200 lx	Motion-controlled, if required	COESFELD, COESFELD PLUS
Milking pit or movement range for milking personnel	500 - 600 lx** 1000 lx***	Very good colour rendering Ra >90-100 at 5000K / 5400K, directed light, high illumination level, motion-controlled, if necessary	COESFELD PLUS
Milking carousel / fully automatic milking system	100 lx	Very good colour rendering Ra >90-100 at 5000K / 5400K, luminaires suitable for cleaning with pressure washers (IP 69K)	COESFELD PLUS, URANUS
Milking station, cattle area	200 lx	Very good colour rendering Ra >90-100 at 5000K / 5400K, luminaires suitable for cleaning with pressure washers (IP 69K)	COESFELD, COESFELD PLUS, BERN LED
Milk production	200 lx	Very good colour rendering Ra >90-100 at 5000K / 5400K	COESFELD PLUS, URANUS
Milk rooms	200 lx	Motion-controlled, if required	COESFELD, COESFELD PLUS

* Average illuminance according to DIN EN 12464-1:2011 (D) or DIN EN 12464-1:2013 (D) and DIN EN 12464-2:2014-05
** Recommendation: Agricultural Chamber of North Rhine-Westphalia
*** According to interpretation of food quality control



> Cows have difficulty seeing red light. During the night rest times, red light will not disturb the animals while allowing the farmer to carry out simply tasks in the sheds.

Keeping	Illumination level*	Special requirements	Suitable luminaires
Calving barn	200 lx		COESFELD, COESFELD PLUS, BERN LED (red light)
Nursing barn, bull barn	80 lx		COESFELD, COESFELD PLUS, BERN LED (red light), POLARIS
Rearing and lactation (resting barn)	100 lx***	Long days with 10 to 16 hours of light	COESFELD, COESFELD PLUS, BERN LED (red light), POLARIS
Rearing of young cattle	100 lx***	16 hours of light and 8 hours of darkness - greater daily weight gain - earlier onset of sexual maturity - positive influence on milk gland development	COESFELD, COESFELD PLUS, BERN LED (red light, POLARIS
Feed preparation	200 lx		COESFELD, COESFELD PLUS, POLARIS
Feed table	150 - 200 lx		COESFELD, COESFELD PLUS, POLARIS
Calf village, calf boxes and igloos	80 lx		COESFELD, COESFELD PLUS
Resting barn	200 lx	Day/night rhythm with 16-hour day phase and 8-hour night phase - up to 12 % capacity increase - up to 8 % feed intake - improved animal observation (heat) - earlier sexual maturity for young animals	COESFELD, COESFELD PLUS, BERN LED (red light), POLARIS
Rehabilitation barn	200 lx		COESFELD, COESFELD PLUS, BERN LED (red light), POLARIS
Dry standing time (resting barn)	100 lx***	Short days with 8 hours of light and 16 hours of darkness	COESFELD, COESFELD PLUS, BERN LED (red light), POLARIS
Covered outdoor areas	50 lx		COESFELD, COESFELD PLUS, POLARIS

* Average illuminance according to DIN EN 12464-1:2011 (D) or DIN EN 12464-1:2013 (D) and DIN EN 12464-2:2014-05
** Recommendation: Agricultural Chamber of North Rhine-Westphalia
*** Recommendation: Bavarian State Institute for Agriculture (LfL)

POULTRY

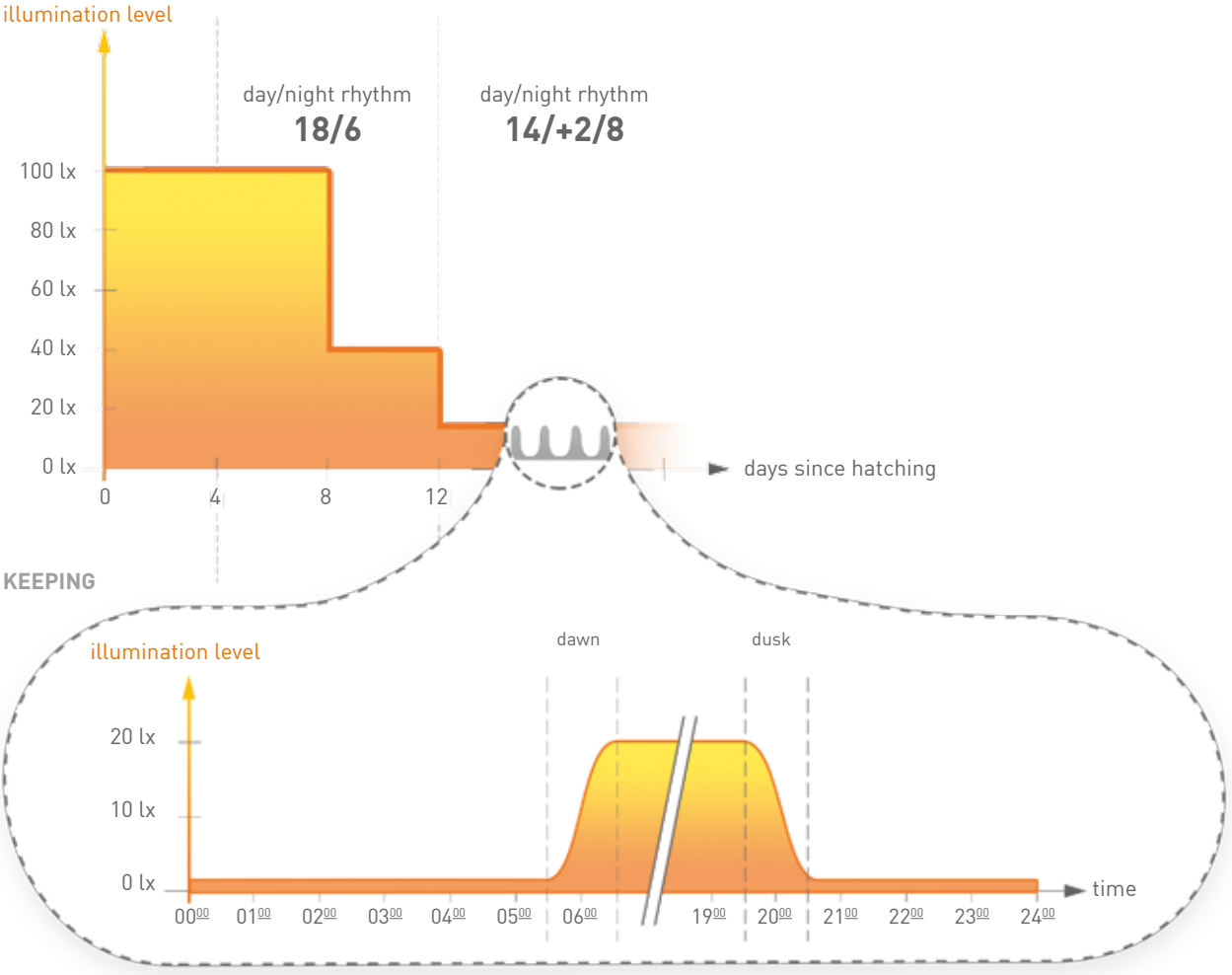
Regular checks of animals and technology are crucial for keeping poultry. These checks verify animal welfare (protection of animals), feather pecking and cannibalism among the animals. In addition to care and rearing recommendations, correct illumination also influences the number and weight of eggs for layers and the growth rate for meat producing chickens.
Birds are photosensitive – they adapt their behaviour and their physiological reactions to the changing light influences over the course of the year. Shed concepts with daylight use are designed to guide the light evenly into the room without sun spots to avoid crowding and therefore crushing of animals.
So-called intermittent illumination programs are used in windowless sheds to increase the yield of the animals. These light cycles are based on a shortened day/night cycle and can be used with so-called "step-up" and "step-down" programs for controlling sexual maturity, feed intake and laying period.
Scientific studies have shown that short-wave light (violet-blue range) and an illumination level of 50 lx promote feather picking and aggressive behaviour.
To prevent anomalies in animal behaviour, the light intensity is reduced to 5 lx in dark sheds and increased to 10 - 15 lx in laying sheds.
The prerequisites for good illumination in poultry sheds are therefore flexible use through different illumination programs, dimmability and warm colour temperature.
Poultry are sensitive to flickering light, like that from fluorescent lamps operated with a throttle on 50 Hz alternating current. The animals only stop noticing the flickering when the frequency is clearly above 50 Hz. LED luminaires are operated with direct current and therefore generally free from flickering. For light programs or for daylight controlled lighting systems, however, it has to be ensured that either only current dimming or pulse width modulation with a pulse frequency clearly above 50 Hz are used.

Keeping	Illumination level*	Special requirements	Suitable luminaires
Floor-raising of young hens	20 lx	Day/night rhythm 4/4/4 (two night periods)	COESFELD PLUS
Rearing of meat-producing chickens	60 lx	12 hours illuminated	COESFELD, COESFELD PLUS
Rearing of meat-producing chickens / turkeys / egg-laying chickens in small groups as cage system	Rearing turkeys 80 - 100 lx (from day 4) 30 - 40 lx (from day 8) 20 lx (from day 12)	Day/night rhythm 18/6	COESFELD PLUS
Floor raising	20 lx		COESFELD PLUS
Dark shed	5 lx		COESFELD PLUS
Duck fattening shed	60 lx	From day 21, a dark phase (at least 8 hours) has to be ensured (less than 2 lx). The sheds have to be equipped with light openings of at least 3 % of the shed footprint. Even distribution has to be ensured.	COESFELD PLUS
Egg-laying hens / cages	15 - 20 lx	Min. 8 hours of dark phase (less than 0.5 lx) with dusk/dawn phase, 12-14 hours illuminated for good laying performance. Newly erected sheds have to be equipped with light openings of at least 3 % of the shed footprint, ensuring even distribution.	COESFELD PLUS
Meat-producing chickens	20 lx	Day/night rhythm 4/4/4/. 24-hour light program with at least 6 hours uninterrupted dark phase which follows the natural day/night rhythm. An illumination intensity of min. 20 lx at head level of the animals and at least 80 % illumination of the shed have to be ensured during the light hours.	COESFELD PLUS
Turkeys	20 lx	Until the 14th day hourly dark phases, from the 14th day gradual build-up of an 8 hour dark phase. 16 hours illuminated.	COESFELD PLUS

* Average illuminance according to DIN EN 12464-1:2011 (D) or DIN EN 12464-1:2013 (D) and DIN EN 12464-2:2014-05

EXEMPLARY ILLUMINATION PROGRAMME

REARING



- Constant illumination during the first 24 to 48 hours after hatching can help the chicks with getting accustomed to the new environment. The illumination level should be 100 lx from the fourth day at the latest and then about 40 lx from the eighth day.
- From the twelfth day, an illumination level of approx. 20 lx is recommended with a day/night rhythm of approx. 12-14 hours illumination and about 8 hours dark phase. Gradual dimming is recommended during the dusk/dawn phases (FadeIn/FadeOut).
- Emergency lighting with max. 2 lx can be used during the dark phase to prevent panic reactions.

Source: © 2009 KTBL Kuratorium für Technik und Bauwesen in der Landwirtschaft, article: Anforderungen in der Geflügelhaltung (Requirments for poultry farming)

HORSES / RIDING HALLS / MULTI-PURPOSE HALLS

High requirements apply to lighting when dealing with horses. Different illumination levels are used for best possible presentation of horse and rider, from housing and caring for the horses in the stables to training or competitions in the riding hall.
Riding halls are mostly used during bad weather, in the evening or during the dark, cold time of year. Existing daylight openings often do not provide sufficient light for the riding hall. A daylight-controlled lighting system dims the artificial light in the hall with a high level of energy efficiency, providing a constant illumination level.
Similar to nocturnal animals, horses can see their surroundings much more clearly during dusk/dawn or in moonlight than humans. This means that they become unnerved by sudden changes from dark to bright light. Dimmable illumination can remove this moment of shock by using so-called "fade-in" and "fade-out" functions.
Great differences in illumination density on the ground in combination with dark, reflective surfaces can be interpreted as hazard areas, particularly by young horses.
Homogeneous illumination is therefore recommended for riding halls and riding fields.
Sand and dust kicked up by the horses means that luminaires in riding halls become dirty very quickly. They are therefore cleaned with a hosepipe about once per year.
Modern riding halls are equipped with sprinkler systems for watering the sand. Watering creates a high level of moisture in the air of the hall and the finely dispersed water can settle on the luminaires.

Good illumination quality is characterised by the illumination level and by good colour rendering. Particularly during tournaments or horse shows with a lot of photography and filming, good colour rendering from the luminaires supports perfect presentation of the animals.
For other uses of the hall, e.g. for events or exhibitions, different switching groups with different dimming levels can be created to make optimum use of the hall.

Equestrian sports	**Illumination level***	**Special requirements**	**Suitable luminaires**
Outdoor riding field	120 lx, 150 - 250 lx**	Very even illumination	POLARIS, URANUS (version for pole mounting)
Riding (riding hall)	150 lx	Very even illumination	COESFELD, COESFELD PLUS, CENTAURUS, POLARIS, URANUS
Jumping (riding hall)	200 lx	Very even illumination	COESFELD, COESFELD PLUS, CENTAURUS, POLARIS, URANUS
Tournament (riding hall)	400 lx, 600 lx **	Very even illumination	COESFELD, COESFELD PLUS, CENTAURUS, POLARIS, URANUS
Trick riding (riding hall)	100 lx	Very even illumination	COESFELD, COESFELD PLUS, CENTAURUS, POLARIS, URANUS
Keeping			
Horse keeping areas	80 - 100 lx	Daylight has to be ensured. The ratio of windows to box footprint has to be at least 1:20. 8 hours illuminated.	COESFELD
Retreat areas	15 lx		COESFELD
Multi-purpose halls			
Hall	300 lx	Dimmable illumination, possibly with different switching groups, consisting of diffuse light sources and floodlights with colour rendering characteristics >90 Ra for brilliant colour rendering	COESFELD, COESFELD PLUS, CENTAURUS, POLARIS, URANUS

* Average illuminance according to DIN EN 12464-1:2011 (D) or DIN EN 12464-1:2013 (D) and DIN EN 12464-2:2014-05
** Recommendation


FEI LEGENDS

PIGS

Pigs are particularly demanding with regard to hygiene and cleanliness. Regular disinfection of sheds, especially of the farrowing areas, is the basic prerequisite for successful rearing of the animals.
The intensive hygiene process includes rough cleaning, e.g. with a pressure washer, several hours of soaking, cleaning from floor to ceiling with plenty of water, followed by rinsing and drying of the sheds and then application of the disinfectants.
Surface cleaning today is carried out manually, mobile or stationary. Stationary systems range from sprinkler systems to high-pressure dispersion systems with fog nozzles up to 100 bar.
The entire process places enormous wear on the materials of all installations in the sheds. Objects such as the luminaires are required for visual checks during cleaning and cannot be dismantled.

Another challenge is the ambient temperature during the cleaning process and e.g. for piglet rearing. Higher ambient temperatures are generally beneficial for the cleaning procedure. The usage concentration of the cleaning agents and disinfectants is optimised between +4 °C and +30 °C.
For piglet rearing, a constant ambient temperature of +30 °C supports the health of piglets in the first days of life.
The installation of luminaires in a pig shed therefore requires robust luminaire housings which are resistant to chemicals and lye. Protection rating IP 69K for intensive cleaning processes is required here just as much as permanent ammonia resistance for the sensitive electronic components.

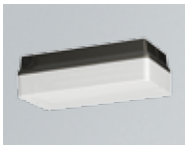
Keeping	Illumination level*	Special requirements	Suitable luminaires
Farrowing area	200 lx	Luminaires suitable for cleaning with pressure washers (IP 69K)	COESFELD PLUS
Covering centre	300 lx	14-16 hours illuminated	COESFELD, COESFELD PLUS
Hygiene sluice	200 lx	Luminaires suitable for cleaning with pressure washers (IP 69K)	COESFELD PLUS
Storage room	100 lx	Motion-controlled, if required	COESFELD
Feeding shed, Sows in pig, large groups	80 lx**	An orientation light is required for the dark phase	COESFELD, COESFELD PLUS
Sow showers	200 lx	Luminaires suitable for cleaning with pressure washers (IP 69K)	COESFELD PLUS
Sows in pig, small groups	80 lx**		COESFELD, COESFELD PLUS

* Average illuminance according to DIN EN 12464-1:2011 (D) or DIN EN 12464-1:2013 (D) and DIN EN 12464-2:2014-05
** Recommendation: Agricultural Chamber of North Rhine-Westphalia

LED LUMINAIRE RANGE – OVERVIEW

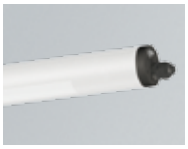
5 years manufacturer's warranty • 50,000 operating hours

BERLIN LED



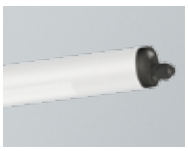
> ceiling and wall surface-mounted luminaire, compact design
> ambient temperatures between -25 °C and +35 °C
> replaces TC-SEL 11 W and TC-L / TC-D 18 W

BERN LED



> tubular luminaire Ø 60 mm
> small space requirement for very tight situations
> IP 69K version for intensive cleaning processes, e,g, using pressure washers
> 24 V version with red LEDs available
> suitable for ambient temperatures between -30 °C and +40 °C

BERN LED EX



> tubular luminaire Ø 60 mm
> explosion protected for zone 2 and zone 22
> IP 69K version for intensive cleaning processes, e.g. using pressure washers
> suitable for ambient temperatures up to -40 °C

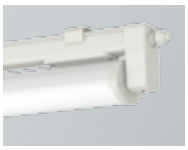
CENTAURUS

> floodlight for high ceilings
> replacement for HQL lamps up to 1000 W
> for integration into DALI controls
> uniform illumination for large areas
> different lighting technologies

COBURG LED

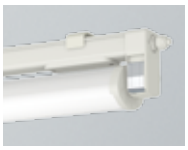
> single-battery emergency luminaire
> emergency light operation through electronic integrated emergency lighting unit, including charging, indicator, mains monitoring and protection against total discharge
> emergency light duration 1 h or 3 h, with self-test function

COESFELD



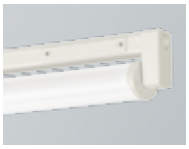
> ammonia-resistant, fume-proof reflector tube luminaire
> single or twin lamp
> suitable for ambient temperatures between -25 °C and +40 °C
> IP 65 (single lamp / twin lamp) and IP 67 (single lamp)
> cable gland M20, through wiring on request
> ammonia-resistant, fixed connecting cable 2 × 1.5 mm²
> different colour temperatures

COESFELD PLUS



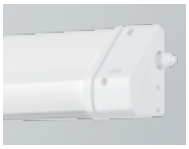
> ammonia-resistant, fume-proof reflector tube luminaire
> single lamp
> suitable for ambient temperatures between -25 °C and +40 °C
> IP 65, IP 67, IP 69K
> cable gland M20, through wiring on request
> for integration into DALI controls
> 100,000 operating hours
> 4 kV (protection against transient over-voltage)
> different colour temperatures and high colour rendering capabilities
> ammonia-resistant, fixed connecting cable 4 × 2.5 mm²

ERFURT LED



> reflector tubes luminaire
> single or twin lamp
> IP 65 (single lamp / twin lamp) and IP 67 (single lamp)
> cable membrane M20 and 2 × 1.5 mm² through wiring

FULDA LED



> polymer luminaire resistant to acid, lye and fuel
> installation in wall and ceiling recesses for low ceiling heights
> installation in work pits for indirect lighting

POLARIS

> floodlight for ceiling wall or pole mounting
> replacement for HQL lamps up to 400 W
> elliptical light distribution
> for integration into DALI controls
> different lighting technologies

SCHÖNEFELD LED

> single-battery escape route luminaire with pictogram foils according to DIN EN ISO 7010
> compact design
> emergency light operation through electronic integrated emergency lighting unit, including charging, indicator, mains monitoring and protection against total discharge
> emergency light duration 1 h or 3 h, with self-test function

TALON W

> wall surface-mounted luminaire made of extruded aluminium profiles
> housing, anodised black or silver
> different light technologies for public squares or entryways

TEGEL LED

> centrally supplied escape route luminaire with pictogram foils according to DIN EN ISO 7010
> compact design
> mains and emergency light operation via electronic transformer

URANUS

> floodlight for ceiling wall or pole mounting
> replacement for HQL lamps up to 250 W
> for integration into DALI controls
> different lighting technologies

PROTECTION RATING TEST

IP 69K

INGRESS PROTECTION FOR ACCIDENTAL CONTACT AND FOREIGN BODIES

1st index	Protection Designation	Explanation
6	Dust protection	Total protection against contact with live or internal, moving parts. Protection against dust ingress.

INGRESS PROTECTION AGAINST WATER

2nd index	Protection Designation	Explanation
.9K	Protection against water ingress during high-pressure/ steam jet cleaning	Hot water (80 °C) impacting from any direction under high pressure (80-100 bar) on the luminaire must not enter.

TEST CONDITIONS FIRST INDEX (6)

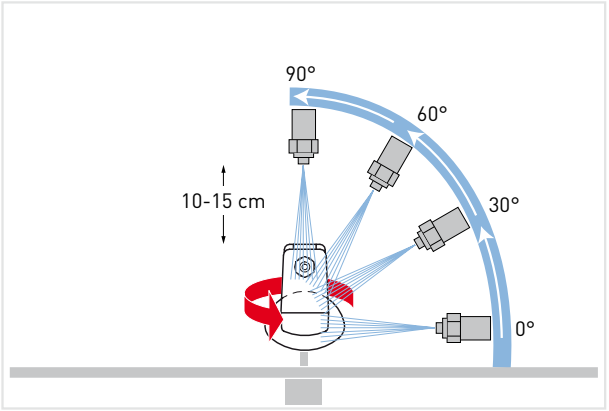
Vacuum test with dust/air mixture

Vacuum	⩽ 2 kPa (20 mbar)
Test duration	8 h
Test dust	50 % limestone and 50 % fly ash
Grain size distribution	33 weight fractions ⩽ 32 µm / 67 weight fractions ⩽ 32 µm, but ⩽ 250 µm

TEST CONDITIONS SECOND INDEX (9K)

Protection test against water ingress

Test device	High-pressure water system / flat nozzle
Spray angle	0°- 30°- 60°- 90°
Distance	100 - 150mm --> on turntable --> speed (5 ±1) 1/min
Water flow rate	14 - 16 l/min ± 5 %
Water pressure	8000 - 10000 kPa (80 - 100 bar)
Water temperature	80°C ± 5°C
Test duration	30 s per position



> Schematic diagram: protection rating test IP 69K

LUMINAIRES PUT TO THE TEST

NORKA TEST LUMINAIRES UNDER REALISTIC CONDITIONS

01. IMPACT TEST: In impact tests according to DIN EN 50102, the maximum mechanical stress of the materials is tested using spring hammers and drop hammers.

02. IP RATING TESTS: IP rating tests are carried out according to DIN EN 60529 to test the effects of dust, coarse foreign bodies or water and consequently the tightness of housing, diffusers and gaskets.

> **Dust test:** Dust tests are carried out to assess the effects of dust and sand both on and in the luminaires.
> **Test IP 69K:** The IP69K test verifies the protection against hot water during high-pressure or steam-jet cleaning according to DIN EN 40050. The test conditions require a pressure of max. 100 bar at a temperature of 80 °C.
> **Spray water test:** The spray water test is used to test the resistance against moisture penetration.
> **Pressurised water test:** During the pressurised water test, a hazardous amount of water ingress must not occur when the luminaire is immersed in water.

03. TEMPERATURE TEST: The temperature test is necessary to guarantee the long-term reliable functioning of the luminaires within a temperature range of -50 °C to 90 °C and to provide definitive statements on their luminous flux characteristics in connection with heat increase.

04. CLIMATIC TEST: The climatic test for potentially explosive zones according to DIN EN 60079 is used to certify climatic resistance under extreme conditions of 80 °C and 90 % relative humidity.

05. VIBRATION TEST: The vibration test is a procedure used to examine the mechanical strength of individual components and to determine the functionality of technical systems when exposed to vibrations.

06. CHEMICAL TEST: This test is used to verify the resistance of materials against chemicals. Material effects such as deformation, embrittlement and cracking can then be avoided.

07. HEATING TEST: When testing the durability and heating, the temperatures of all parts installed in the luminaire are recorded during normal and abnormal operation and then compared to the maximum permissible temperatures.

50 % ENERGY SAVING AT 100 % LIGHT

INDIVIDUAL LUMEN PACKAGES PROVIDE NEW OPTIONS

Requirements for good lighting and up to 50 % energy savings are being demanded more and more of lighting designers and luminaire manufacturers by public transport companies, the German Federal government (EnEV – 'German energy conservation act' Energieeinsparungsverordnung) or the national Authority for the Environment.

In many fields of application it is already possible to use LED luminaires without neglecting requirements for "good lighting".
The use of energy efficient LED technology is also ideal for the typical areas of application for NORKA luminaires.

ONE LUMINAIRE – MANY LUMEN PACKAGES
Apart from the well-known characteristics, such as extremely long service life, resistance to vibrations and instant light in sub-zero temperatures, LED luminaires offer another advantage: the luminous flux does not depend on the luminaire length. A T5 or T8 luminaire can be replaced at the same length 1:1 by an LED luminaire.

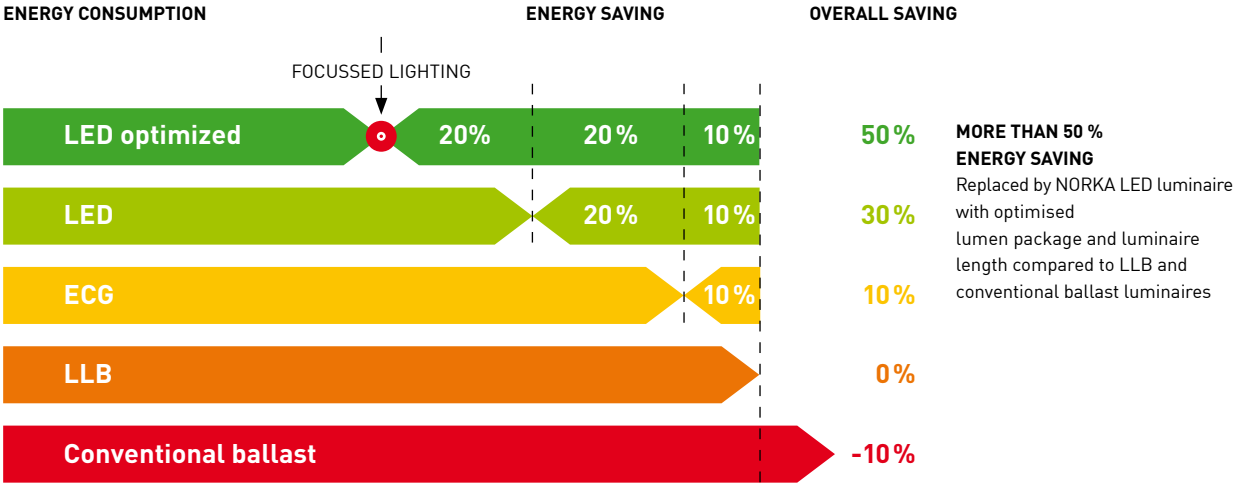
Different luminous fluxes enable larger or smaller lumen packages to be set for the same luminaire length.
Compared to T5 and T8 lamps, this option offers the advantage of being able to select the right lumen package individually for the general conditions of the illumination level and uniformity. Previously, the redevelopment of existing lighting systems by 1:1 replacement of luminaires meant that the required illumination level was frequently exceeded. The consequence: more light was used than actually needed.
With NORKA LED luminaires the lighting designer now has the opportunity of planing with individual lumen packages, thus keeping energy consumption to a minimum. In this process, energy savings of over 50 % are possible, compared to lighting systems with conventional ballast.

The following applies as a guide value for energy saving for a 1:1 replacement at the same illumination level:
20 % compared to electronic control gear (ECG);
30 % compared to low loss ballast and
40 % compared to conventional ballast.

In a further stage, the large choice of different luminous fluxes provides the opportunity of cutting investment costs by using the full capacity of the lumen package per luminaire length.

The result is a balanced ratio between number, length and output of the luminaires that can be presented by means of another comparative calculation.

PLANNING FOCUSSED LIGHTING
means achieving the best possible luminous flux for the required illumination level while using as little system power as possible. Professional lighting calculations support the determination of the correct luminous flux as a function of the installation height of the luminaires. The installation height also has an influence on the selection of the light characteristics, e.g. a narrow beam for high ceilings or an extreme wide beam for very low ceilings.
For the keeping of livestock, "focussed lighting" allows the best possible illumination level to be achieved while taking into account the DIN stipulations and the required values for animal welfare.



50 % ENERGY SAVING WITH AN ILLUMINATION LEVEL OF 200 LX

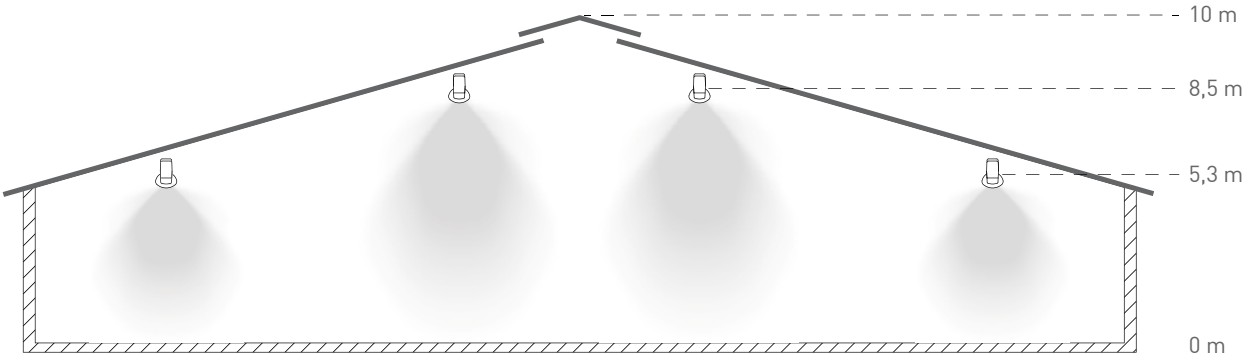
CALCULATION EXAMPLE FOR A SHED WITH A RIDGE ROOF:

Resting barn L × W: 121 m × 35 m, room height: 10 m, nominal illumination level: 200 lx

LIGHTING CALCULATION RESULT*

		Existing	New
Manufacturer		any	NORKA
Quantity		272 units	272 units
Version		Moisture-proof luminaire, medium beam, low loss ballast, inductive	COESFELD, m1200, PMMA Transopal® (impact strengthened), medium beam
Article number		-	445 480 35 23 - 3800lm
Configuration		1 × T8 58 W / 5200 lm	1 × LED 33 W / 4080 lm
System power		66 W	33 W
Light output ratio		78.8 %	97.7 %
Height of reference surface		0.2 m	0.2 m
Net total luminous flux of all luminaires		1,414,000 lm	1,109,760 lm
Total power		17,952 W	8,976 W
Total power per surface (800 m²)		4.24 W/m² (2.10 W/m²/100 lx)	2.12 W/m² (1.00 W/m²/100 lx)
Average illuminance	Em	211 lx	212 lx
Minimum illumination level	Emin	141 lx	138 lx
Maximum illumination level	Emax	260 lx	262 lx
Uniformity g1	Emin/Em	1:1,49 (0,67)	1:1,54 (0,65)
Uniformity g2	Emin/Emax	1:1,84 (0,54)	1:1,9 (0,53)

* The maintenance factor was not taken into consideration for this calculation.



THE PRINCIPLE OF SHORT GASKETS

Typical NORKA — that is a good description for this clever luminaire design. These luminaires have been offering as few points of attack as possible for moisture, dust and insects for over sixty years. This is achieved by special closure techniques with minimum sealing lengths.

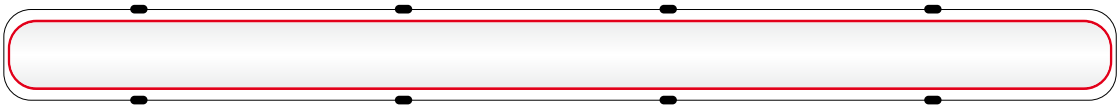
The longer a sealing system, the greater the possibility of a leak or mechanical damage. Conventional moisture-proof luminaires achieve tightness through the adaptiveness of the sealing material and the uniformly applied pressure between luminaire cover and housing. The pressure is usually generated across the entire length using quick release closures requiring no tools.

Extreme requirements such as cleaning processes with chemicals or acidic or alkaline atmospheres quickly corrode the materials. Materials of lesser quality age more quickly or they oxidise and become brittle.

NORKA exclusively uses high quality gaskets made of non-ageing, form-retaining silicone / synthetic rubber. The housing materials and gasket seatings are perfectly adapted to the corresponding gaskets and applications. A short sealing system can create a higher sealing pressure to achieve stronger, safer and more permanent sealing.

NORKA LUMINAIRE ERFURT, 1.2 M LONG WITH SHORT GASKET
GASKET LENGTH APPROX. 0,4 M

CONVENTIONAL DIFFUSER LUMINAIRE, 1.2 M LONG
GASKET LENGTH APPROX. 2,6 M



ADVANTAGES OF SHORT NORKA GASKETS:
> high sealing pressure through mechanical screw rings
> sealing materials adapted to the applications
> permanent, durable sealing against moisture, dust and insects
> permanent protection of internal components

DISADVANTAGES OF DIFFUSER LUMINAIRES WITH LONG GASKETS:
> gasket is displaced after opening
> thin walls
> sensitive quick-mounting pressure cap
> unstable overall luminaire

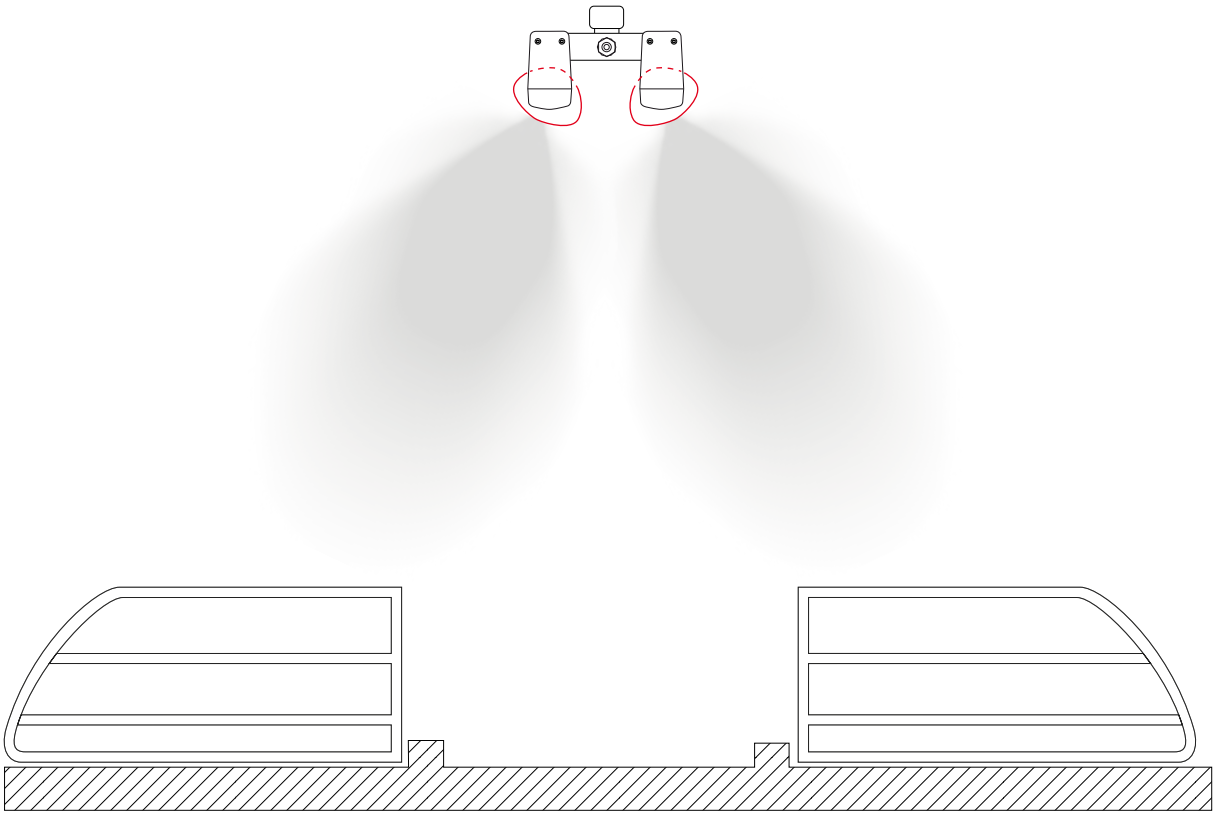
LIGHT WHERE IT IS NEEDED

Optimised light distribution through swivelling reflectors — positioned in maintenance-friendly locations.
To achieve uniform illumination of the room, conventional diffuser luminaires have to be evenly spaced throughout the room. In some situations they have to be placed in hard to reach positions.

In stables, this could be the ceiling over the boxes or a space on the rear wall. Maintenance is often only carried out when all animals have been driven out in order to spare the animals any unnecessary stress.

Swivelling reflector tubes from NORKA on the other hand offer the option of directing the light at the object from the viewing angle.

Especially in stables with boxes for small groups, mounting two-lamp luminaires in the area of the centre aisle is ideal. The two independently swivelling reflector tubes are each directed towards the boxes. Maintenance can be carried out at any time, even with the animals in the stable. Installation costs and mounting effort can be clearly reduced by optimum arrangement of the luminaires.



ADVANTAGES:
> light can be adjusted in any direction
> avoids glare
> reduces light connection points
> fast, easy maintenance

REPRESENTATIVES / WORLDWIDE

Australia
NORKA Lighting Sales Pty. Ltd.
14 Knighton Avenue
Airport West
Melbourne, Victoria 3042
Australia
Tel. +61 393 315 666
Fax +61 393 316 333
www.norkalighting.com.au
andrew@norkalighting.com.au

Austria
LKD Licht Kommunal Digital GmbH
Münchner Bundesstrasse 144
5020 Salzburg
Austria
Tel. +43 662 432 514-0
Fax +43 662 432 514-111
www.lkd.at
office@lkd.at

Belgium
CCLLIGHT
Rue Golden Hope 35B
1620 Drogenbos
Belgium
Tel. +32 2 334 34-36
Fax +32 2 334 34-40
www.ccllight.be
info.@ccllight.be

Czech Republic
Elektrolicht CZ s.r.o.
Masná 27/9
602 00 Brno
Czech Republic
Tel. +42 054 532 12 84
Fax +42 054 521 40 20
www.elektrolicht.cz
info@elektrolicht.cz

Denmark
SafeExIT
Herstedøstervej 19
2600 Glostrup
Denmark
Tel. +45 434 550-10
Fax +45 434 550-11
www.safeexit.dk
kontakt@safeexit.dk

Finland
Valoiste Oy
Aleksis Kiven katu 20B
33211 Tampere
Finland
Tel. +35 810 439 17 00
Fax +35 832 220 311
www.valoiste.fi
info@valoiste.fi

France
RIDI France Sàrl
ZI du Forlen
Impasse des Imprimeurs
67118 Geispolsheim
France
Tel. +33 388 77 -07 77
Fax +33 388 77 -36 99
www.norka-luminaires.fr
info@ridi-france.com

Great Britain
NORKA (UK) Limited
Strategic Lighting Group
Narrow Lane End Works
64a Worple Road
Epsom, Surrey KT18 7AG
Great Britain
Tel. +44 845 450 66-78
Fax +44 845 450 66-79
www.norka.com
mattwh@norka-uk.com

Greece
Moda Light
17th klm of Athens
Lamia National Highway
145-64 Kifissia Athens
Greece
Tel. +30 210 625 38-02
Fax +30 210 625 38-26
www.modalight.gr
info@modalight.gr

Luxembourg
Minusines S. A.
8, rue Hogenberg
1022 Luxembourg
Luxembourg
Tel. +35 249 58-58
Fax +35 249 58 -66 67
www.minusines.lu
info@minusines.lu

Netherlands
Industrielicht B.V.
Van Hennaertweg 7
2952 CA Alblasserdam
Netherlands
Tel. +31 786 92 09-00
Fax +31 786 92 09-05
www.industrielicht.nl
info@industrielicht.nl

New Zealand
Enlightenz
243-249 Bush Road
P.O.Box 302 302
North Harbour
Auckland 0751
New Zealand
Tel. +64 941 449-50
Fax +64 941 449-51
www.enlightenz.co.nz.
info@enlightenz.co.nz.

Norway
Frizen Belysning
Narviga 7
4633 Kristiansand
Norway
Tel. +47 380 771-00
Fax +47 380 771-01
www.frizen.no
post@frizen.no

Poland
Krulen Spolka z o.o.
Al. Stanów Zjednoczonych 20 A
03-964 Warszawa
Poland
Tel. +48 226 166 054
Fax +48 226 728 109
www.krulen.com.pl
info@krulen.com.pl

Portugal
inolite Iluminación S.L
Calle Aragón 390 - 394, 3º
08013 Barcelona
Spain
Tel. +34 935 405 066
Fax +34 935 405 066
info@inolite.com
www.inolite.com

Romania
ODRA IMPEX ,95 SRL
Saint Agnes Street no. 206
Popesti – Leordeni
77160 Ilfov County
Romania
Tel./fax +40 213 69 85-22
Tel./fax +40 213 69 85-21
www.odra.ro
odra@odra.ro

Russia
LIH Light Impex Henze GmbH
Bürgermeister-Schwaiger-Strasse 43
85567 Grafing / Munich
Germany
Tel. +49 809 270 995-7
Fax +49 809 270 995-8
www.lih.de
info@lih.de

Slovenia
ES d.o.o.
Ob Zeleni jami 9
1000 Ljubljana
Slovenia
Tel. +38 615 40 16-50
Fax +38 615 40 16-49
www.es-svetila.com
prodaja@es-svetila.com

Spain
inolite Iluminación S.L
Calle Aragón 390 - 394, 3º
08013 Barcelona
Spain
Tel. +34 935 405 066
Fax +34 935 405 066
info@inolite.com
www.inolite.com

Sweden
Fergin Sverige AB
Bangardsgatan 9
591 35 Motala
Sweden
Tel. +46 141 500 25
Fax +46 141 536 94
www.fergin.se
info@fergin.se

Switzerland
Regent Beleuchtungskörper AG
Dornacherstrasse 390
4018 Basel
Switzerland
Tel. +41 613 355-579
Fax +41 613 355-204
www.regent.ch
info.bs@regent.ch

NORKA

Norddeutsche Kunststoff-
und Elektrogesellschaft
Stäcker mbH & Co. KG

Lichttechnische Spezialfabrik

Contact
Sportallee 8
22335 Hamburg
Germany

P. +49.40.51 30 09-0
F. +49.40.51 30 09-28

info@norka.de
www.norka.de