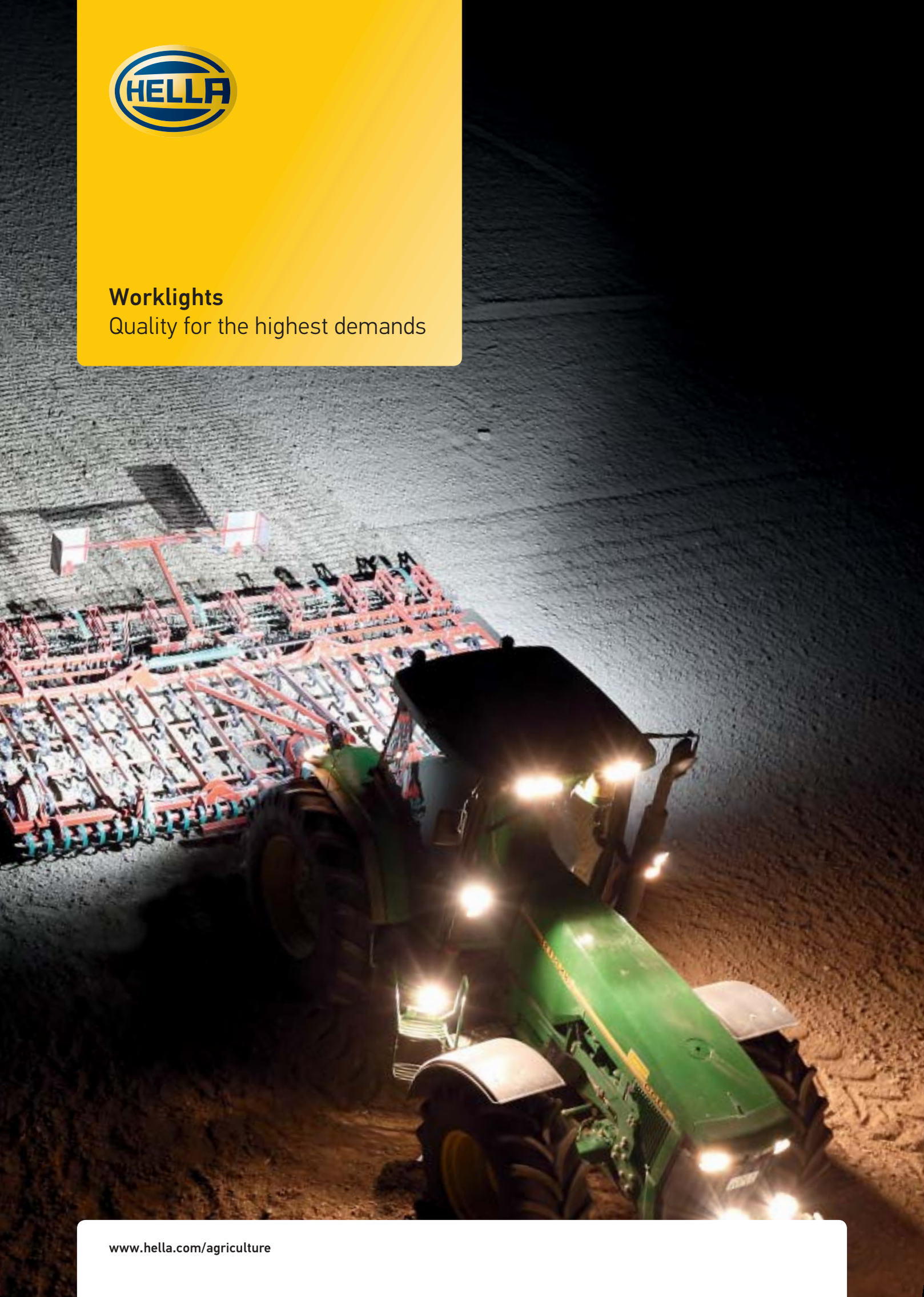
Worklights
Quality for the highest demands



www.hella.com/agriculture

The challenge

Increasing the size of a farm forces farmers to work longer hours after it gets dark. At the same time, agricultural machinery has got bigger and the speed of tractors has increased over the years. The demands on people and machines have clearly risen.

The solution

Farmers need stronger working lights with excellent illumination to be able to see in front of them and concentrate on their work for longer periods at night. That is why we at HELLA have developed increasingly powerful worklights - in the highest quality. Our customers need to be able to rely on our worklights at all times. When it comes to the crunch, quality is the main aspect that counts.

We want the best working conditions for you.

In order to be able to work faster, more precise and more productive, farmers need ideal light conditions. HELLA's worklights guarantee this - thanks to their unique quality.

Stronger and better working lights help.
Sleep researchers in Basel working together with scientists from the Fraunhofer Institute for Work Management and Organization have discovered that people react strongly to light. For example, the colour temperature of lighting has a considerable effect on responsiveness and performance. Experiments have shown that people get tired quicker if lighting is too weak and colour temperatures are dull and yellowish. The reason is that the body perceives such light as twilight and switches to work being over. Optimum working light, as produced by HELLA worklights, helps, enabling you to remain awake longer in the evenings and concentrate more on your work, thereby raising the night worker's productivity.

Only quality protects against tiredness.
Scientific studies have shown that the human eye has the capacity to always orient itself to the lightest point of a surface. For relaxed vision, however, balanced illumination is necessary. The lighting technicians at HELLA therefore construct worklights so that light concentration in the close, very frequently, strongly illuminated area is reduced and consistently increased at a distance. That means that the eye does not tire so quickly and the farmer can concentrate for longer periods.

Quality pays off.
HELLA's uncompromising endeavours in terms of quality reduces repair and failure times to a minimum - and in the case of LED worklights - to practically zero. That enables HELLA worklights to be operated maintenance free for up to 60,000 hours. In order to optimise the design life and performance of the light source, HELLA has developed a sophisticated thermal management system.

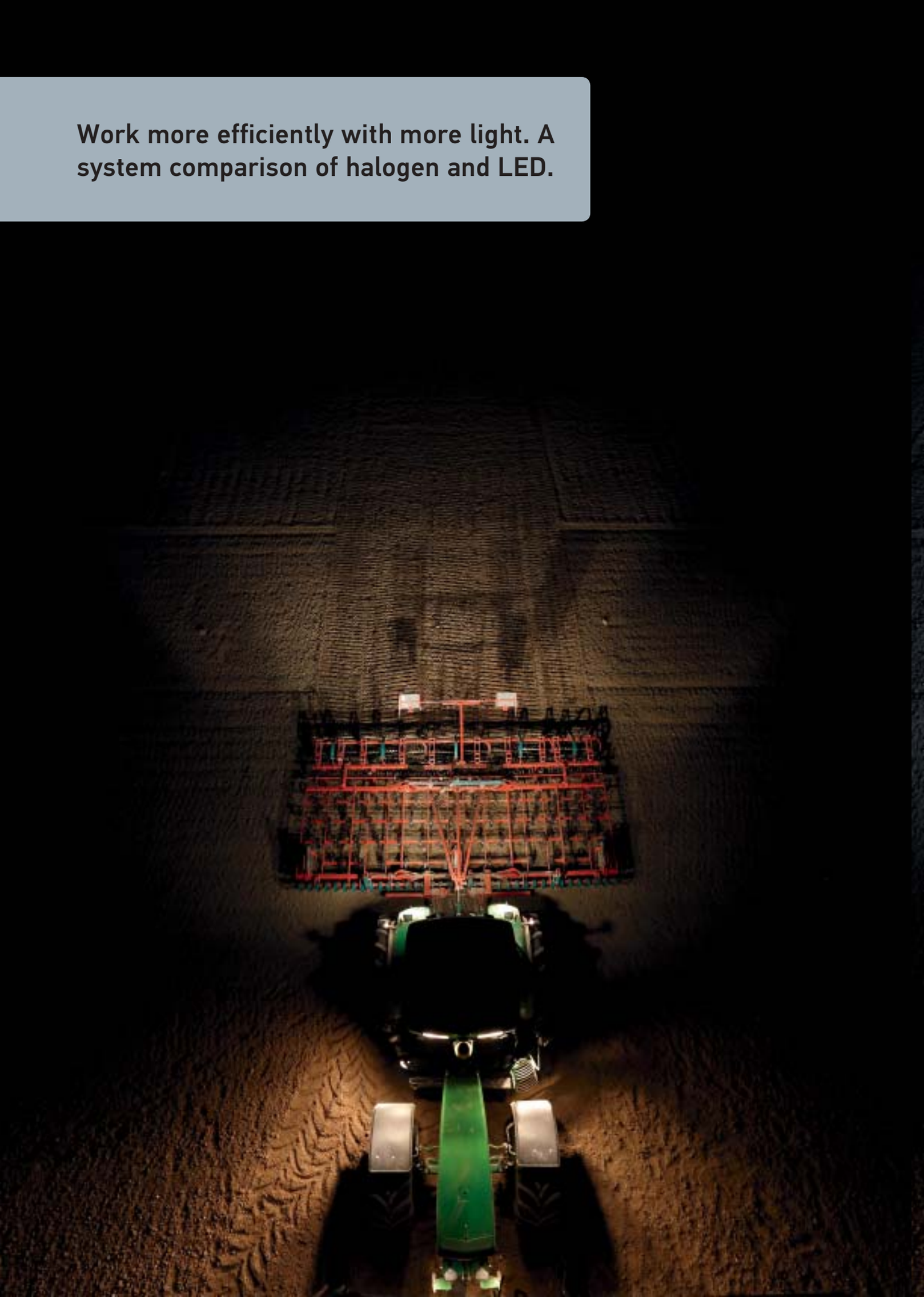
Take advantage of OEM quality.
HELLA quality offers the guarantee of a reliable brand product. HELLA is established as a global OEM for all the leading international vehicle and agricultural machinery manufacturers, as we place emphasis on the highest quality in all areas. For example, all worklights are subjected to extreme stress tests in development and production.

Older eyes need more light.

Every second a farmer is older than 45* - the eye's ability to adjust to the dark decreases. Even at the age of forty, the ability to see at night is much worse than for a twenty-year old. HELLA LED worklights make difficult work at night easier. They ensure better illumination of the range of operation. They help to reduce physical stress and enable efficient working.

* Source: Rhineland Farmer's Association (RLV), 16.03.2011

Work more efficiently with more light. A system comparison of halogen and LED.



Milestones in light technology: The evolution of HELLA worklights.

Module 70 halogen

Module 70 LED

Halogen worklights: the proven standard.
HELLA has continually improved the design of its halogen worklights over a number of decades. The challenge: halogen light sources generate a great deal of heat. This heat can only be deflected if the headlights have a relatively large mounting depth. In order to still be able to offer the customer compact worklights, HELLA developed housing and lenses made of synthetic material with a higher heat resilience to enable smaller headlights to be constructed with the same power.

Xenon worklights: a quality leap.
The use of Xenon technology enabled the light yield of worklights to be decisively improved. HELLA launched the first Xenon headlight on to the market in 1995. Since then, HELLA has made a significant contribution as a technology leader to its further development.

LED worklights: the next generation.
LED technology is much more demanding than the technology of halogen and Xenon worklights. That is why quality differences are particularly noticeable for these devices. HELLA has been the market leader in LED headlights for years.

This is what we mean by HELLA quality:

HELLA is a market leader in Europe for worklights and as an OEM supplies all the leading manufacturers of agricultural machinery worldwide. The expectations with regard to the quality of the products from the family-owned company are correspondingly high. HELLA is continually investing in advanced technologies to also meet these expectations in the future.

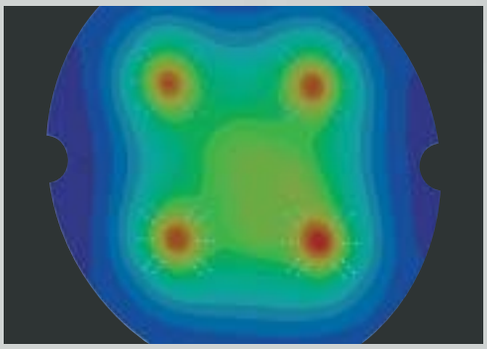
Innovative Capacity
In order to develop worklights to the highest quality, HELLA has been cooperating with L-LAB, the research institute for lighting technology and mechatronics at Paderborn University, for many years. Together we have developed the HELIOS software which simulates the light distribution of planned headlights.

Our customers benefit directly from the development results and investments that HELLA makes in research and development. For example, through innovative LED worklights that produce a brighter, more pleasant light which consume less electricity and last longer.

Long-life cycle
LED worklights last up to 60,000 hours. They are, therefore, an example of the extremely long-life cycle of HELLA products. This quality factor in turn not only results from using high quality materials and components, but also from a well-thought-out production process which reliably prevents errors. In addition to this direct functional value, there are, however, other aspects of quality that HELLA attaches great importance to. That includes first-class equipment and exceptional product reliability.

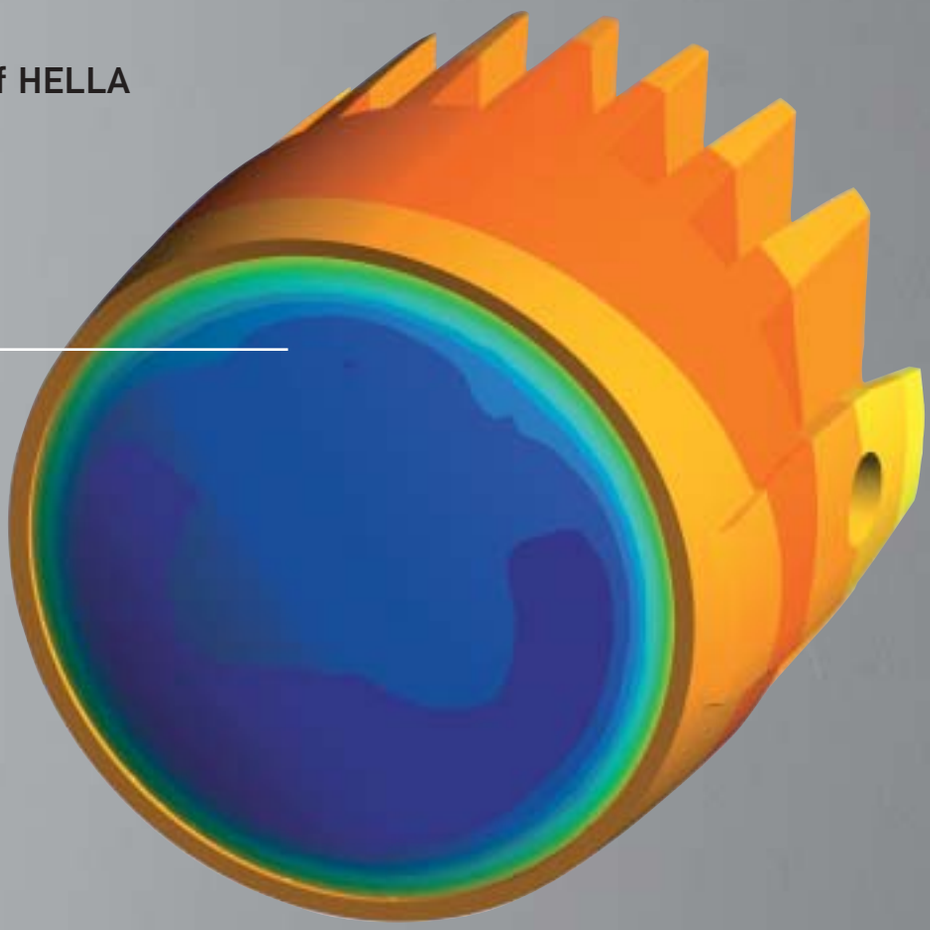
Demands
It is also a matter of course at HELLA that all products meet legal standards to the same extent as the requirements that agricultural machinery manufacturers have on original parts.

Service
Finally, the service for the product is also a part of the HELLA pledge of quality. That is why HELLA offers excellent customer service, ranging from operating instructions and maintenance through to the availability of service parts for older product lines.

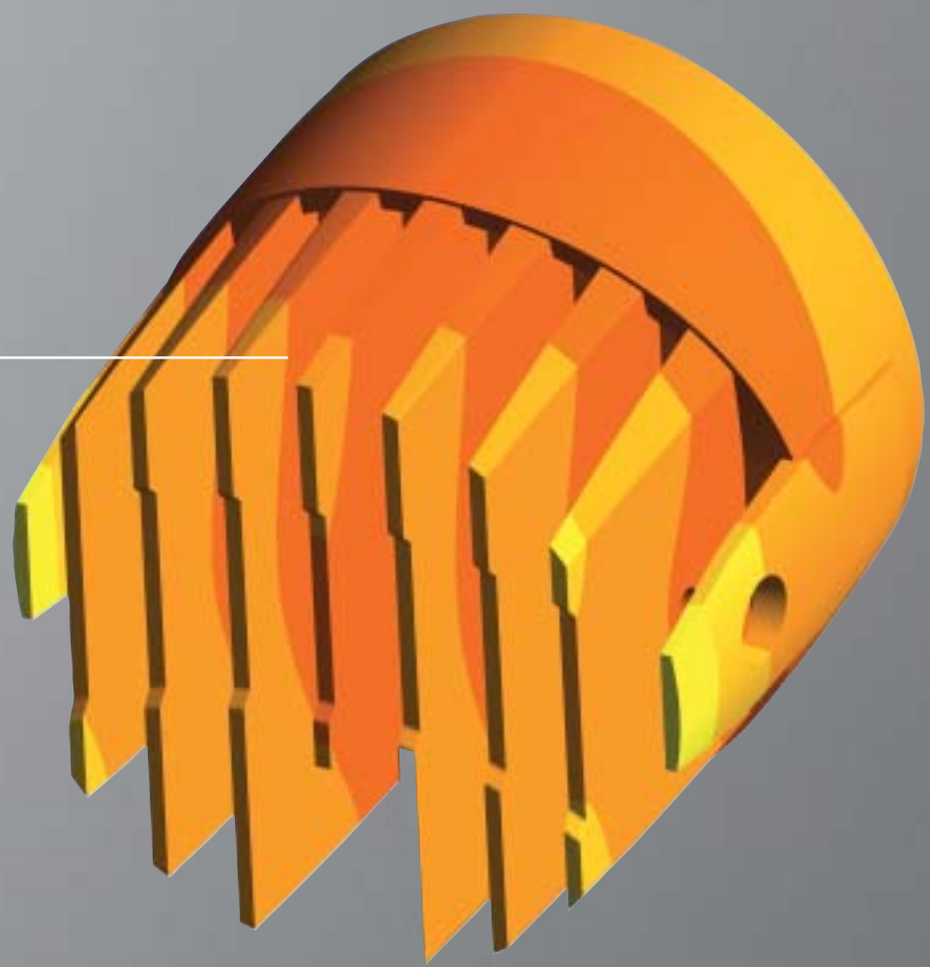


The perfect balance for a particularly long-life cycle
The stronger the light of an LED, the higher the operating temperature. LEDs that are too hot have a weaker glow and a shorter design life. It is, therefore, up to the skill of the developers to find the mean value for all requirements.

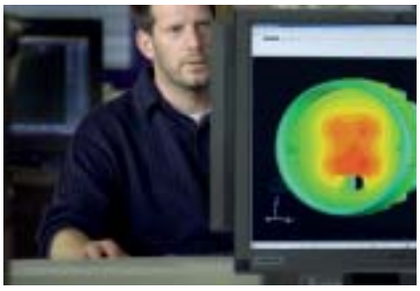
This is how the optimal thermal management of HELLA works.



Heat and light are separated. The simulation of heat distribution clearly demonstrates how HELLA's thermal management works: although light is emitted at the front of the headlight, it stays cool there (blue). The heat (orange) is deflected to the rear where it cannot do any harm.



High temperatures reduce the power and design life of LEDs. In HELLA worklights, the thermal discharge of the LEDs is, therefore, quickly deflected to the rear. There, the heat is discharged into the air via the aluminium housing. The cooling fins accelerate this process as they enlarge the surface of the housing.



New worklights are developed using the HELIOS light simulation software. The computer prediction with 99.9% accuracy is so precise that successful models can be directly put into practice in reality.

One million simulated light beams for a first-class HELLA product.

The development of a new HELLA worklight begins with a lighting technology concept. As lighting technology, particularly in the LED range, has developed at a breathtaking speed over the last few years, there are no standard solutions. With every new headlight, the design of the reflector must be recalculated and LEDs must be chosen.

In order to guarantee the optimum light distribution of the future worklight, it must first be tested in the computer model. The HELIOS software simulates on average the path of a million single light beams! Different reflector designs can be compared with each other and different illuminations are offered.

Once the design for the lighting technology is available, the electronics department set to work. They design the circuit board with the control of the headlight. At the same time, the arrangement of the LEDs and the construction of the reflector is particularly important. Only if no errors are made during construction, will the headlight not produce any magnetic fields later and pass the test of electromagnetic compatibility. If that were not the case, then the headlight would disturb the reception of radio, GPS and mobiles.

The next demanding task is to create the mechanical concept. That is because the more light a headlight generates, the more heat needs to be deflected. Many of our competitors' worklights on the market load the LEDs too much to maximise the light yield. The LEDs then suffer much quicker from wear and tear due to the increased temperature. HELLA thus uses a complex range of tests to determine how to realise an optimum light yield without going beyond the recommended temperature range of the LEDs. This element of thermal management is as much a part of the mechanical design as the question of how to guarantee the tightness of the housing. Finally, the sensitive electronics of the LED worklights must be safely protected against the penetration of water and dirt.

What does a reflector have to look like to illuminate a field well? Using the high performance HELIOS simulation program, HELLA developers can already explore this question in the design stage.

A important quality feature of worklights is their electromagnetic compatibility (EMV): The devices should not generate any magnetic fields which disturb the electrical system, the radio or GPS reception. A headlight is tested in the absorber chamber to see if it emits electromagnetic waves. The absorbers ensure that the measurement is not distorted from outside by reflections or magnetic fields.

Developments for practical situations.

Finally, the lighting technology, electronic and mechanical concept are joined together in a computer simulation. One of the things tested is whether the heat of the LEDs is sufficiently deflected by the planned housing. The robustness of the construction is also simulated and tested - for example, the capability to resist vibrations and short-term force effects, e.g. caused by hanging branches. That enables us to ensure that worklights will later meet the high requirements of our customers in practical situations.

The simulation results generally display a great deal of similarity with real tests. Deviations seldom occur. Nevertheless, all HELLA worklights are subjected to hard stress tests both during development and production. In addition to the ISO defined tests, these tests include those that HELLA has developed itself and which go far beyond the requirements of the ISO tests, such as:

- **Ageing capability test:**
  The worklights are additionally tested with a shortened test time under more stringent conditions. That enables us to demonstrate the maximum resilience of our products.
- **Lens pull-off test:**
  Headlights are randomly selected from production to test their adhesion.
- **Hammer pendulum impact test:**
  Headlights are tested for their robustness with a pendulum impact test in our testing laboratory.

More detailed information and videos about the topic of quality can be found at **www.hella.com/quality**.

Why HELLA worklights keep their promise.

Heat, impacts, knocks for hours on end without interruption: worklights need to put up with a lot in their everyday use. Numerous complex tests are employed at HELLA to ensure that worklights are permanently able to stand such extreme demands.

HOT AND COLD TESTS
In temperature cycle tests, HELLA worklights are exposed to temperature fluctuations of -40°c to + 90°C in climatic chambers.

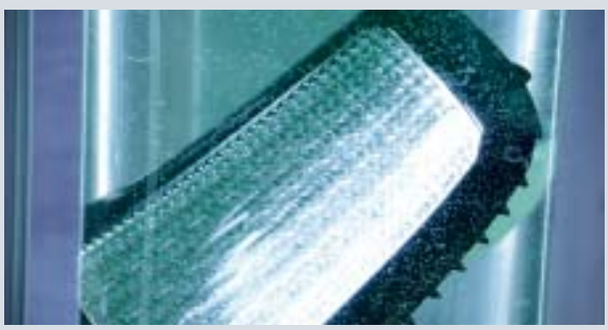
VIBRATION TEST
During the vibration test, HELLA worklights are shaken for hours. with the devices being exposed to acceleration of 9.6 G. At the same time, the temperature fluctuates between -30°C and +80°C.

SPLASH WATER TEST

In the universal splash water cabins HELLA's worklights are exposed to simulated rain, splash-water, sprayed water and spray mist, and tested for tightness with water pressure of up to 10 bar.

HIGH-PRESSURE CLEANER TEST

This test simulates cleaning in a carwash or with a pressure cleaner. At the same time, the headlights are exposed to water pressure of 100 bar and a water temperature of +80°C.



IMMERSION AND PRESSURE TIGHTNESS TEST

In the immersion test, HELLA's worklights are put into an immersion pipe a meter deep under water. The test is only passed if no water has penetrated into the device after 30 minutes.

DUST AND SALT SPRAY TEST

During the dust and salt spray test, dust from unfired Portland cement and fine salt mist is used to test how reliably HELLA's worklights are protected against being penetrated by solid foreign bodies.

HELLA worklights:
Only the best for our customers.

The most important aim of HELLA's quality policy is the satisfaction of our customers. Our customers expect first-class products - that is why not one single worklight leaves our production without its functions capability being tested and found to be good. But not only the products, also current production is constantly checked. And finally, our highly qualified and responsible employees guarantee constant high quality with their commitment to perfection. That is why we consistently invest in in-house training and further training measures.

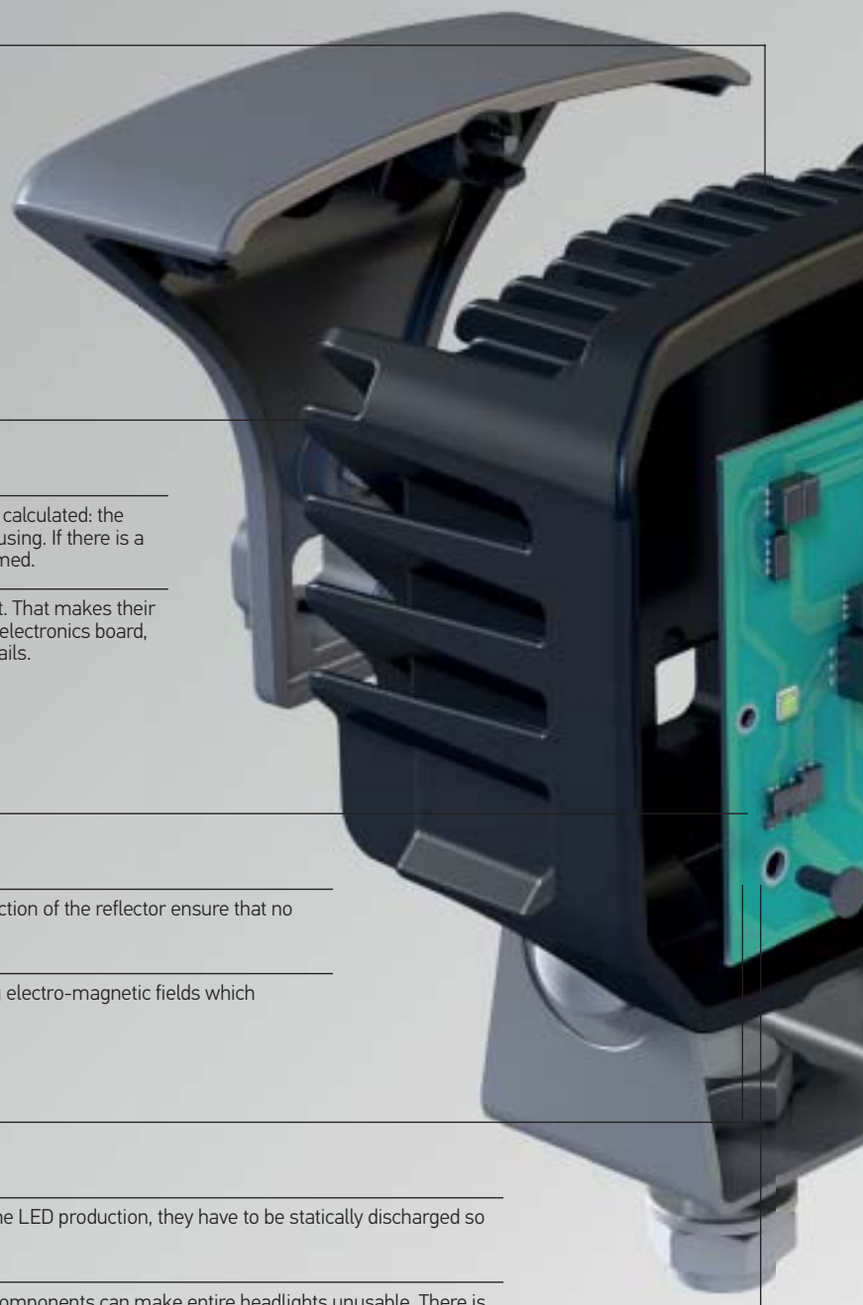
Hella worklights are produced in highly modern plants.
Important parts of production take place, for example, in vacuum chambers. That helps to ensure that no dust settles on reflectors during metallization with aluminium and that the surfaces are spotless. Because even the tiniest of particles change the light yield and put balanced illumination at risk.

Detecting error sources with Poka Yoke and rendering them harmless. The principle of the Japanese Poka Yoke is based on the assumption that no-one and no machine works entirely error-free. That is why it is important to continually check production. It is, however, even better to identify and eliminate error sources in advance.

One example of avoiding mistakes: The light surfaces of reflectors and lenses must be fitted precisely due to their special calculation. Although the lenses are partially labelled "TOP", mix-ups or mistakes during assembly can still occur. In order to avoid such fitting errors, HELLA worklights are equipped with special twist protection. Between the lens and the reflector there are recesses and fins to enable accurate fitting. In addition, the reflector is led into a recess in the housing using a centring pin.

HELLA quality in comparison.

Where others save, HELLA invests in top quality. Here you can see in detail why allegedly cheap offers from discounters can become expensive.



Surface coating

⊕ High-quality coatings protect the aluminium components of HELLA worklights from salt and chemicals and therefore from corrosion.

⊖ Corrosion can lead to the worklights becoming untight. In the worst case, water can penetrate and destroy the electronics.

Thermal management

⊕ The thermal management of HELLA worklights is thoroughly calculated: the heat of the LEDs is evenly distributed and deflected via the housing. If there is a risk of overheating, individual LEDs will be automatically dimmed.

⊖ LEDs can very quickly overheat without thermal management. That makes their design life drop dramatically. Hot spots can deform the entire electronics board, soldering connections can break and the complete headlight fails.

Electromagnetic compatibility (EMC)

⊕ The LED arrangement of HELLA's worklights and the construction of the reflector ensure that no interference occurs from magnetic fields.

⊖ LED worklights that are not correctly shielded, produce strong electro-magnetic fields which interfere with the electronic system, radio and GPS.

Electro-static discharge (ESD)

⊕ Before HELLA employees are allowed to enter the LED production, they have to be statically discharged so that no components can be damaged by loading.

⊖ Static discharge caused by damaged electronic components can make entire headlights unusable. There is a threat of expensive downtimes.

Reverse polarity

⊕ HELLA worklights are protected against reverse polarity. If they are wrongly connected, they will not be damaged.

⊖ If a wrongly connected worklight is not protected against reverse polarity, the electronics will be completed destroyed when switching it on.

⊕ HELLA quality advantages

⊖ Where others save

Attempting to save in the wrong place, costs more in the end, as inferior headlights provide less power and often fail.

Quality of the LEDs

Only LEDs that have undergone strict tests are used in HELLA's worklights. The selection guarantees the extremely long design life of the LEDs for up to 60,000 hours.

Resorting to untested, cheap LEDs brings the risk of a shortened design life and malfunction. LED technology cannot play out its strengths.

Adhesion

The worklights at HELLA are hermetically sealed by high-accuracy adhesive robots. This guarantees that the lens is glued at an optimal angle for the optimum light yield which has been precisely calculated.

Inferior worklights are often glued manually. An irregular adhesive bed can lead to the lens angle and thus the light yield not being ideal. If the lens is no longer tight or becomes detached, water can penetrate and make the worklight unusable.

Light distribution via the reflector system

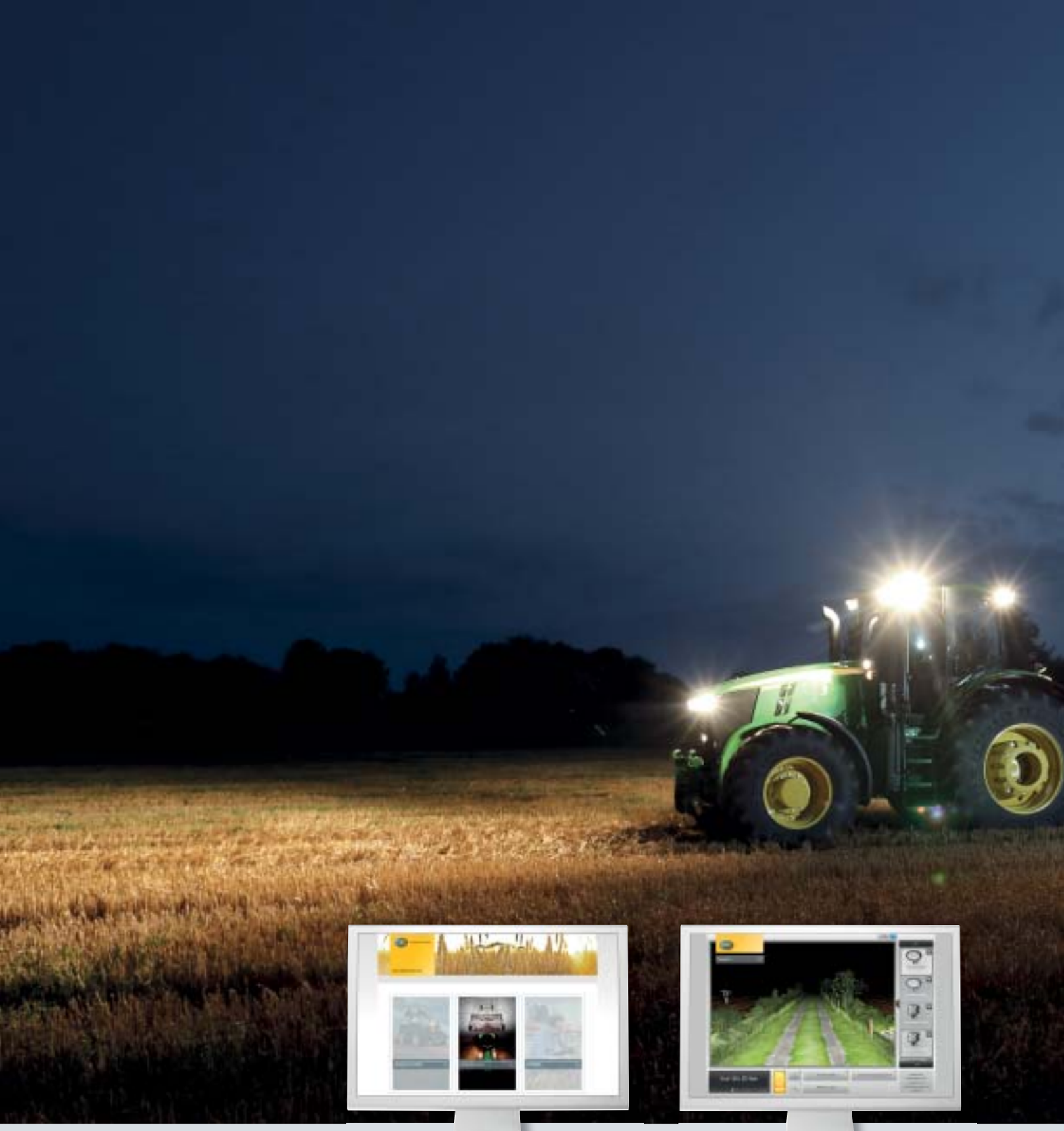
The reflectors of HELLA worklights are calculated in such a way so that the range of operation is evenly illuminated and the light optimally used.

Worklights with an unsuitable light control system illuminate the range of operation unevenly and waste a large part of the light. Light places distract the eyes and at others details are only difficult to discern.

Lens material

The lens of HELLA worklights, which is 100% suitable for daily use, consists of a high quality, impact and scratch-proof plastic. The light exit remains homogeneous even after colliding with a branch or something similar.

Lenses made of inferior plastic can break and scratch easily. Each scratch leads to undesired light refractions - the more there are, the more irregular the illumination is.



More information about HELLA's worklights can be found on the internet with our App for mobile end devices, or in the comprehensive product brochure:

Homepage Agriculture
Informative, compact, interactive. Here you will find all you need to know about the products and technologies for agricultural use.
www.hella.com/agriculture

ELIVER - The light comparison tool
This online tool enables you to compare many HELLA worklights on the basis of their illumination in a realistically appealing environment.
www.hella.com/eliver

Worklight configurator
Which worklight is the correct one for your application? The HELLA online configurator provides you with suitable product suggestions including all the relevant information about the product.
www.hella.com/agriculture

Mobile App Worklights
Let yourself be drawn into the interactive world of worklights and experience the variety of lighting technologies, explosion animations and much more. Simply download from iTunes or Google Play App!
www.hella.com/apps

Worklights product brochure
In our over 100-page brochure you can find product information, fitting recommendations and much more.
Now available as a PDF download at
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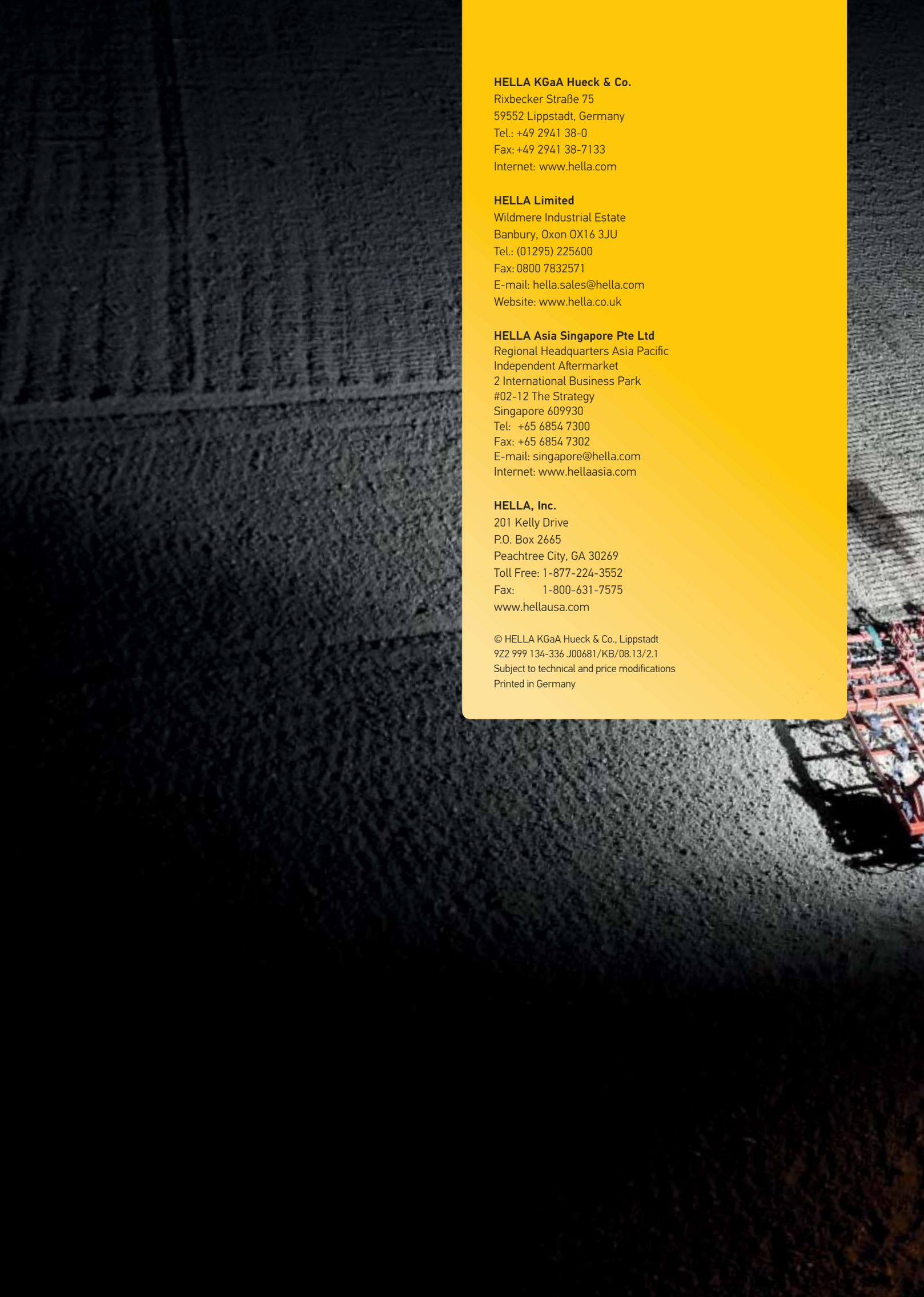

HELLA KGaA Hueck & Co.
Rixbecker Straße 75
59552 Lippstadt, Germany
Tel.: +49 2941 38-0
Fax: +49 2941 38-7133
Internet: www.hella.com

HELLA Limited
Wildmere Industrial Estate
Banbury, Oxon OX16 3JU
Tel.: (01295) 225600
Fax: 0800 7832571
E-mail: hella.sales@hella.com
Website: www.hella.co.uk

HELLA Asia Singapore Pte Ltd
Regional Headquarters Asia Pacific
Independent Aftermarket
2 International Business Park
#02-12 The Strategy
Singapore 609930
Tel: +65 6854 7300
Fax: +65 6854 7302
E-mail: singapore@hella.com
Internet: www.hellaasia.com

HELLA, Inc.
201 Kelly Drive
P.O. Box 2665
Peachtree City, GA 30269
Toll Free: 1-877-224-3552
Fax: 1-800-631-7575
www.hellausa.com

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