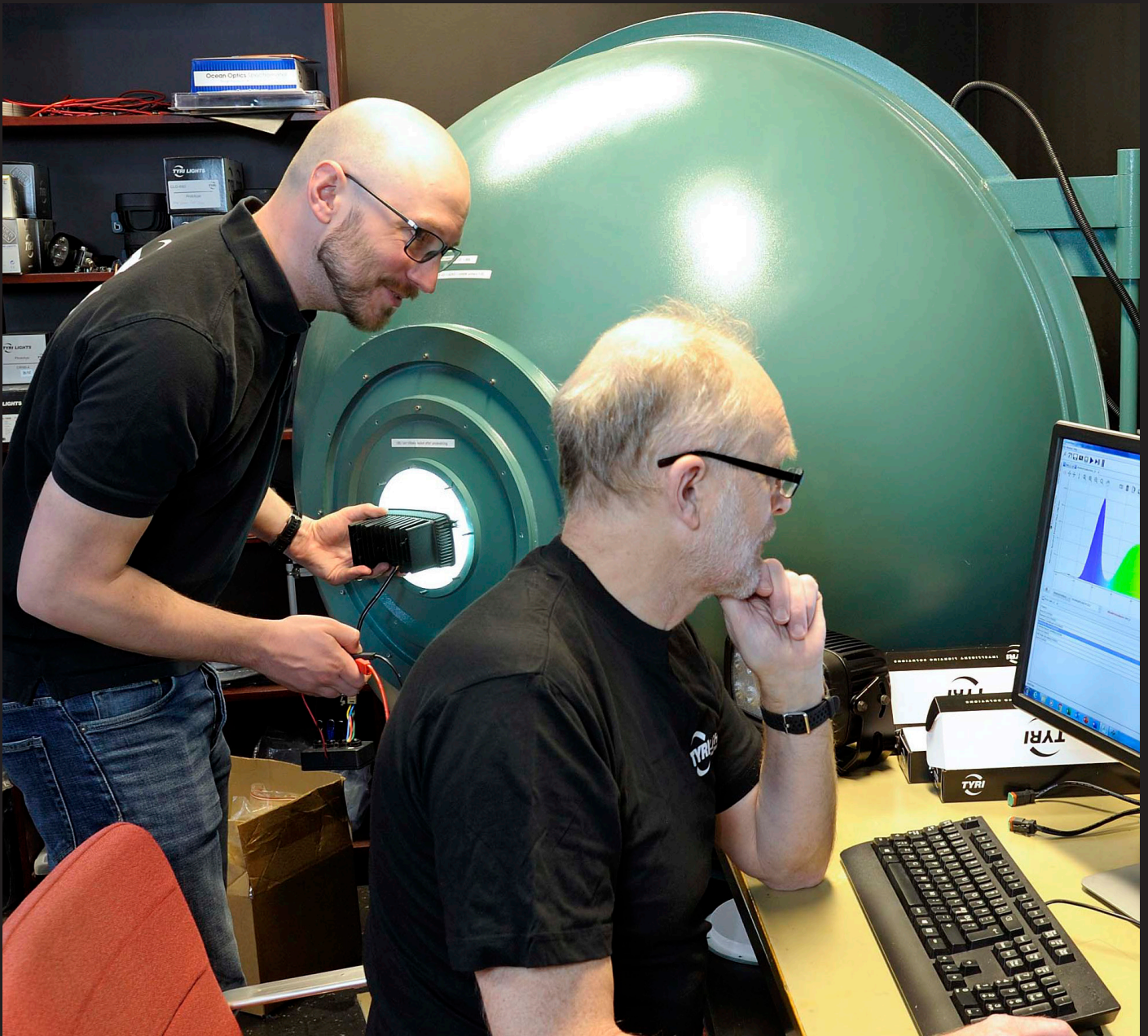




THE BIG GUIDE TO TESTING & APPROVALS





LIGHT ACADEMY

A new platform for insights, tips, updates and industry trends for work lighting in off highway vehicle manufacture and beyond.

www.tyrilights.com/tyri-light-academy





CONTENTS

TYRI Test Lab – unique, practical & efficient
p 4-5

The quest for optimal light distribution
p 6-7

EMC testing in-house for agile development
p 8-9

It's all in the details
p 10-11

Innovation and a good work environment - the
secret behind TYRI's success and low staff
turnover
p 12-13

Stimulating simulations
p 14

From Beetles to work lighting
P15

Four tips for good lighting
p 16

Tested and Approved - all you need to know
about TYRI testing
p 17

TYRI TEST LAB

Unique, practical & efficient



TYRI's lights must withstand harsh stresses in the toughest environments. To guarantee that the lights perform in environments where they are subjected to impacts, high salt content, moisture, water, dust, and extreme cold or heat, all products are tested in TYRI's own test lab. Anders Johansson, Head of Quality Testing, takes us on a tour of the lab.

Many lighting manufacturers send their products away for testing, but TYRI has an in-house laboratory. This enables us to quickly and easily examine new products and make modifications to existing products. When we develop new innovations, it is highly practical to have access to our own lab. It allows us to perform tests at an early stage and determine whether we are investing in the right technology, instead of being surprised by faults and shortcomings far into development. Furthermore, it goes much faster when we produce customised lights with clear requirement specifications for what the lights must be able to cope with," says Anders.

Vibration testing

To ensure that the lighting is able to withstand the impacts and vibrations to which it is subjected in heavy equipment, the lights are tested in a shaker. It shakes the light with different accelerations at different frequencies in order to check that nothing breaks. Vibrations in the light's various materials are also analysed in the shaker to identify any resonance frequencies.

"If we discover that a material in the light starts to oscillate, we will have to address the design in order to eliminate this," says Anders.

SALT SPRAY CHAMBER

In the salt spray chamber, the lights or their components are sprayed with a mist of distilled water mixed with salt. This is done to test how TYRI's materials withstand corrosion.

"White rust normally appears in this type of test, and is completely harmless. What we watch out for is the emergence of iron oxide rust, which can affect the quality of the light. We have recently started using a new kind of coating on our light housings, which has shown significantly

better corrosion resistance than the coating previously used. We could confirm this after hard testing in the salt spray chamber,” says Anders.

DUST TESTING

In mines, on farmlands, and in essentially all environments where heavy vehicles are used, there is dust. To ensure that TYRI’s lighting can cope with all extreme environments, it must be able to withstand fine-grained dust. In dust testing – which is carried out to determine how well the lights are sealed – the lights are exposed to vacuum and dust is dispersed.

“We work from international guidelines for dust testing. The guidelines describe, among other things, the required size of the dust grains and the degree of vacuum. This test is incredibly efficient to conduct in-house instead of engaging with external testing institutes, which often have relatively long waiting times,” says Anders.

GONIOPHOTOMETER & INTEGRATING SPHERE

An important part of the testing process is when the distribution and character of light are tested.

“In our goniophotometer we can precisely measure the width and length of the light beam from different angles in order to obtain a representation of the light beam’s propagation. From these measurements we also glean information about the luminous flux, luminous intensity and half-value angle. In the integrating sphere we measure

the colour temperature of the light as well as the colour rendering index, and we can compare how closely we are able to emulate sunlight, since sunlight is usually considered optimal,” explains Anders.

AN EVOLVING LABORATORY

“Today we subject our lights to extreme heat and cold in our environmental chamber to make sure that the products perform in all conditions and the toughest environments.

And we measure luminous flux in another device. Our hope is that we will soon be able to test both temperature and luminous flux simultaneously, which will both streamline the testing process and enable us to study other results. That would allow us to see how illumination is affected when the light is extremely cold or overheated,” says Anders.

Following TYRI’s development of INTELLiLight – intelligent lighting controlled via an app – the need arose for new types of tests in the lab.

“Many lighting manufacturers send their products away for testing, but TYRI has an in-house laboratory. This enables us to quickly and easily examine new products and make modifications to existing products.”

A. JOHANSSON, TYRI HEAD OF QUALITY TESTING

“We don’t yet know exactly which tests will be required from my side going forward,

but we anticipate increased standard tests in the lab to ensure the sustainable development of the wireless INTELLiLight. Since we are now introducing new technology with which to work, we will start to regularly conduct software testing and be sure to maintain the app,” says Anders.



THE QUEST FOR OPTIMAL LIGHT DISTRIBUTION

Optical engineering is a challenging profession. This is particularly true when optical solutions must be adapted to design preferences while retaining optimal light distribution. Per-Arne Torstensson is a Senior Optical Engineer at TYRI whose workday consists of integrating lens systems and technologies in lights with a specific visual design. He tells us a bit more about important things to consider when attempting to create optimal light distribution.

Per-Arne Torstensson has worked with optics for over 30 years, the last three of which have been at TYRI. "The reason I applied to work at TYRI was because they utilised LightTools, one of the most sophisticated software tools for optical design. This aroused my curiosity immediately and I felt it would be an exciting challenge. At TYRI I am able to further develop my optics expertise in lighting, and I am also able to learn how a light and its technology can be integrated in a specific visual design," says Per-Arne.

OPTICAL ENGINEERING

A large part of Per-Arne's work involves creating optimal light distribution around a heavy vehicle, which often has many different lights mounted that must be combined in the right way for the best possible illumination. Furthermore, the lights must also satisfy customer design preferences without compromising the quality of light distribution.

"A forestry industry harvester usually has 25 to 30 lights, which frequently have different properties and different light distribution. The lights must have different properties but still work together to achieve optimal light distribution around the vehicle. It's a fairly complex task getting this to work, and it is this knowledge that we at TYRI want to share with our customers. The correct lighting on a heavy vehicle is imperative for both safety and productivity," says Per-Arne.

LENS DESIGN

Design within lighting has become increasingly important

over the years, and vehicle lights are today a hallmark of many brands. TYRI works regularly with design development, and gladly develops new lights based on customer design preferences. Sometimes, however, a design specification from a customer has already been fully decided, which makes it difficult to achieve an optimal solution for the optical system. It is Per-Arne's job to tackle this challenge and try to find a lens design able to fit the criteria.

Complicated designs sometimes require more than one lens, which together direct uniform and powerful light around the heavy vehicle. The lenses are produced by injection moulding with different plastic materials such as polycarbonate. The calculated shape of the lens must be preserved throughout production, but since plastic shrinks when it cools after injection moulding, irregularities in the shape sometimes crop up which significantly change the properties of the lens. These irregularities can often be compensated for in the calculations prior to moulding, but, when working on multiple lenses, the irregularities can accumulate and complicate the work.

LIGHT GLARE

Another important aspect of working with optics is to try

10	a_1	0,005
00	a_2	0,02
00	a_3	0,01
50	a_4	0,002

$\text{slope} = \frac{\log(a_x + 1) - \log(a_x)}{\log(f_x + 1) - \log(f_x)}$

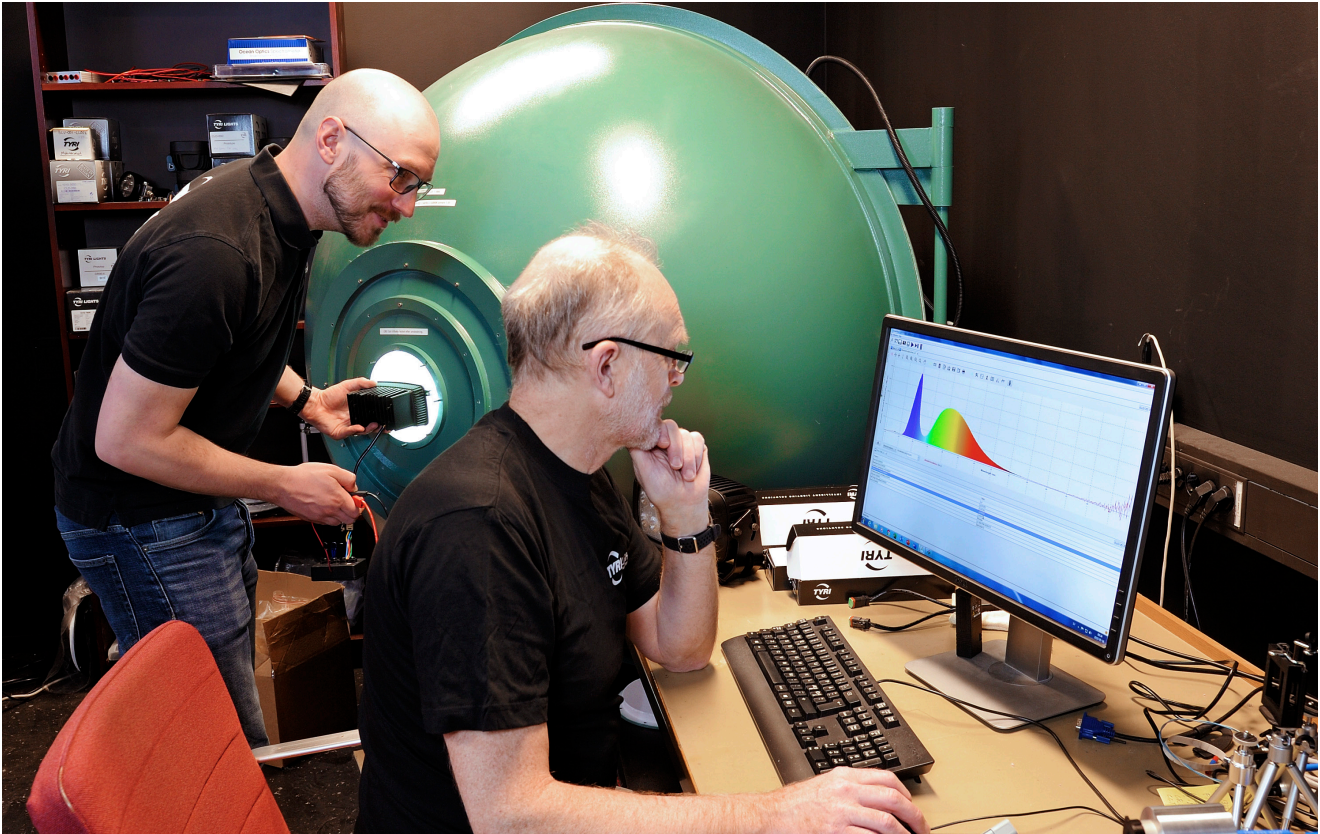
$\text{offset} = \frac{a_x}{f_x \cdot \text{slope}}$

$\text{slope}_2 = \frac{\log(0,01) - \log(0,02)}{\log(300) - \log(200)}$

$\text{offset}_2 = \frac{0,02}{200 \cdot -1,7095} = 171,6$

$\text{area}_2 = \frac{171,66}{-1,7095 + 1} (300^{-0,7095})$

$1) G^2 = 2$



Per-Arne Torstensson (Senior Optical Engineer) & Anders Johansson (Test Engineer)

to create light distribution that produces minimal glare. Instead of using moving components, we often work with the light's active illumination components. Per-Arne works to get different dispersion patterns in the light to switch on and off in order to 'reorient' light distribution. "In this, INTELLi*light* is an effective tool able to handle glare well by means of automatic dimming using simple light sensors. One of our goals is to start using cameras as sensors in INTELLi*light* lights, since this would provide more information about oncoming light and manage dimming more efficiently."

“

Design within lighting has become increasingly important over the years, and vehicle lights are today a hallmark of many brands.”

P.A. TORSTENSSON, TYRI SENIOR OPTICAL ENGINEER

LIGHT DISTRIBUTION AND LUMEN

An LED module distributes light in different directions, and the lens system must then direct the light to achieve the desired light distribution. It's important to remember that the lumen total cannot describe good light distribution alone. Light distribution of 2,500 lumen

can be much better than 4,000 lumen, since the latter can diffuse and have a greater risk of glare.

“What best describes a light's properties is its intensity distribution, in other words, how the light is distributed at different angles, not the LED light's maximum lumen. Many customers make the mistake of asking for the highest lumen total, but that does not necessarily provide the best light distribution. This can be compared to judging the performance of a car by only getting information about its horsepower, which says nothing about how fast the car accelerates or its top speed. Good light distribution is far more complicated than a high lumen total,” says Per-Arne.

Moreover, different companies and suppliers measure lumen based on different factors. Manufacturers in China, for example, frequently specify the theoretical lumen instead of the effective lumen retained after the light has passed through the lens system. In a best case scenario, approximately 75-80 percent of the LED light's theoretical lumen can be collected by a lens. In inadequate optical solutions, not even half of the light's theoretical lumen may be attainable.

EMC TESTING IN-HOUSE FOR AGILE DEVELOPMENT

The aim of TYRI's EMC laboratory is to test how the company's lights affect and are affected by other electronic components. The walls in the room – which is reminiscent of a bank vault – are covered in a 3D material which dampens signal reflection, thereby increasing measurement accuracy. The lab is an important investment into increasingly self-sufficient quality testing in the company.

Håkan Dalsvik, Electronics Engineer at TYRI, oversees EMC testing at the company, and he shared the ins and outs of the tests with us.

Håkan has worked at TYRI since the year 2000. At that time, TYRI's workforce comprised of seven individuals, and he was the first electronics designer in the company. Since then, the company has grown, relocated and expanded its premises. Today, Håkan is the Senior Electronics Engineer and is responsible for the company's EMC testing, which means conducting electromagnetic compatibility tests to determine how well an electrical component performs in an electromagnetic environment without causing or being susceptible to interference from other equipment. If the interference and resistance of different pieces of equipment are adapted to each other, they should be able to work together and achieve electromagnetic compatibility.

The goal is for one piece of equipment to not disturb or

be disturbed by another. Because TYRI's lights contain electronics, tests must be conducted when new products are developed.

Many companies conduct EMC tests externally, but TYRI prefers testing in-house, which ensures that standards applicable to different applications are complied with.

"If we encounter problems in our EMC tests, such as flickering in the light, we don't want to have to wait for external testing or queue for new tests. In-house testing enables us to quickly and efficiently alternate between testing and experimentation in an agile process, resulting in better and more accurate tests at a lower cost. Moreover, it's great to be able to conduct the tests ourselves since we trust our testing and know that they will be carried out meticulously with guaranteed quality," says Håkan.

“

...in-house testing enables us to quickly and efficiently alternate between testing and experimentation in an agile process, resulting in better and more accurate tests at a lower cost..”

H. DALSVIK, ELECTRONICS ENGINEER

Interference in the electromagnetic environment can result in the lights not functioning as they should. Interference may come from other equipment, via the air or a cabling system, or as electrostatic discharge (ESD).

TYRI has invested in an in-house laboratory with access to a dampened monitor room and measuring equipment specifically designed to

test whether the lights affect their surroundings in an electromagnetic environment. If a light produces a high level of interference in, for example, the FM band, it can lead to poor radio reception. Other equipment that can be affected by excessive interference includes sensor signals to control equipment and other wireless



communication. The ability of the light to withstand electrostatic discharge is also tested in-house. This type of test provides a clear indication of whether or not the light will function in a statically charged environment. For example, if the light is not sufficiently immune to electrostatic discharge pulses from an ESD gun, the LEDs may fail, and this would necessitate the development of other solutions by the Development department.

“

Our goal is to expand the lab to also be able to test how our lights are affected by other electronic components. This will become of particular interest when our INTELLi*light* products broaden our range and contribute to increased EMC testing.”

H. DALSVIK, ELECTRONICS ENGINEER

“Our goal is to expand the lab to also be able to test how our lights are affected by other electronic components. This will become of particular interest when our INTELLi*light* products broaden our range and contribute to increased EMC testing,” says Håkan.



UK Material Planner, Savitri Persaud-Heyhirst and UK Quality Manager, Ian Tiler

IT'S ALL IN THE DETAILS

Design | Production | Parts

All three are important to provide a work light that stands up to harsh environments and continues to perform even when the going gets tough.

Making sure TYRI work lights are manufactured to the highest possible standards is part of our DNA. Here we speak with two of TYRI UK's key team members about how they ensure the high quality of TYRI lights.

TYRI prides itself on the quality of its work lights, from the components to the final manufactured product. The policy of 100 % inspection of all lights ensures TYRI has

very few returns and maximum customer satisfaction. UK Material Planner, Savitri Persaud-Heyhirst and UK Quality Manager, Ian Tiler explain more about their background and the TYRI ethos that delivers the highest quality product available.

Hailing from the sunny shores of Barbados, Savitri has been with TYRI UK for 5 years and not looked back since, "I have immersed myself into life in the UK and I now truly feel like I am settled, both at home with my family and at work with TYRI," says Savitri. With a background in management processes from design, purchasing, planning and sales she is well suited to the challenging role at TYRI, controlling over 2000 parts and ensuring each ordered item is to the highest standards.

Since starting work at TYRI, Savitri has implemented changes that have allowed her to drill down more into detailed procedures to ensure all parts supplied are to the highest quality. Working with Ian Tiler, Quality Manager, they ensure that any quality issues are caught prior to the parts being entered to the production line.

Savitri has developed a deep understanding of how the TYRI products are manufactured by spending time on the production line, building the lights and getting to know how each part fits into place, "Having detailed product knowledge is key to allowing me to converse with suppliers more effectively and increase understanding to avoid potential errors in delivery," she explains. "This then builds into developing a more effective working relationship with suppliers to get the best service possible."

Ian Tiler, Quality Manager at TYRI UK has been with TYRI for just over a year and with experience across design, engineering, production and quality, he has the right skill set to ensure effective quality policies and procedures are followed. He describes himself as a methodical worker who has a keen interest in how things work. As

a child, this curiosity got him into trouble though, as he explains, "I wanted to know how the TV worked, so I set about removing the back of the TV set to have a good look. My dad came home from work to find the TV in pieces and me peering into the back of it. He was not very happy to say the least!"

Ian works on the factory floor, which comprises of production lines for the LEDs and benches for smaller batch production and new product trials. At the end of each line is a quality inspector, who liaises with Ian, to adopt a stop and fix approach on any issues that are

identified. This ensures that errors are corrected quickly, and all product is 100% inspected prior to it leaving the factory. Ian enjoys being on the factory floor and is hands on, building and testing product with production, "It's important to build a strong working relationship and camaraderie with the

team so they feel comfortable identifying quality issues and bringing them directly to me so we can find a solution and prevent quality issues down the line," he explains.

In July 2019, changes were made to the UK factory, with updates to the production floor including a new carousel system and introduction of new robots. These changes ensure TYRI's already high standards of quality are extended further with more consistency, less stoppage on the production line and that any quality problems are identified at source, prior to entering the production process. This also sees TYRI UK's capacity double. "It is an exciting time for TYRI UK's operation, and we look forward to being able to grow to meet our customers demands whilst still maintaining our quality levels and standards," says Ian.

TYRI commits to 100 % inspection
of all work lights to ensure very
few returns and maximum
customer satisfaction.



INNOVATION & A GOOD WORK ENVIRONMENT

The secret behind TYRI's success and low staff turnover



With its 200 dedicated employees worldwide, TYRI manufactures around 1,300,000 per year. And, all of its manufacturing is demand-driven, customized and quality-assured. Success lies in the company's competent production management, a work atmosphere that fosters collaboration, a steady flow of orders and use of robotics. On that solid foundation, the production line is being expanded to meet the steady increase in demand. Jimmy Nordén, Factory Manager at TYRI Sweden, proudly tells about the work and efforts of his team.

Jimmy Nordén has been working as factory manager and the head of TYRI's production for nine years. It's an exciting job, where he constantly meets new challenges

involving opportunities to acquire new skills.

"I started out as a designer the first year I worked at TYRI. After that, I was offered the position as factory manager. It's interesting and exciting work that I truly enjoy. This is where it all happens, out on the factory floor, where we create our products. It's particularly fun and satisfying to be a part of the company's success and rapid growth, meeting the challenge of constantly adapting production based on that," says Jimmy Nordén, Factory Manager at TYRI.

TYRI currently manufactures around 300,000 lights per year at its factory in Gothenburg and Jimmy anticipates a 30 percent increase over the next year. If he's right, it would push the number to 400,000 lights produced in

2020. Over the last few years TYRI as a global group has put a lot of focus on finding the optimal work flow for efficient production, while still maintaining a healthy work environment, with a pace that everyone can handle.

“It’s important for everyone in the team to feel secure with the pace and our routines. We’ve found a way of creating an even flow that is efficient, without it causing undo stress on our employees. We’ve also implemented a rotating schedule for our work tasks. It adds variety and enables our employees to develop new skills by working in different parts of the production line. We’re a fantastic team, where everyone is equally important and appreciated. Staff turnover is very low and our employees stay for many years because they thrive here.

MODERN TECHNOLOGY

TYRI is constantly updating its manufacturing process with the latest technology. The production team also typically comes up with own solutions to the challenges they encounter by finding and creating their own tools or implementing changes as needed. For example, using a 3D printer, TYRI manufactured a fixture that the light is attached to throughout the manufacturing process. Afterwards, it is easily connected to a test machine for testing both function and light capacity.

More recently, collaborative robots have also been integrated into the production process.

“We’re always striving to improve the work situation, automating certain manual tasks like screwing, applying glue and selecting materials. If a worker does those

“

We’re a fantastic team, where everyone is equally important and appreciated. Staff turnover is very low and our employees stay for many years because they thrive here.”

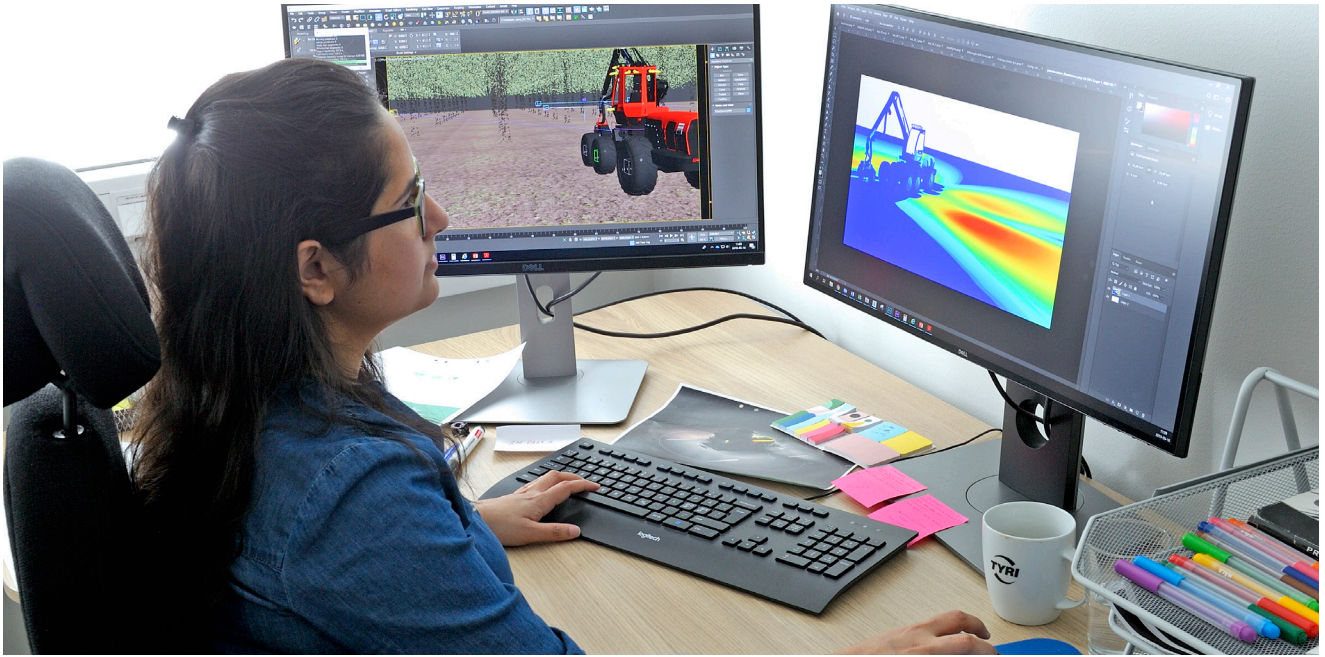
tasks, light after light, it becomes very repetitive. Now, we are lightening the burden of such tasks by using robots. Our collaborative robots are a form of modern technology that increases safety, since the robot stops whenever you touch or move it. With these robots, we are able to not only increase comfort, but also maintain a high level of efficiency without the risk of an accident that might otherwise result when working very close to a robot,” says Jimmy.

FLEXIBLE, QUALITY ASSURED PRODUCTION

When developing a new design and new products, tests are always conducted in TYRI’s lab. But, the company’s careful quality control doesn’t end there. All products are tested continuously at the factory during assembly. Assembly technicians check each lamp, immediately removing any products that don’t meet the high quality standards. But Jimmy says that what really makes TYRI stand out is its focus on the customer and flexibility.

“We are constantly putting our very best effort into always meeting customer requirements and adapting the product or service accordingly. That applies to all aspects, whether it’s delivery requirements or a customized design resulting from collaboration with the development department. It’s work that is both stimulating and fun, but above all it requires that we constantly remain updated on the latest technology and knowledge,” concludes Jimmy.



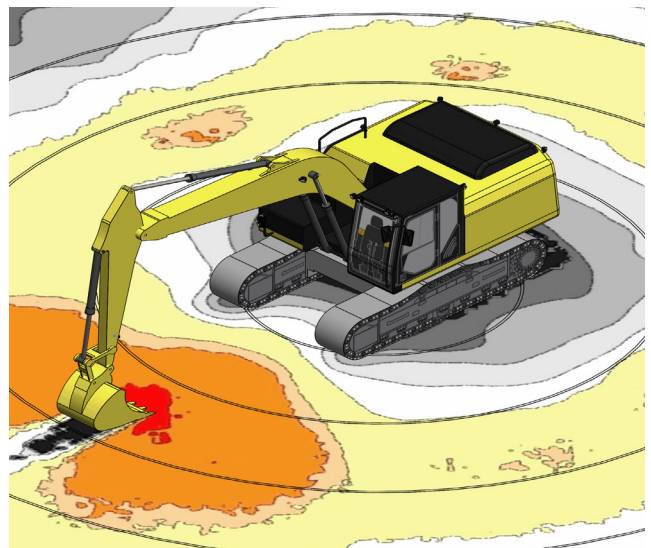


STIMULATING SIMULATIONS

Knowing how your lighting is going to perform is vital to a design. TYRI uses customer specific 3D data to create a simulation that examines the light from all perspectives.

When developing a new work light, the careful calculation of lumen output, spread and position is essential for the product's efficacy. A 3D simulation helps determine the exact shape and positioning of the work light, how the light will fall, highlights any shadows and creates a unified field of lighting.

TYRI produces these simulations, in house, using specialist software. Giving customers a unique insight before a product is created – ensuring that the lighting performs as expected when incorporated into the completed machine design.



FROM BEETLES TO WORK LIGHTS

Dr Lia Fernandez is one of the optic specialists at TYRI. She is the person the company turns to when the Development department needs advice on, for example, how a light lens should be improved, or when sales representatives need help and insight into light and optics. But Lía has not always worked with lights. Before joining TYRI, she wrote her PhD thesis on optical phenomena in beetles.

“For my PhD thesis at Linköping University, I studied the structure of beetle exoskeletons from an optical perspective. It may sound a bit odd, but it was a perfect way to try to understand light reflections at an advanced level because some beetles have exoskeletons that reflect light in very interesting ways. Beetles move between light and dark areas of the rainforest, and the variation in exoskeleton colours and reflection in different light conditions can confuse predators, which therefore avoid eating them,” explains Lía.

Lia was born and raised in Madrid, Spain, and studied in Sweden through the Erasmus student exchange programme at the university. After a year, she enjoyed living in Sweden so much that she didn't want to return to Madrid.

“I wanted to stay in Sweden! Fortunately, I received an offer to earn my PhD in Linköping, and not long after that I met my boyfriend who also studied there. I learnt Swedish, moved to Gothenburg after completing my studies, and discovered TYRI, who were looking for an optics specialist to join their team. It suited me perfectly,” says Lía.

TYRI values knowledge and expertise highly and therefore endeavours to surround itself with experts from different fields in order to offer world-class lighting solutions. Lía Fernández provides expertise in the field of light distribution and optics, which are important aspects of TYRI's development work.

“If a light does not shine as it should, I will try to determine the fault. To do this, I use a microscope to look at the lens, among other things, in order to confirm that it has been manufactured correctly. It involves comparing the physical lens with the model and then considering how we can improve it,” says Lia.

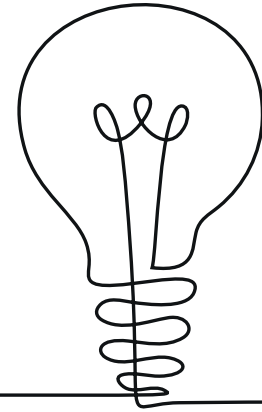
The Sales department is also interested in Lia's



knowledge of optics. Because account managers have a close relationship with customers and are expected to present the products in an informative yet straightforward manner, they need to understand and be conversant in optics so as to represent TYRI's lighting expertise and recommend suitable lighting solutions. The account managers frequently ask Lia for assistance in simulating how a light and the light distribution thereof will function, which helps them to more easily demonstrate this to the customer.

“It's great to be able to share my knowledge of optics and how light works. It's important for TYRI that everyone understands why lighting works the way it does. I look forward to continuing to educate both my co-workers and TYRI customers, sharing this knowledge with them for improved lighting solutions,” concludes Lia.

LIGHTING KNOW-HOW



Four tips for good lighting

A well-lit environment makes us feel safe and allows us to work easier. In a well-lit environment we can focus on the things we want to do instead of being disturbed by uncomfortable lighting, glare and hazy colour rendering. Per-Arne Torstensson, Optical Engineer at TYRI, provides some tips on factors that produce good lighting.

1

UNIFORM ILLUMINATION

The eye is drawn to bright areas, and when the light is uneven it can be distracting when your gaze and focus are constantly drawn to the brightest area. We want to avoid so-called hotspots, and have uniform lighting instead.

2

MINIMAL RISK OF GLARE

Both for the sake of safety and to reduce discomfort, the risk of glare should be minimised for those working in the area of light distribution. It doesn't matter how effective a light is if it is directed incorrectly and produces glare. This then negates the actual purpose of lighting, which is to facilitate visibility.

3

A SUITABLE COLOUR TEMPERATURE

Find a colour temperature that is comfortable on the eyes. Different colour temperatures suit different environments. Warm light, for example, works well when an area is covered in snow which reflects a cold blue light. Colder light can work well for working on dark soil. In general, colder light results in greater glare discomfort than warm light. Cold blue light also has greater dispersion and reflects a lot more small particles compared to a warm light source. For example, in an environment around a combine harvester where many small particles fly through the air, there is a lot for the light to reflect, which means that cold light is probably not the best choice.

4

GOOD COLOUR RENDERING

A colour rendering index (CRI) can be used to measure how well light sources render colours. If a colour of the light spectrum is absent, certain colour nuances will not be rendered. Sunlight has optimal colour rendering with 100 percent on the CRI. The higher the CRI of your illumination, the more it emulates sunlight. Since our eyes are adapted for sunlight, we want to emulate sunlight to the greatest extent possible. This can be particularly important in the food industry or when harvesting, where colour rendering plays a vital role in indicating the ripeness or condition of the food.

TESTED & APPROVED

All you need to know about TYRI testing



EMC EN55025 / CISPR 25

It is of vital importance, especially on emergency or military vehicles, that lighting does not effect control systems, cameras, on-board computers and other radio sensitive equipment. This is why TYRI lights are scrutinised to ensure they do not interfere with EMC functionality.



IP 69K

IP 69K ratings offers complete peace of mind that the work light you are installing has undergone rigorous tests to ensure it is both durable and conforms to the highest standard on the scale of protection against water, moisture and dust ingress.



VIBRATION TESTING

TYRI lights undergo extensive vibration testing, for up to 8 hours on all axes, above 10 Grms at a frequency range from 5 – 2000 Hz. This simulates the forces applied to the lights once mounted on off highway machines.



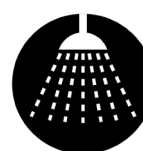
ENVIRONMENTAL TESTING

TYRI lights tested in hot and cold temperatures, as well as humidity, for a minimum of 35 days. They are tested in conditions up to -40°C to + 85°C and up to 90% humidity.



SHOCK TESTING

As well as vibration testing, TYRI lights undergo shock testing to a force of 50G. This ensures that TYRI lights will withstand punishment from your work environment.



SALT SPRAY TESTING

TYRI lights undergo rigorous salt spray testing to ensure they are approved to ASTM B117 standards. This ensures that even in corrosive environments, TYRI lights will continue to perform.



REVERSE POLARITY / OVER HEAT / OVER-VOLTAGE PROTECTION

TYRI lights have built in temperature sensing circuits which reduce the output to regulate the temperature of the light. This prevents damage to the LED's that can result in premature failure. TYRI LED lights are also reverse polarity protected in the event of incorrect installation. Should the wires become crossed during connection, TYRI lights will not function until the wires have been connected in the correct configuration, protecting the LEDs and associated circuitry.



TYRI locations

USA

TYRI Americas
4917 Coye Drive
Stevens Point, WI, 54481
USA

Phone: +1 715 344 8600
sales@tyri.us
www.tyri.us

BRASIL

TYRI ILUMINAÇÃO
Rua Santos Macarini 650
Navegantes – SC 88371-554
BRAZIL

Phone: +55 41 9961 6304
flima@tyri.com.br
www.tyri.com.br

RUSSIA

TYRI RUSSIA
Marshal Blucher Avenue, 12
Building 7, St. Petersburg
195197, RUSSIA

Phone: +7 (800) 222 75 51
sales@tyri-russia.com
www.tyri-russia.com

SWEDEN

TYRI SE
Aröds Industriväg 78
422 43 Hisings Backa
SWEDEN

Phone: +46 (0) 771 150 100
sales@tyri.se
www.tyri.se

ITALY

TYRI ITALY SRL
Via Bardonecchia 185
Torino (TO)
10141 ITALY

Phone: +39 345 5658902
luca.belli@tyrilights.com
www.tyrilights.com

UK

TYRI UK
Engine Shed Lane
Skipton, North Yorkshire
BD23 1UP, UK

Phone: +44 (0) 1756 700 568
sales@tyri.co.uk
www.tyri.co.uk

JAPAN

TYRI JAPAN KK
2-11-4 Shiohama
Koto Ku
Tokyo 135-0043, JAPAN

Phone: +81-(0) 3 6458 7396
jeremy.sanderson@tyri.jp
www.tyrilights.com

- TYRI has subsidiary offices in Norway and South Korea