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Opinion
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ALIGNED #2

A magazine from EASY-LASER®

A proactive shift

With over two decades of experience, Andreas Sand welcomes an industry that is becoming less reactive

Bearing forensics with Alejandro Pérez Martínez

Turkey is opening up to more maintenance

Welcome to the global *World of Easy-Laser®*

Easy-Laser has always had an international presence – a significant portion of our sales comes from global markets. This not only means a broad customer base but also a deep understanding of the maintenance needs worldwide. In this issue, we explore the theme of "Global maintenance," highlighting both similarities and differences, opportunities and challenges that we encounter in our work.

Because maintenance is gaining in importance, especially the proactive kind, more industries today are aligning their machines with laser equipment. More companies are now relying on vibration measurements rather than the calendar when scheduling maintenance.

And more organizations are designating substantial resources to maintenance departments.

In this issue we traveled to places like Mexico, Sweden, USA and the Netherlands to let our global partners share their local experiences. For example, we had the privilege to meet Alejandro Peréz Martínez, a bearing failure analysis specialist from the city of Puebla in the middle of Mexico who shares his valuable experiences and insights into the maintenance work he is performing in North and South America.

We also went to Europe and Turkey. After years of repairing the same machine which suffered from identical breakdowns, Ozan Onur Okumuş decided to start PEAK Technical Engineering three years ago, focusing on proactive maintenance. At first, he was met with a conservative and skeptical response. But after performing a few successful alignment jobs with documented proven effects, the clients kept coming back.

Even though we still face some challenges, awareness of maintenance is still on a global rise.

While the stories from our partners show that proactivity is not yet prioritized, once maintenance engineers are let in they are often asked to stay. ■

Mikael Terner

Mikael Terner, CEO, Easy-Laser

Contents

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Norrköping, Sweden

Time to take *proactive action*

With a career in maintenance spanning more than three decades, Andreas Sand is witnessing a significant shift in the profession from reactive to proactive approaches. While he welcomes this change, he emphasizes the need for the industry to attract future talent.

As a maintenance engineer specializing in industrial gearboxes and CEO at Drivsystem 05 in Norrköping, Sweden, Andreas Sand has dedicated his career to installing, servicing, and repairing machinery.

For the past 20 years, Andreas and his colleagues have tackled malfunctioning gearboxes plagued by inefficiency, noise, and functionality issues. Their tasks often involve disassembling machines, replacing seals and bearings, and addressing various types of gears, including planetary, coaxial, parallel, worm, and slewing gears. Drivsystem 05 is committed to creating sustainable solutions for machinery with rotating parts.

However, as clients continue to seek the services of Drivsystem 05, the nature of their assignments is evolving. While a significant part of their work still involves installation, alignment, and urgent repairs on-site, a large and growing part of their day-to-day work now takes place off-site.

"Nowadays, much of my time is spent in the office conducting causal analysis, holding strategic meetings, and producing event reports. I handle documentation and surveillance. Today, there is so much data available, enabling our company to adopt a more holistic approach to maintenance," Andreas explains.

Despite their busy schedules repairing gearboxes, Drivsystem 05, with its nine employees, is now highly focused on preventing gearboxes from breaking down. Utilizing modern equipment, Andreas assists clients with laser alignment, vibration readings, temperature readings, and oil condition monitoring to ensure gearboxes operate at full capacity. ▶

» The importance of maintenance is still highly undervalued and underestimated. We need to make education more accessible and increase awareness of our services.

Andreas Sand, CEO, Drivsystem 05

> While handling breakdowns is still a significant part of the everyday operation, Andreas Sand is experiencing an industry which is increasingly focused on proactive maintenance.

Andreas describes this shift as part of a growing trend towards proactive maintenance, driven by increased awareness of its benefits.

"Companies have realized that proactive maintenance can save money. By extending the lifespan and efficiency of a gearbox, companies can maintain production, increase revenue, and ultimately boost profits. Instead of dealing with sudden breakdowns, proactive maintenance allows for scheduled production stops, making workdays more predictable," he notes.

He emphasizes that this approach applies to all moving parts. Under ideal conditions, a machine could theoretically last forever. However, since perfect conditions do not exist, the impact of load, vibration, heat, wear, and gravity must be minimized.

Andreas attributes this change partly to the introduction and implementation of Industry 4.0, the next generation of industrial development involving automation, sensors, machine learning, and advanced robotics. He also credits a growing awareness fueled by an increasingly progressive generation of professionals.

"I remember when budgets were based on usage and repair. Machines were used until they failed and then repaired. This approach often led to costly production halts. Convincing someone to invest

» Companies have realized that money can be saved.

Andreas Sand,
CEO, Drivsystem 05

in proactive maintenance has been challenging. Fortunately, more companies now see the bigger picture. By investing proactively, they ultimately improve their bottom line," Andreas recalls.

Beyond economic benefits, Andreas highlights environmental and social sustainability as key drivers of this change. More efficient machines use less energy, fewer unexpected breakdowns reduce the demand for spare parts, and a more predictable maintenance schedule creates a healthier working environment.

Despite the growing awareness of proactive maintenance, Andreas acknowledges that there is still much work to be done.

"The industry is conservative, and we still need to be reactive to some extent, as unexpected events will occur. However, for every project involving hands-on maintenance and repairs, we always include a causal analysis. We discuss how companies can further improve their proactive maintenance, even with small adjustments like regular oil sampling and laser alignment," he says.

As the maintenance industry continues to evolve, Andreas has identified a potential concern.

"Over the past decades, opportunities in our field have declined. There was a time when most major industrial companies had in-house maintenance departments with their own service technicians and engineers, leading to unmatched consistency and knowledge. That has changed," he explains.

Departments have gradually been dissolved, creating a knowledge gap that is difficult to fill. Additionally, education has become less accessible, making it harder to pursue a career in maintenance.

"There have been some excellent educational initiatives to simplify the path to a maintenance profession. However, we as professionals need to do more. Maintenance is and will remain the most important factor in promoting a more sustainable industry. We need to make this case and provide future generations with fair opportunities to become our colleagues," Andreas concludes. ■

Name: Andreas Sand

Age: 50

Lives: Norrköping, Sweden

Does: Founder and CEO of Drivsystem 05 AB, and passionate about maintenance. Helps organizations become more sustainable through extended service life and increased energy efficiency of machinery.

Four to four

Maintenance is becoming more important everywhere. However, different markets face different challenges. We reached out to four partners in four regions to give them the opportunity to share their experiences.

Jan Oscander
Easy-Laser
Sweden

In which three industries do you have the majority of your customers?

Industries with a lot of machines, like paper mills, steel mills and mines. And service companies for those industries, as well.

What emerging trends are you noticing in the maintenance field within your region?

Weakness of frameworks in newer constructions! And the speed of installation of new machines.

What do you see as the biggest challenge currently facing the maintenance industry?

The urgency demanded to complete the installation phase and the lack of requirements for correct installation.

What's the most unique or unusual task you've accomplished using Easy-Laser equipment?

Before an international swimming competition, I was contacted to measure the slope of the starting blocks. Quite an unusual assignment!

» We have a skills shortage in the maintenance industry

John-Paul Lambert, Benchmark PDM Inc.

Murilo Medeiros
EASYVECTOR
Brazil

Oil and gas, service companies and shipyards

Industry 4.0, on-line monitoring, cloud data-bank.

Reducing energy consumption, reducing maintenance costs, renew maintenance teams and turnover.

We have a customer that is using the Easy-Laser XT440 shaft alignment system to align shovel bores for the mining industry.

Loris Bragagnolo
GVS Reliability Products
Australia

Mining, power generation, general industry

Companies looking to use IoT and AI to process large amounts of inputs from their plant to better schedule and predict future maintenance practices.

A lack of qualified tradespeople across various disciplines like fitters, electricians, machinists, and welders.

I used our XT22 flatness laser to set the levels on my bathroom renovation floor so I could tile perfectly!

John-Paul Lambert
Benchmark PDM Inc.
Canada

Energy (nuclear, hydro and wind), pulp & paper and steel industries

Slow shift to green energy, getting rid of coal. But we still have a strong oil and gas industry.

Lack of skilled workers. We have a very big skills shortage in the maintenance industry.

Checking and measuring a more than ten meter, heavy, vertical pump shaft for straightness. Because of the weight we had to measure down the sides. Also, doing alignment training on an 80 meter tall wind turbine tower was interesting and unique to say the least.

» We ended up giving it a proper alignment and the problem stopped. I realized there was potential in maintenance.

Ozan Onur Okumuş, Technical Manager and co-founder, PEAK Technical Engineering

Bursa, Turkey

Turkey is ready for *reliability*

By focusing on reliability and proactivity, they became one of Turkey's fastest growing companies within industrial maintenance. And as the awareness of how important alignment is continues to grow, Ozan Onur Okumuş and his partners at PEAK Technical Engineering expect the demand for their services to follow.

In the city of Bursa, about an hour's drive south from the Turkish metropolis of Istanbul, Ozan Onur Okumuş and his ten colleagues at PEAK Technical Engineering are getting ready for another day in the field. As an authorized distributor of Easy-Laser products, they are responsible for providing their clients with the right equipment – whether it's the XT770 for shaft alignment or the XT950 for bore straightness measurement. PEAK also offers training for these products and, thanks to their engineering expertise, they also perform hands-on maintenance, installation, and repair on-site.

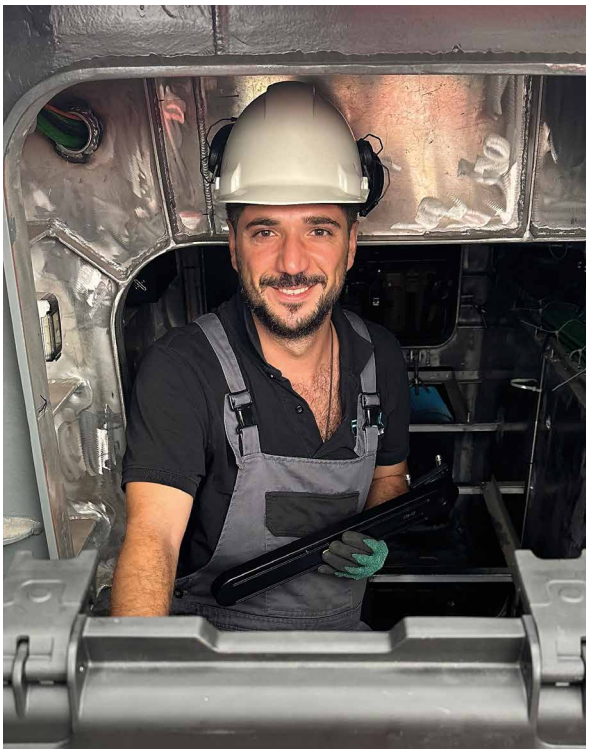
As one of the biggest economies in Europe, Turkey possesses one of the most diverse industrial sectors on the continent, including automotive, marine and steel-iron production.

And PEAK Technical Engineering is involved in all of them, which means a lot of moving parts to align.

Today the staff is made up of two handfuls of service co-workers. And thanks to successful projects they have gained a customer base that stretches across the entire country of Turkey.

"We travel a lot and work a lot. We're in the process of incorporating subsidiaries across the country into our operation to be able to meet the increasing demand."

The rise to becoming a countrywide operation has been swift. Three years ago the company didn't exist and prior to that Ozan worked at a biodiesel company as a maintenance engineer. One of the most common tasks revolved around one particular machine that needed special attention. ▶



› The demand for proactive maintenance in Turkey is steadily increasing. Pictured is Tayfun Turgay out on an assignment.

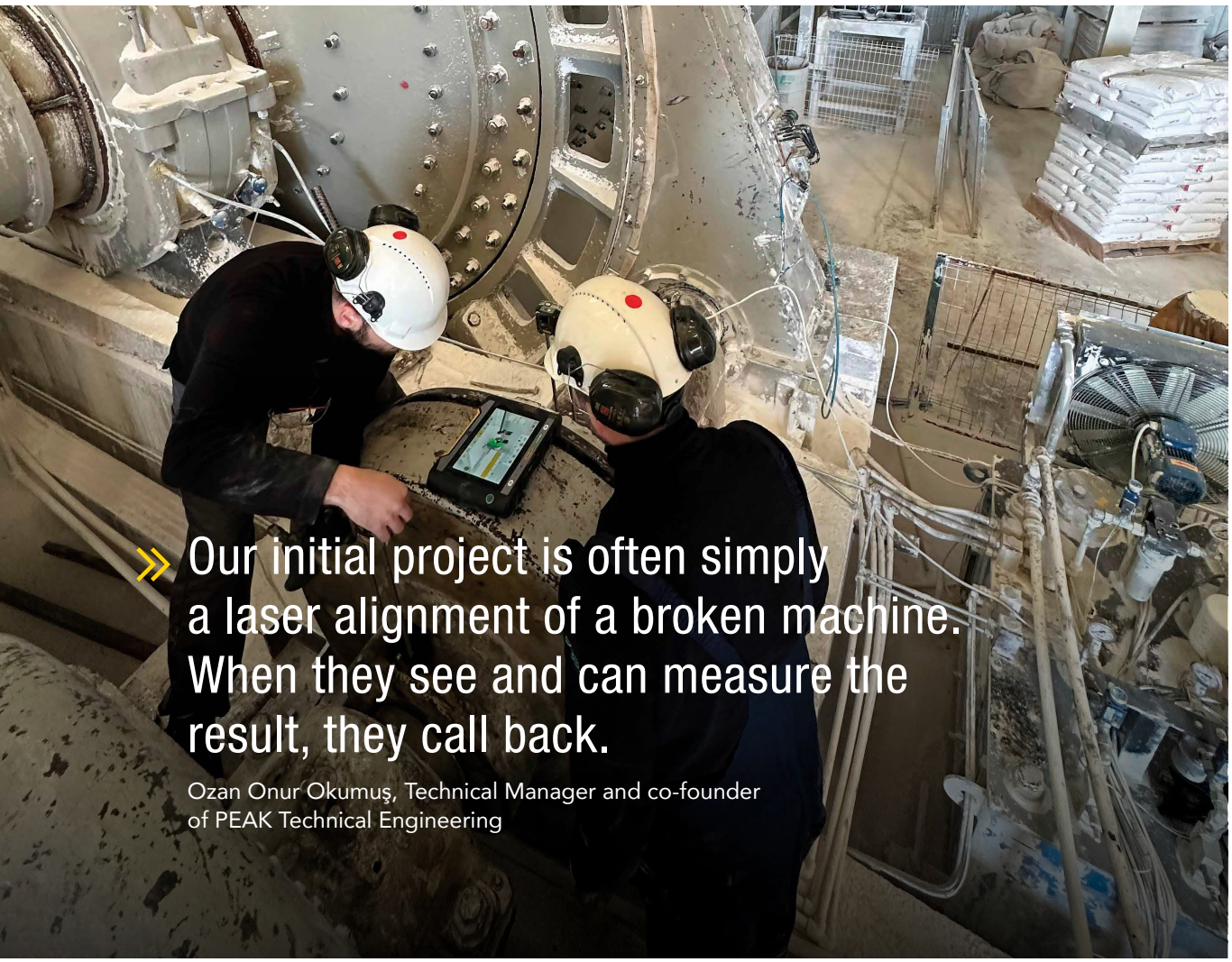
"The machine kept breaking down which meant that we had to change parts basically on a daily basis. I suggested that we should try to work more proactively. We ended up giving it a proper alignment and the problem stopped. I realized there was potential in maintenance."

Ozan decided to go his own way. Together with Mert Sönmez they founded PEAK Technical Engineering and focused on proactive and predictive maintenance offering customers laser alignment and vibration measurements. After some successful projects they quickly began to gain some traction. The company expanded and more clients discovered the benefits of reliability and working proactively. Tasks included geometric measurements for straightness, flatness, parallelism and dynamic measurements. Often using Easy-Laser equipment.

In 2023, they became an authorized Easy-Laser distributor. The year after, they received the Golden Gazelle Award after being one of the fastest growing partners.

The partnership has continued to evolve. Today PEAK Technical Engineering and Easy-Laser work closely together on several levels. Training is one example, but also in terms of product development in order to suit local needs.

"Easy-Laser has been helpful from the start and a great support for us and our clients. One example is language, an important factor in Turkey. When Easy-Laser added Turkish to their software, it made a difference for us and helped us grow," he says.



» Our initial project is often simply a laser alignment of a broken machine. When they see and can measure the result, they call back.

Ozan Onur Okumuş, Technical Manager and co-founder of PEAK Technical Engineering

As a native Turk, Ozan explains his home country has been through economic hardships. Just like large parts of the world, Turkey has been experiencing increasing costs in commodities and energy, which is why companies have been trying to find different ways to save resources. He portrays the industrial sector as conservative but open to new solutions.

"When we describe the benefits of reliability and maintenance, they listen. But you have to give them something. Some kind of proof. Our initial project is often simply a laser alignment of a broken machine. When they see and can measure the result they call back."

Many of those initial clients have since become loyal customers, with PEAK now performing proactive maintenance rather than waiting for things to break. And according to Ozan the word is spreading.

Even though industries in Turkey are starting to see the benefits of laser alignment and vibration measurements, there is still a long way to go before proactive maintenance has made its full breakthrough, Ozan explains.

"Perhaps it will take five years. Maybe ten. You have to remember that five years ago there were barely any companies like PEAK Technical Engineering. Today we are maybe 15 and counting. In a few years we might be 50." ■

In 2024 PEAK Technical Engineering received the Golden Gazelle Award after being the fastest growing Easy-Laser partner.

Name: Ozan Onur Okumuş

Age: 34

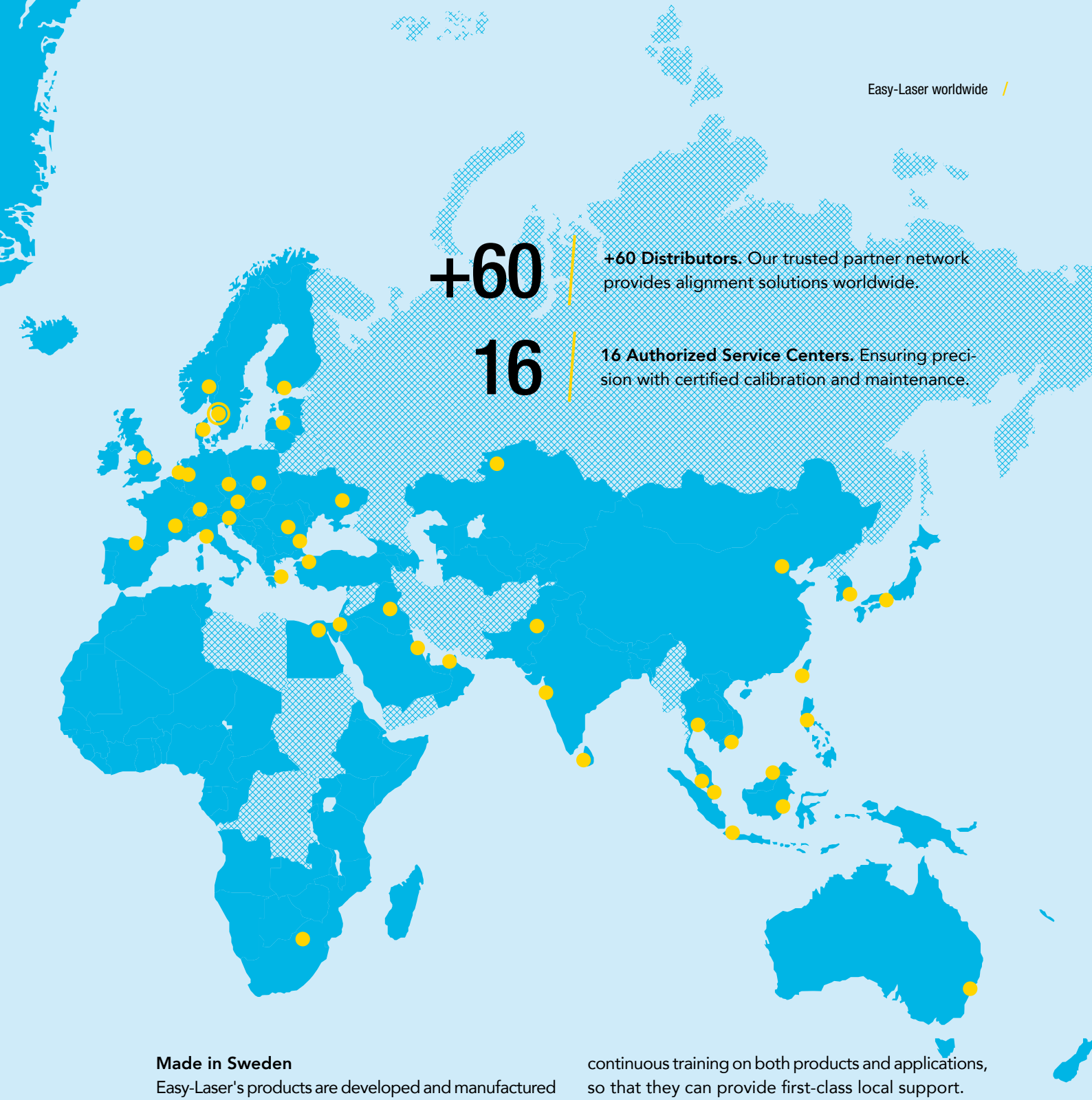
Lives: Bursa, Turkey

Does: Technical Manager and co-founder of PEAK Technical Engineering. Helping Turkish companies with maintenance in a vast variety of industries such as automobile, marine and steel-iron.

We are right *where you are*

We are global and local, big and small – at the same time. And that's exactly how we want it. You can find us worldwide, from Alaska in the west to New Zealand in the east. No matter where you are, rest assured that you'll get the help you need from experts with extensive knowledge in measurement and alignment. Solutions tailored to your needs and your budget.

Easy-Laser AB, Head office Local distributor Where we are represented



+60 **+60 Distributors.** Our trusted partner network provides alignment solutions worldwide.

16 **16 Authorized Service Centers.** Ensuring precision with certified calibration and maintenance.

Made in Sweden
Easy-Laser's products are developed and manufactured in Sweden, where we also have our own sales team. In addition, we have subsidiaries in Germany and Singapore.

Our distributor network
We work closely with distributors in over 60 countries. They are a natural extension of our own sales organization and some we have worked with since the very beginning. It is important to us that our partners have knowledge of various applications and solutions and really understand the customer's needs. Therefore, we ensure that they receive continuous training on both products and applications, so that they can provide first-class local support.

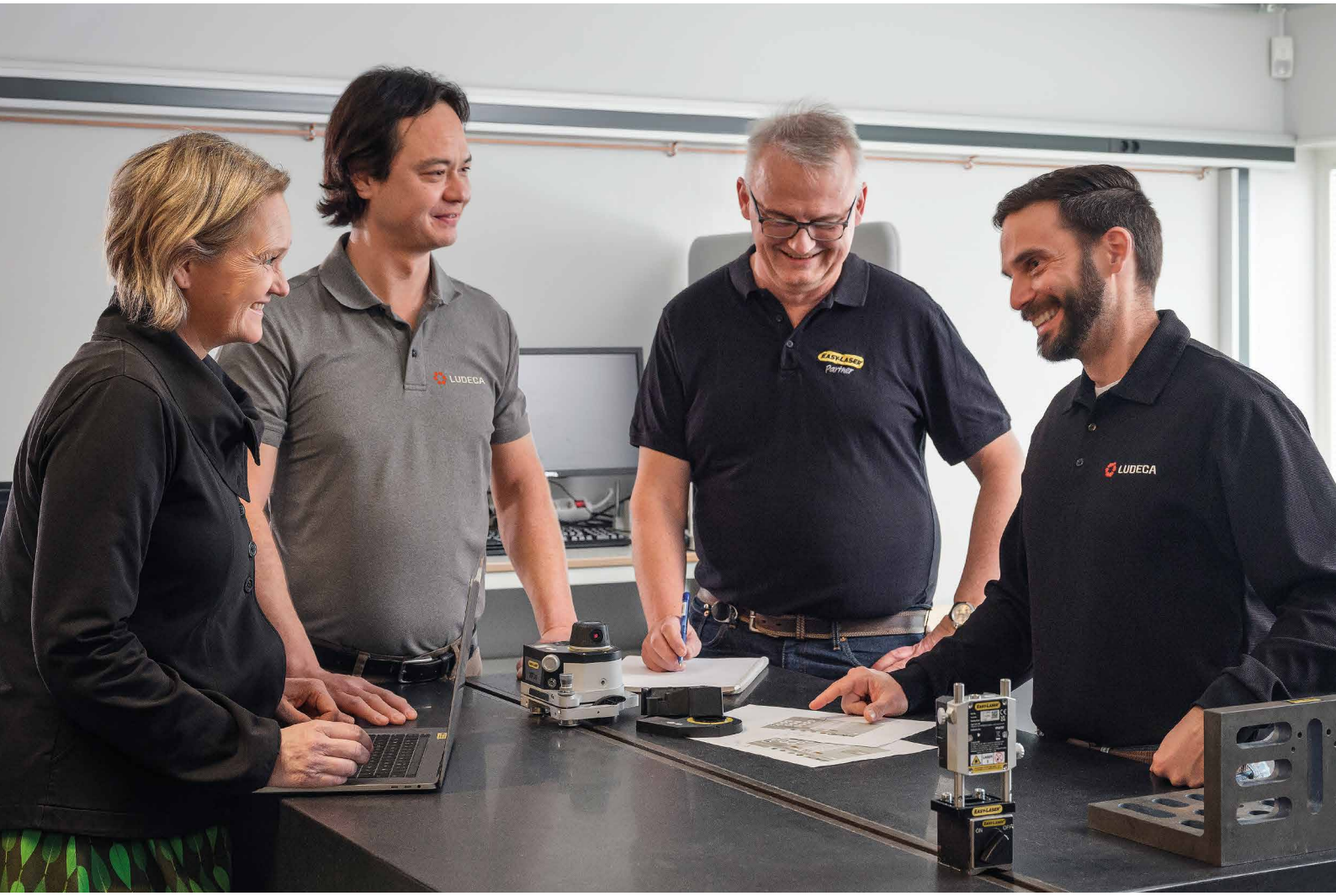
Service Centers
Several of our partners have well-equipped Service Centers where you can send your measurement gear for service or regular calibration. We want to be able to provide this as close to you as we can, so that you get your equipment back as soon as possible. We know that time is money. ■

Find your nearest Easy-Laser distributor.
› easylaser.com/en-us/contact

Miami, Florida, USA

Driving product *innovation*

At Easy-Laser, we continuously seek ways to enhance our products.
This led us to create the Product Advisory Board.



› Julia Niklasson, Daus Studenberg, Peter Sandström and Carlos Bienes discussing future improvements.

By involving partners in the R&D process, Easy-Laser has been able to gain local insights into how to improve their products based on actual user experiences.

The Product Advisory Board was born out of an idea to create a forum where our partners, spread across all continents, could share their experiences and insights. The result? Better solutions for everyone.

"Often our partners provide valuable insights from their local markets. For us, this is a way to incorporate different perspectives into our product development," says Peter Sandström, Head of Product Management at Easy-Laser.

Ludeca, the leading provider of reliability solutions in the USA for over 40 years, is an obvious member of the Board. They contribute significantly to our product development with a wealth of input and ideas. Recently, they highlighted some improvements for the Bore alignment program.

"The customers are really focused on user experience, and Ludeca pointed out areas that could be improved. Thanks to their input, we've made these changes, benefiting all our users," Peter adds.

"Our partners know their end-users best. For us, it's crucial to involve as many perspectives as possible – that's how we keep improving," Peter says. He emphasizes the importance of Ludeca's commitment to quality and customer care, which aligns perfectly with Easy-Laser's values.

Daus Studenberg, National Product Manager for the Alignment Division at Ludeca, shares his thoughts:

"The collaboration between Easy-Laser and Ludeca has been fantastic. It is not only that Easy-Laser provides the easiest-to-use laser tools out there. It is also important that they are accurate and field dependable. We pride ourselves on taking field feedback directly to Easy-Laser to help improve the product. Ludeca's vision is about being the most trustworthy partner in the world of reliability. That is what we strive to achieve. Integrity is also very important and that as well aligns with Easy-Laser," Daus says.

He continues, "Attention to the realities of our customers needs is extremely important to make sure that we provide what they require to run their facilities at maximum uptime. It's not just about having a great product, but also having the organization to back it."

Our close relationships with partners like Ludeca around the world make all the difference when it comes to developing better alignment solutions. ■

» For us, it's crucial to involve as many perspectives as possible – that's how we keep improving.

Peter Sandström,
Head of Product Management, Easy-Laser

Puebla, Mexico

The terrible truth behind ball bearings

– and the lesson to learn

This is not a crime novel, and nor is it a police report. But the title is still relevant for describing the field of work Alejandro Pérez Martínez is in. Being a bearing failure analysis specialist, forensic engineering is indeed his area of expertise. His services are in high demand, primarily in the Latin American countries. Aligned Magazine had the opportunity to talk to him during a rare visit to Sweden.

Alejandro Pérez Martínez is a Mexican native, residing in Puebla, a city with a million and a half inhabitants a couple of hours southeast of Mexico City. Puebla has a football team in the national top tier, but is possibly best known for being the centre of Volkswagen's Mexican enterprise. The brand's classic Beetle was still produced in Puebla in the early 2000s. Mexico, with a population of around 130 million, is an important market for Easy-Laser. Alejandro is an equally important person, having been one of our allies since 2015.

How did that start?

"Well, I first met Mikael Terner, CEO of Easy-Laser, and then gradually more and more people from Easy-Laser, and we just hit it off", he says. "We have several interests in common, alignment of course being one. More and more companies in Latin America are looking into alignment, and Easy-Laser is recognized as a strong, global actor."

But why this interest in alignment, and why now?

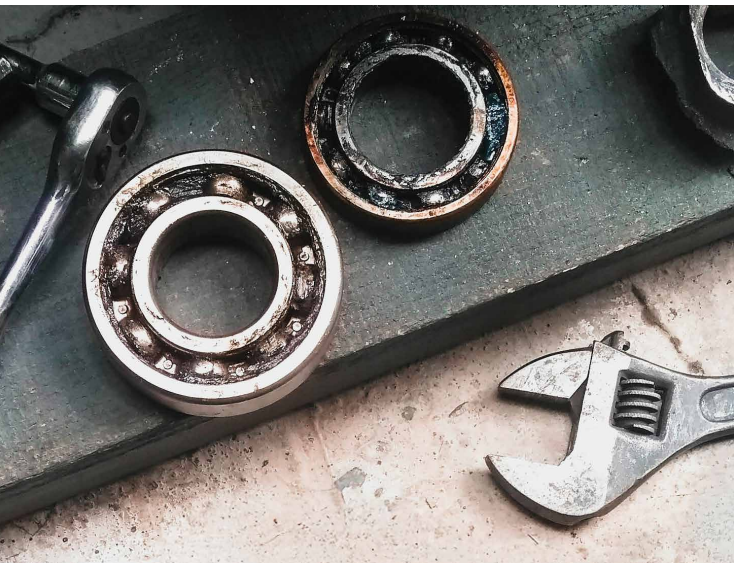
"They are starting to realize the importance of alignment as part of their maintenance and reliability work. Reliability seems to be on the agenda all over the world, including the countries where I work. How can they make their assets live longer and provide more stable uptime ▶

and productivity? They recognize that if they carry out alignment, it's really the start of higher machinery reliability."

Learning by doing

So, the main thing you do is you travel to teach others about ... failure?

"Did you know that the global, annual cost of bearing failures adds up to 7.4 billion dollars?", Alejandro asks rhetorically. "That's insane, but still not the most important factor. And shaft misalignment is responsible for up to 50% of all costs related to rotating machinery breakdowns. Also not very sane. Every time I give a lecture, or talk at a conference, or lead workshops, what I do is I design the presentation from experience. Most of my audience consists of maintenance people, and they can relate to what I'm talking about. I always try to be very hands on, using real items as props, touching them, rearranging them you know, in a tactile way. Children learn by imitating, but grownups learn by doing things themselves. That's why my lectures and the training I give will always combine theoretical stuff with practical."



> "Of the ten billion ball bearings being manufactured every year, nine billion will outlive the machine", Alejandro says.

That sounds pedagogical enough.

"Absolutely, yes. Especially with the bearings, you need to touch, you need to smell, you need to see how they look. It's better to have the real thing there because it's what the people in my audience work with every day. Replacing a bearing, mounting a bearing, and so on. I can't just show them photographs of bearings. I need to have the real thing with me."

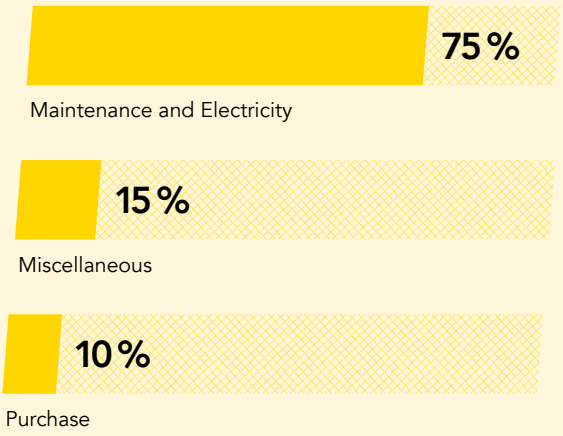
So, what do they take away after an hour or a day with Alejandro Pérez Martínez?

"Haha, well, that's one of the things I always want to find out. When I'm done, I actually ask the participants what they have learned, and they can

Did you know?

The purchase price of a machine usually only accounts for around **10 %** of the machine's total life cycle cost. Instead about **75 %** of the costs are for maintenance and electricity consumption.

The right knowledge can significantly reduce that amount.



usually summarize that in a couple of sentences. I find it satisfying that I may have contributed to some change for the better even when it comes to guys who have been doing their job for 20+ years."

Reliability and sustainability

What is it that makes you sought-after?

"Hm, it must be the specific talent that not everybody has, to transfer knowledge. Not very many people can do that. A lot of smart people with impressive and specific competences can still be disappointing when they try to convey their knowledge to others."

When you talk about reliability, it sounds almost inevitable to also talk about sustainability.

"Yes, I agree. In Latin America we're still in earlier stages of the sustainability debate. I personally would like these companies to talk and act more in the sustainability field. It's a necessary thing for all of us. It's ultimately about taking responsibility, as humans and as companies. The connection between sustainability and reliability is there for everyone to see."

The life cycle of a ball bearing

OK, but if we should talk a bit about the ball bearings. When did they enter your life?

"Well, in the early 2000s I worked for SKF, and that's the first time I came in contact with bearings. I worked for SKF in Mexico, and then for a time in the Netherlands. After that I founded Grupo MTF. Since 2012 that has been my work, my own company. A lot of traveling all over the Latin American countries, and always with the bearings in focus. I do have people working for me, but in the end it's a one man show, haha!"

So, SKF, the inventors of ball bearings?

"Yes, that's the claim, anyway. They gave me the opportunity to be out in the field, and I learned so much about this component. I consider myself ▶

a field engineer. I'm very passionate about that, about maintenance, about reliability, about people, because I'm not talking only about the machines. I'm concerned about the people. The bearings became sort of symbolic for all of these concerns of mine, my passion. Ultimately, this is how I became a bearing failure analysis specialist."

I have heard Roman Megela, whom you know, say that the theoretical life cycle of a bearing is … forever.

"And that's true. Most bearings will survive the machine. Then of course there are bearings of different qualities. The ones used in, for example, standard kitchen blenders won't need to be of the highest quality. But overall, of the ten billion ball bearings being manufactured every year, nine billion will outlive the machine."

The benefits of increased reliability

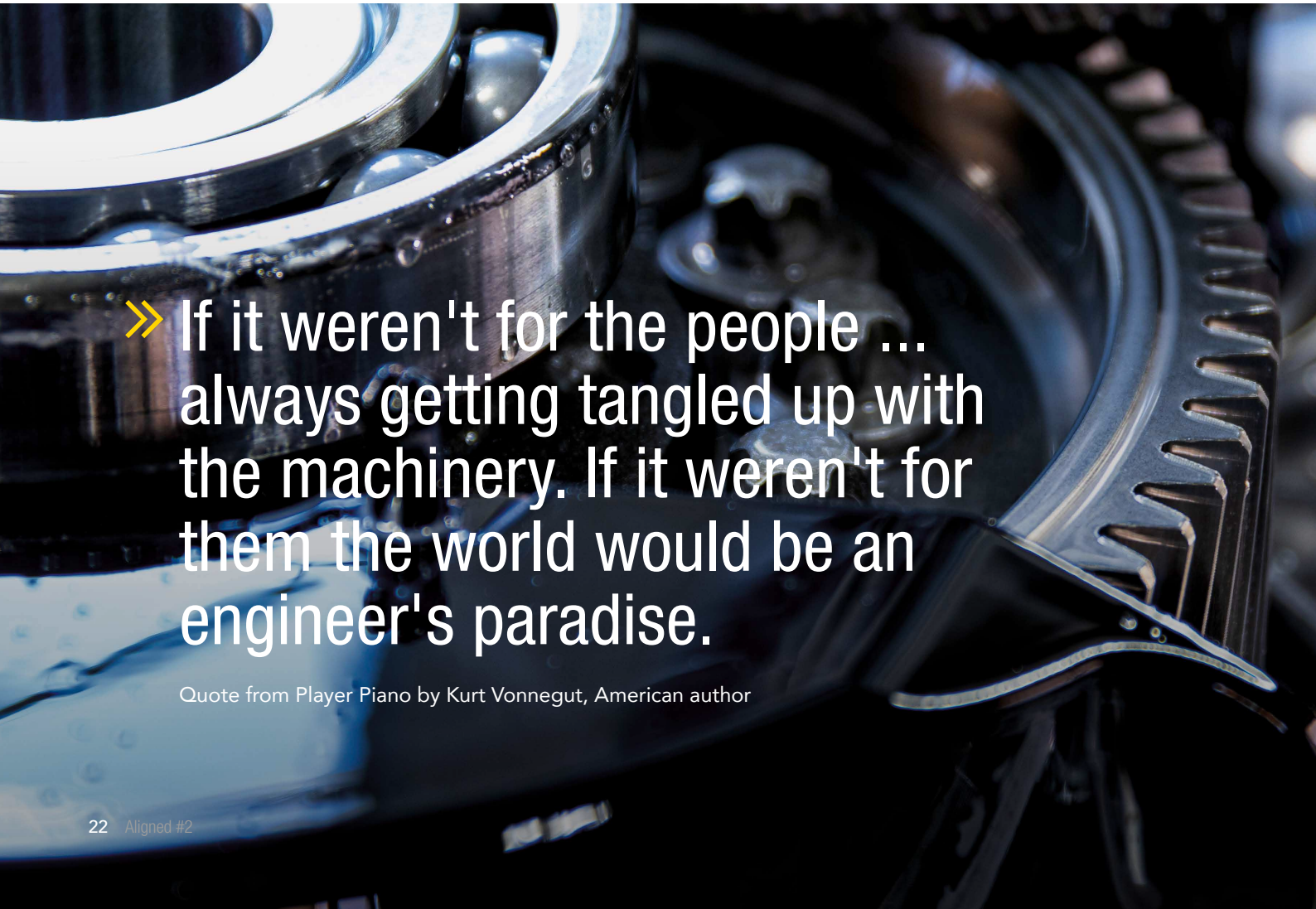
Alejandro's focus, though seemingly on machines, is in fact on people. True, badly treated machines will break down and become scrap too early. But more importantly, before being scrapped, they will constitute serious threats to people's lives. Far too many examples of this exist.

So it's fair to say that you're on a mission?

"I am indeed! Having a forensic perspective is still necessary, but in the future there will hopefully be less accidents to analyze. Staying ahead of breakdowns will be the priority, first and foremost to save lives. Everything else, like prolonged life cycles of expensive machines and increased shareholder value, should be considered as a bonus."

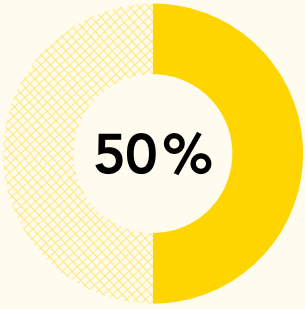
And how would you go about it? What's your suggestion?

"Let's talk about maintenance engineering and reliability engineering. The former is focused on efficient maintenance and repair, and if it's well carried out it can lead to less repair needs. This is achieved by learning how to perform maintenance before anything actually breaks. Reliability engineering, on the other hand, is focused on eliminating failures



» If it weren't for the people ... always getting tangled up with the machinery. If it weren't for them the world would be an engineer's paradise.

Quote from Player Piano by Kurt Vonnegut, American author



Shaft misalignment is responsible for up to **50%** of all costs related to rotating machinery breakdowns.

altogether. The key factor here is precision. By controlling the causes of breakdowns, which may include redesigning, you can actually save lives and money alike. Precision is crucial to real change. If you want to go from shaky, dirty, hot and noisy machinery to smooth, quiet, cool and clean, then precision is of the essence. Excessive vibration robs your machine of life length and reliability."

Good news for shareholders

Of course, the main incentive is that increased reliability will not only affect a machine's life cycle in a positive way, it will also, and mainly, prevent accidents and actually save people's lives. The latter is by far the most beneficial effect, and should be more than enough to encourage change. In addition, company value increases when reliability does. This is good news for shareholders, among others.

"Exactly. When we talk about reliability and proper maintenance, we're really talking about safety and human lives. A machine that breaks down unexpectedly can cause severe injuries or even fatalities. I've seen it happen far too many times. You know, when I talk about the 'terrible truth' behind ball bearings, I'm not trying to be sensationalist. The truth is terrible because it reveals how much unnecessary waste and danger we create through improper maintenance and alignment."

As our talk comes to an end, he pulls out a small bearing from his pocket, holding it up to the light.

"The bearing is a precision part and must be treated as such. This simple component can tell us so much about a machine's history – and its future. When I analyze a failed bearing, I'm not just seeing metal and grease. I'm seeing lost productivity, wasted resources, and potential safety hazards."

Alejandro continues:

"But here's the hopeful part – all these issues are preventable. That's the most important lesson to learn here. With proper alignment, installation, and maintenance, we can dramatically extend machinery life and reliability. And every single effect of doing so is positive. There's no downside whatsoever. All we have to do is convince everybody! That's what I do, that's my passion." ■

Name: Alejandro Pérez Martínez

Age: 49

Lives: Puebla, Mexico

Does: International speaker, bearing and lubrication expert, specializing in the forensic analysis of components. Managing Director of Grupo MTF.

The complete *reliability solution*

Flatness. Flatness of sole plates. A non-flat surface might cause soft foot. Depending on machine type, the flatness requirements differ. Follow manufacturer recommendations.

› XT770 GEO with laser transmitter XT20 or XT22.

Co-planarity. Check that machine sole plates are co-planar. If not, this can be a source for soft foot.

› XT770 GEO with laser transmitter XT20 or XT22. Digital precision level XT290.

Soft foot. Always check for and eliminate different kinds of soft foot to get a reliable installation. Soft foot is the "silent machinery killer".

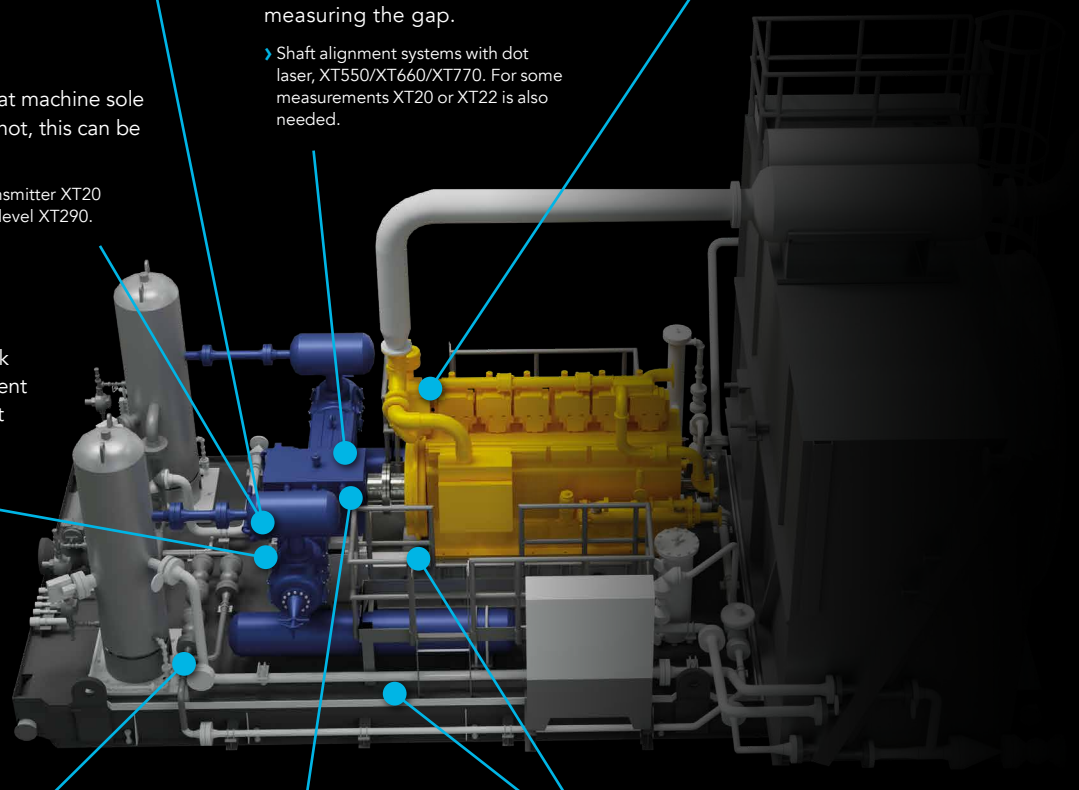
› Shaft alignment systems XT440/XT550/XT660/XT770.

Pipe strain. Check the influence of pipe connections to verify that correct alignment can be made without adding pipe strain.

› Shaft alignment systems with dot laser, XT550/XT660/XT770. For some measurements XT20 or XT22 is also needed.

Bearing play. On the compressor, we need to measure the main bearing clearance and the connecting rod bearing clearance. The clearance space is measured by lifting the shaft/rod and measuring the gap.

› Shaft alignment systems with dot laser, XT550/XT660/XT770. For some measurements XT20 or XT22 is also needed.



Hot spots. A thermal image can reveal possible alignment problems. Add a before and after image to your alignment report.

› XT Display unit with Thermal camera (IR).

Dynamic measurement. Detect unwanted movement caused by thermal growth, pipe strain and other dynamic forces. This should always be done during commissioning.

› XT770 with Dynamic brackets.

Straightness. Checking the straightness and possible sag of base frames and engine housing. A bent housing will affect bore straightness.

› XT770 GEO with laser transmitter XT20 or XT22.

Pictured is a typical rotating machine, highlighting what has to be checked to achieve reliable machinery operation, and what can be measured with Easy-Laser. The combustion engine can of course instead be an electrical motor, and the compressor a 4 throw or more model. Most applications in the image can also be found on other common installations like a motor and pump, propulsion drivelines, etc. Easy-Laser has solutions for all types of machinery.

Belt alignment. Alignment of cooling fan drive. By aligning your belt drives you lower energy consumption and prolong the life of belts.

› Digital belt alignment system XT190.

Shaft alignment. Alignment of coupled, rotating machinery. Measurement programs for horizontally arranged, vertical/flange mounted, cardan/offset mounted and machine trains. Easy alignment with live values.

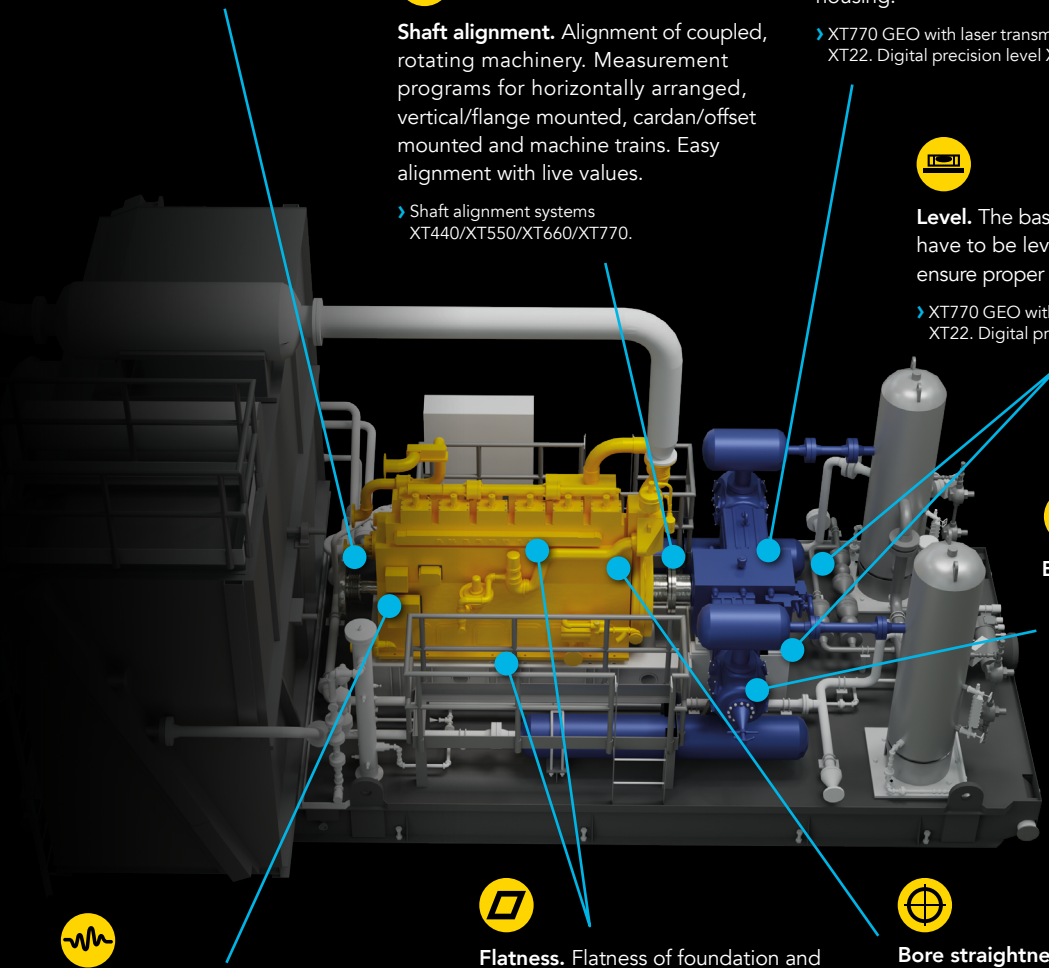
› Shaft alignment systems XT440/XT550/XT660/XT770.

Flatness. In this application, top plane flatness is measured to verify bore straightness of the compressor. If found not flat this can indicate a twisted housing.

› XT770 GEO with laser transmitter XT20 or XT22. Digital precision level XT290.

Level. The base and the machine frames have to be level within tolerances to ensure proper operation and lubrication.

› XT770 GEO with laser transmitter XT20 or XT22. Digital precision level XT290.



Bore shape. Checking out-of-roundness to find severe wear and tear.

› XT950 or XT770 with bore brackets.

Vibration check. Check for early signs of wear and diagnose faults such as unbalance, misalignment and looseness.

› Vibrometer XT280.

Flatness. Flatness of foundation and sole plates. Flatness on parting surfaces to ensure cylinder head gaskets will be able to do their job as intended.

› XT770 GEO with laser transmitter XT20 or XT22.

Bore straightness. Measure straightness of cam and crank shaft bearing journals. Or bearing journals and stern tube on a ship, for example.

› XT950 or XT770 with bore brackets.

› For an overview of our systems, take a look at pages 32–35

Making shaft alignment easier – *and more reliable*

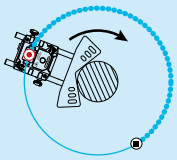
Pumps and motors are among the most common rotating machinery in the industry. Pumps then vary a lot in design, and how they are set up – horizontally, vertically, etc. But the basic principles of measuring the misalignment and then aligning them are very similar. Our XT laser shaft alignment systems offer many great functions to simplify the job. Not only for pumps but for most rotating machinery actually! Here are some examples.

Alignment with live values
With real-time values you can follow the machine movement on screen, at the place where you adjust during alignment. This makes the alignment much easier.

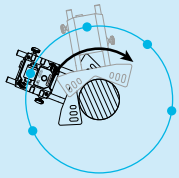
Compensating for thermal expansion
Thermal expansion is mainly caused by the temperature difference in a machine when it is offline (cold) vs. online (hot). This can cause a machine that is perfectly aligned while not in operation to be misaligned out of tolerance when it's running. By adding data for thermal expansion to the system, the alignment targets in cold condition get compensated to achieve a perfect alignment during operation.

Use alignment tolerances
With automatic tolerance check you get visual feedback of when your machine is aligned at least as well as required. Use tolerances provided by the equipment manufacturer, or for example the built-in tables for ANSI/ASA standards.

5 Five different measurement methods



Continuous sweep
Hundreds of measurement values are recorded automatically during continuous rotation of the shafts. You can start and stop at any angle, the result is presented instantly. Quality check of measurement is provided. A very quick and easy method for coupled machines.



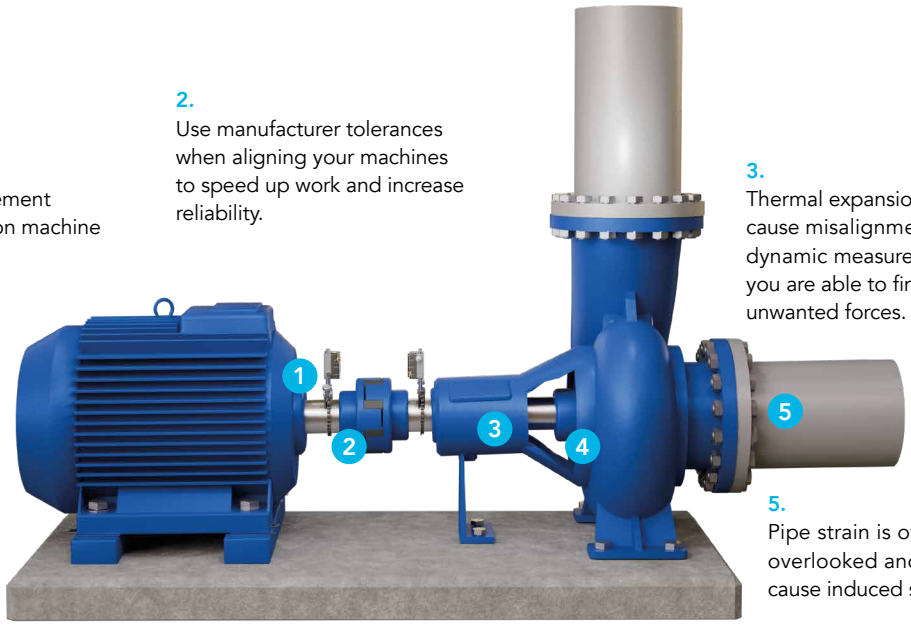
Uncoupled sweep
This method simplifies measurements when machines are uncoupled. One measuring unit is stationary, then the other is rotated passing over it with the laser beam. The stationary unit is then placed in a new position, and the procedure repeated. Great for big heavy machinery.

1.
Use suitable measurement method depending on machine and situation.

2.
Use manufacturer tolerances when aligning your machines to speed up work and increase reliability.

3.
Thermal expansion can cause misalignment. With dynamic measurement you are able to find those unwanted forces.

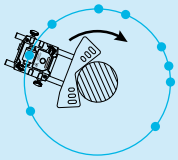
4.
Dynamic measure-ments should always be performed at Site Approval Tests.



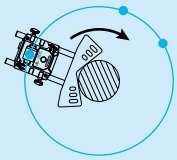
5.
Pipe strain is often overlooked and can cause induced soft foot.

Dynamic measurement prevents machine failure
Dynamic measurement is about finding unwanted movement. All excessive forces like thermal expansion or contraction, pipe strain (dynamic and static), additional heavy loads (e.g. silencers) will generate stress in the machine casing. This might cause them to move or change the designed geometry of the machines, which in turn cause misalignment, internally and externally. Leakages will appear, and a distorted casing might lead to internal contact between stationary and rotating components. Uncorrected, this will inevitably lead to machine failure. If you perform a dynamic measure-ment, all of this can be avoided.

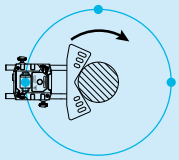
When to measure
The dynamic measurement should be performed at SAT (Site Approval Test) before starting the operation, or every time the equipment has been removed for overhaul and placed back. This way you ensure a reliable machinery installation, and prevent possible costly downtime. ■



Multi point
With this method you record multiple points on the sector rotated. Start and stop at any angle. Multiple points will provide an optimized calculation basis. Perfect for e.g. turbine and sliding bearing applications.



EasyTurn
With the EasyTurn method measurement values are recorded at any three positions, with as little as 20 degrees between. Start at any position. Comes handy if for instance pipes or covers are in the way for larger rotations.

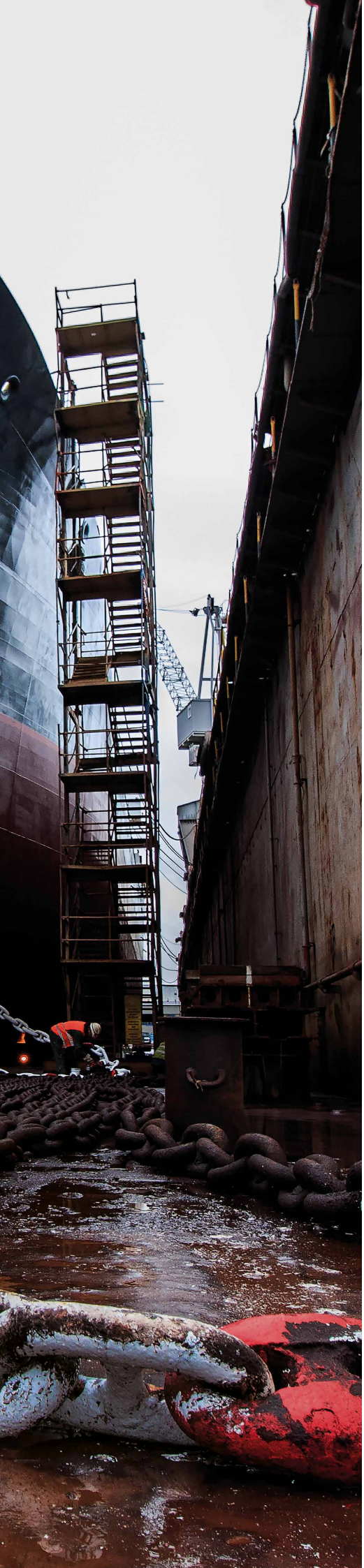


9-12-3
The classic "9-12-3" clock position method, which can be used in most cases. Measurement values are recorded at fixed points. The preferred method when the machine to be aligned is mounted on a moving object, such as for example on a ship in water.

Dordrecht, Netherlands

Preparing for *life at sea*

In the Pacific and Atlantic oceans service stations are few and far between. For Arie Leeuwenburg and his team at On Site Alignment, their mission is to ensure that every vessel makes it safely to shore. “A breakdown at sea can have enormous environmental and economic consequences. Yet, too many companies still disregard proper maintenance,” he says.



Every day on his way to work Arie Leeuwenburg passes the Dutch river Nieuwe Maas running through Rotterdam. Home of the largest seaport in both the Netherlands and Europe, Rotterdam is a symbol for the marine industry.

With more than 40 years of experience, On Site Alignment has made a living on extending the lifespan of large vessels carrying sizeable cargo to an international market.

Today the marine industry makes up 80 percent of the total workload for On Site Alignment with much of the daily tasks focused on aligning rotating machinery in order to reduce vibration, resolve high-temperature issues and prolong the lifespan.

"Investing in ship maintenance in particular is often kept at a low level but can also be decisive in terms of economical survival for most marine companies", Arie explains. Compared to a factory or an onshore operation a ship spends, by definition, most of its time out at sea. This is why a ship that suffers a breakdown out at sea can find itself in deep trouble.

"When something starts to vibrate, it affects the entire construction and not just the individual installation, which can cause further damage to other machinery. And since there are few service stations in the Atlantic, realignment of machinery out there can be challenging."

Arie explains that if a vessel breaks down offshore, you will most likely need to arrange transport via tugboats to the nearest port. ▶

› Bore alignment of propulsion drivelines is one of On Site Alignment's assignments.

> Correct installation of machinery is vital for a reliable operation.

You will need new spare parts and hire the expertise to do the repair and installation. At the same time you will need to store your cargo while the delivery can be expected to be delayed. All of this will cost you. Depending on the size of the vessels it can add up to tens of thousands of dollars per day.

And that's disregarding all the unnecessary waste of resources and energy used in order to sustain the process.

Even if the industry could save money and resources with proactive maintenance, Arie says that maintenance of vessels is often either minimal or non-existent.

"I think the problem is awareness. Today, many ship owners just keep running their boats and hope for the best. I have been thinking and breathing reliability for the last 40 years. For me it's not an issue. But we need to address these questions on a daily basis and educate the people who make the decisions."

In his career he has come across several ways in which companies have been chasing higher profits by cutting corners.

"During the last decades the amount of crew members with knowledge within maintenance has decreased significantly. Because it's cheaper. This means that ships are even more vulnerable to failure. Recently we had a vessel that was sailing with a damaged propulsion system and just kept on sailing until it was completely ruined."

There is also a growing trend with slow steaming,

» I think the problem is awareness. Today, many ship owners just keep running their boats and hope for the best.

Arie Leeuwenburg,
CEO, On Site Alignment

where the ship travels at a reduced speed which can have short term benefits but frequently results in more contamination inside the engines.

"Like many other industries the marine sector is conservative," Arie says. However, as awareness for maintenance in general grow he hopes the shipowners will follow. Especially now when the technology becomes more accessible.

"It's really nice to see the development and that the equipment and processes are becoming quicker and more efficient. The first Easy-Laser XT770 we bought was really something and mind-blowing compared to other equipment. This is equipment that should be on every ship. So once you do proper maintenance the machine can run for many years. Our philosophy and ultimate goal is to align machinery to last forever". ■

› Shaft alignment carried out with XT770.

Name: Arie Leeuwenburg

Lives: Dordrecht, Netherlands

Does: CEO of On Site Alignment. Offices in countries such as Singapore, USA and United Arab Emirates. Mainly focused on the marine sector.

A system for *every need*

In our product line-up you find everything you need for reliable machinery installation and continued maintenance work. These pages give you a quick overview of the product features.

Shaft alignment

XT770 Shaft

With dot laser technology. With XT770 you can align all types of rotating machines. With the unique EasyTrend™ and Twist programs you will be able to check base condition and dynamic forces that may affect reliability. The system comes with a wide range of brackets as standard.

Horizontal · Vertical · Machine train (Unlimited) · Machine train (3 machines) · Cardan/Offset mounted* · Values (Digital dials) · Twist · Dynamic mesurement*

XT770 Shaft + GEO

Same functionality as the standard XT770, however it also sports a flatness laser with digital levels (see page 34). This is the preferred system for reliability professionals all over the world. You get full control of all important steps of machinery installation and maintenance.

Horizontal · Vertical · Machine train (Unlimited) · Machine train (3 machines) · Cardan/Offset mounted* · Values (Digital dials) · Twist · Dynamic mesurement* · Basic flatness · Straightness

XT660 Shaft

The mid-range system which beats most others when it comes to performance/price ratio. The dot laser technology makes it an outstanding tool, providing both precision and versatility for industries of all kinds.

Horizontal · Vertical · Machine train (3 machines) · Cardan/Offset mounted* · Values (Digital dials) · Twist*

*Accessory required

XT660 Shaft wind

Built upon the standard XT660, but this system also has special brackets for alignment of generator and gearbox on wind turbines. There are also additional brackets available which makes it possible to align with locked rotor and the coupling removed.

Horizontal · Values (Digital dials)

XT550 Shaft EX

The only intrinsically safe shaft alignment system where you choose the EX approved tablet (or smartphone) of your choice as display device. Approved for zone 1/21. With dot laser technology and programs for all types of rotating machinery.

Horizontal · Vertical · Machine train (Unlimited) · Machine train (3 machines) · Cardan/Offset mounted* · Values (Digital dials) · Twist*

XT440 Shaft

Our basic shaft alignment system. Still, it has loads of functions and features which you normally only get with much more expensive systems. Utilizes line laser technology for easy and quick operation. And of course it runs with our fantastic XT Alignment app!

Horizontal · Vertical · Values (Digital dials)

Your digital alignment toolbox

The XT Alignment app is at the center of the Generation XT universe. The hardware, with advanced laser technology and optics, is obviously vital to a precise and reliable measurement. But it's in the software the magic happens.

The XT Alignment app gives you all the functionality you need to properly install rotating machinery, and to make sure it operates at full capacity, year after year.

You can use this software with any of our Generation XT products, whether it's a shaft alignment system, vibrometer or a precision level. That way, you only need to learn one tool, and since it's free you don't have to worry about any license hassle. Easy!

› Available on the App Store and Google Play

Geometric measurement

XT950 Bore alignment

With this system you measure straightness of bore centerlines, and align bearings and bearing journals in numerous applications. Measures both full bores and half bores. Suitable for use both in manufacturing and in field services activities.

Straightness · Bore center · Values (Digital dials)

XT Bore alignment Kits

These kits add bore alignment capabilities to your XT770 system. The “Bore bracket kit” is used with your existing XT70-M unit. Includes laser transmitter XT24 and bore brackets. The “Bore upgrade kit” adds detector XT9 (pictured) which allows measurements of even smaller diameters.

Straightness · Bore center

XT980 Sawmill

Used to align both circular saws and band saws, as well as other components in the saw line such as reducers, guide planes etc. Regular checks and adjustment of the machine's angles and straightness increases the quality of the sawn timber, and allows the yield and production speed to be maintained.

Basic flatness · Straightness · Values (Digital dials) · Squareness

Laser transmitters for optimal installations

Some of the most important steps of machine installation is measuring flatness and level. This is to ensure optimal working conditions with proper lubrication for example. Our two laser transmitters XT20 and XT22 have electronic digital levels, which make them not only very easy to set-up and use, but also extremely precise.

This way you satisfy the requirements in standards like ISO and ANSI/ASA at installation. The XT22 super fine turning (1:1320 ratio gearbox!) of the laser beam simplifies beam positioning to detector on very long measurement distances like the 40 m [132'] maximum. Saves both time and a lot of frustration. With this transmitter added to your XT770 system you can check straightness, flatness, level and squareness in numerous applications.

*Accessory required

Belt transmission alignment

XT190 BTA

The best tool for exact alignment of belt transmissions. With digital readout you align to specified tolerances and document the result. With a separate display unit (e.g. your smartphone) you follow the adjustment live at the point where you adjust instead of going back and forth numerous times to check the laser targets.

Belt alignment

D92 BTA

For easy alignment of belt transmissions. Visual readout on targets. Affordable precision which measures at up to 10 meters [33'].

Belt alignment

Other products

XT290 Digital precision level

An essential tool for everyone setting-up and aligning machines. Use it stand-alone or connect to the XT Alignment app which can read up to four digital levels at the same time, and provides the possibility to document the result.

Level

XT280 Vibrometer

Easy-to-use vibration analyzer that quickly diagnoses vibration level, unbalance, misalignment and looseness. The direct readout of 1x, 2x, 3x RPM, total level as well as bearing condition provides necessary information during installation and alignment.

Vibration

XT Display unit with thermal camera (IR)

The industrial grade Easy-Laser XT Display unit has the option to add a thermal imaging (IR) camera along with the standard 13 MP digital camera. Shoot a thermal image before and after alignment and include with the documentation.

Thermal camera

Sustainability goes *beyond 2030*

Sustainability is about helping – not pointing fingers

Recently a Swedish environmental consultant found that by using Easy-Laser products the industry actually becomes more sustainable. Fewer breakdowns. Higher energy efficiency and more predictable work conditions. Good news and further proof for proactive maintenance and prioritizing reliabilty. But at the same time we have to scrutinize the footprint of our own operation.

At Easy-Laser, taking a serious approach to sustainability is obvious. We do it by setting ambitious goals and expect our partners to do likewise. For example our operation is to be climate neutral by 2027. Our R&D department is constantly searching for ways to expand the lifespan of our systems. And everyday we look for ways to improve the conditions for our employees.

We know we're not perfect. We have made and will continue to make mistakes. But our goal is always to make decisions based on what makes sustainable sense.

We do it because we want to, because it's the right thing to do. We do it because we can. We do it because it's expected from us. But most of all because we have to.

Earlier this year I had the opportunity to meet with our global distributors and partners and discuss how we can make our industry more sustainable. It is during those moments that our differences become apparent. Where some came from a situation where the governing bodies have drawn up long term plans to fight carbon emissions, others represented places where sustainability as definition is still being discussed. If we want to reach any of the UN Global Goals we need to realize that everyone has started from vastly different starting points.

For example. In Sweden and the EU where Easy-Laser operates, carbon emissions are at the top of the agenda which means that the European industry is by many metrics world leading in reducing CO_2. Not because of nobility. But because we have the privilege to make it so.

With legislative packages and initiatives such as Fit for 55 and the European Green New Deal the union has the ambition to be climate neutral in a couple of decades.

CSRD. CSDDD. CBAM. With the introduction of a new sustainability abbreviation wave the EU member nations and its citizens have been given a clear set of rules that actually have real impact. In that environment it's easy to claim you're doing your part. Also, it's not really an option.

In other regions reality is different. The E in ESG* is of course of importance. But in large parts of the globe the economic and social aspects of sustainability

*Environmental, Social and Governance

» Operating in a global context you realize that a variation in sustainable outcomes is not a lack of will or knowledge but mere challenges of different realities

Rebecka Tegnander, Quality and Sustainability Manager, Easy-Laser

play a large role. Financial opportunities and working conditions are more urgent issues in countries where citizens are living under harsh conditions trying to get by. There are regions that have to handle the issue of age determination within the workforce because that is how you prevent child labour.

Operating in a global context you realize that a variation in sustainable outcomes is not a lack of will or knowledge but mere challenges of different realities. Which is why we need to encourage and appreciate the work that is actually being done in the international community.

2030 is approaching. Fast. And if we are to succeed, we need to understand our global surroundings and also be given the incentives to promote sustainable industrial behavior. We need regulations that take into account the environmental cost while at the same time not undermining the human aspects. We need to use the opportunity to continue on the groundwork that has already been done and give support to those in need.

That way we can reach our goals and set new ones that go beyond 2030. ■

Rebecka Tegnander
Quality and Sustainability Manager, Easy-Laser

Everything starts with *a solid foundation*

Compressor installation training, the Easy-Laser way

Easy-Laser's Roman Megela is a man on a mission, and reliable machinery installation is a topic he has been coming back to for as long as anybody can remember. With over twenty years experience of commissioning and maintenance within the industry, he is also responsible for training programs, thereamong one that's dedicated to the installation of compressors. It's conveniently named Compressor installation training.

Roman, could you please walk us through this?

"Well, as many already know, I always stress the importance of installation. Machines are built to last a long time, and proper installation is the foundation of reliability."

So what you're saying is that a solid foundation is an appropriate starting point?

"Without any doubt, yes. The installation has a direct impact on any machinery. If we take compressors as an example, installing them correctly will determine their future performance as well as their life cycle expectation. Compressors, just like other machines, will only reach their full potential if they are properly installed. Ignoring this always ends up in a vicious circle."

The training

Roman Megela is the mastermind behind this training program. In short, there are certain key factors regarding the installation and placement of reciprocating compressors. These factors directly impact their performance, reliability, and longevity. Easy-Laser's Compressor installation training provides essential groundwork for engineers and technicians to master the installation procedures for reciprocating compressors, aimed at avoiding failure and ensuring optimal operation. The program is comprehensive and starts with establishing a solid foundation, ensuring that the flatness condition meets the specifications necessary for proper compressor installation.

The outcome

Through Easy-Laser's training, participants gain hands-on experience and knowledge in each of these critical areas. This will ensure that they are well prepared to handle the complexities of machinery installation and maintenance. This training not only enhances the performance and reliability of reciprocating compressors but also extends their longevity, promotes safety, and reduces maintenance costs. Sustainability put to practice! ■

> Checking the main bearing on a compressor.

Key aspects covered include

Top frame compressor flatness verification: ensuring the mounting surface is flat and even to support the compressor properly.

Compressor soft foot: identifying and correcting soft foot conditions to prevent misalignment and stress on the machine.

Bore alignment straightness: verifying and adjusting the straightness of bores to ensure proper crankshaft rotation and lubrication.

Squareness of cylinders: ensuring that the cylinders are square to the compressor crankshaft to avoid operational issues.

Measuring cylinder out of roundness: checking and correcting any deviations in cylinder roundness for optimal performance.

Precision shaft alignment: achieving accurate alignment between the compressor and the driver to minimize vibration and wear.

Thermal growth compensation: accounting for temperature-induced changes in dimensions to maintain alignment and functionality.

Pipe strain verification: ensuring that connected piping does not impose excessive strain on the compressor.

Belt alignment of cooling systems and auxiliary equipment: aligning belt drives to ensure the efficient operation of cooling and auxiliary systems.

Dynamic measurement: conducting final operational tests to verify the overall condition and performance of the compressor.

Learn more about our training possibilties.

> easylaser.com/en-us/support/training

At your service!

Precision is at the core of accurate and reliable alignment work. And to reach high precision, you need perfectly calibrated tools.

Easy-Laser's Service Centers are strategically located across North and South America, Europe, Asia, Australia, and Africa. Every year, they calibrate and service hundreds of systems. And you can rest assured that you get the same quality wherever you turn.

Every Service Center undergoes rigorous auditing and yearly re-certification to ensure the highest standards.

How often should you calibrate your system?

We recommend sending your equipment in for calibration at least every other year – or even more frequently if working with high precision or adhering to ISO standards.

"Our goal is to provide customers with dependable results every time they use our tools," says Michael Rudhag, After Sales Manager at Easy-Laser.

"By keeping equipment calibrated, they can be confident in the accuracy of their alignment work."

Don't overlook the software

Besides keeping your systems calibrated, we strongly advise you to keep the alignment software up to date.

Regular updates give you access to the latest functionality and include improvements and bug fixes to ensure you get the most out of your tools. You can find the latest versions on our website, or, if you use the XT Alignment app on your phone or tablet, in the nearest app store. ■

Michael Rudhag
After Sales Manager,
Easy-Laser

The calibration checklist

When you send your system to an Easy-Laser Service Center for calibration, we don't just calibrate – we perform a comprehensive health check. Every vital component is tested, cleaned and adjusted to ensure optimal performance. Our detailed checklist includes:

- Verifying that all system components are correctly paired
- Checking the charger function
- Updating the software on both display and measurement units (if needed)
- Testing and adjusting laser power
- Conducting a detector check
- Verifying seamless communication between devices
- Performing a final system test, including measurement, data saving, and report generation

A calibration certificate is issued once the system has been checked and approved, and the system is returned to you.

3 Three steps to clean optics

By following these easy instructions you can ensure accuracy and extend the lifespan of your Easy-Laser products.

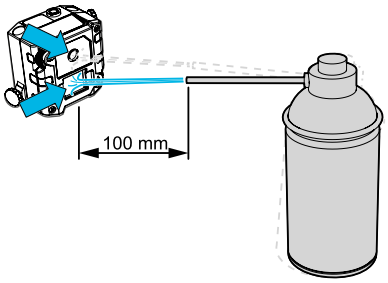
To clean the optics follow the steps below. This applies to both circular and rectangular lenses.

Tools needed

1

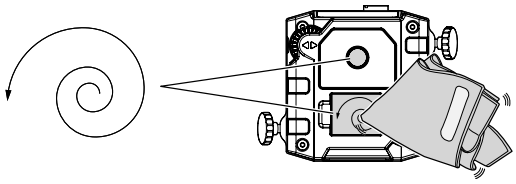
Use gloves when working with optics during the whole process.

2



Start cleaning the optics with the dust blower/conditioned compressed air. Blow the lens clean from a distance of about 100 mm.

3



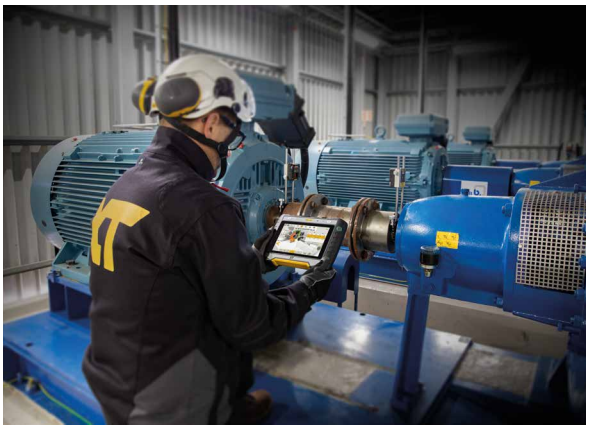
Use a cleaning cloth for optics and start in the center of the optics and work your way out to the edge in a spiral. Note! Do not use ordinary dry cloth, they could cause scratches. Give the edge a wipe at the end.

If there is any dust left on the lenses repeat the steps above.

Elevate your alignment skills

With proper training you get the most out of your tools – and your team.

Machines aligned by skilled professionals will save you money through reduced downtime and extended equipment life. That's why an investment in your team's expertise is one of the most profitable decisions you can make.



We offer tailored alignment training programs globally. Each training is customized to fit your specific requirements, whether your team members are just starting out or are experienced professionals looking to enhance their skills. A mix of theoretical knowledge and hands-on practice gives them the tools and confidence they need to apply their skills in the real world. You can choose between onsite training or join us at our nearest training facility – whichever suits you best.

Reach out to your local Easy-Laser partner to discuss the ideal training solution. ■

Learn more about our training possibilties.
› easylaser.com/en-us/support/training

Learn more about reliability

Want to learn more about reliability and related subjects? Maybe get a certification to prove your skills? Here are some organizations which provide knowledge and/or training locally and globally.

CMC Latam
Congreso de Mantenimiento y Confiabilidad
› cmc-latam.com

RATS
Rotating and Turbomachinery Society
› rotatingspecialist.org

Mobius
› mobiusconnect.com

Noria
› noria.com

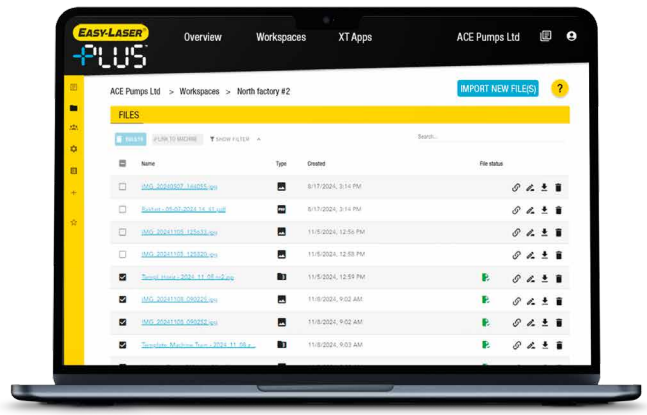
AMP
› assetmanagementprofessionals.org

SMRP
› smrp.org

EFNMS
European Federation of National Maintenance Societies
› efnms.eu
Find your national organization on the EFNMS web site.

Added value

Did you know we offer a cloud service for XT laser system users? It's called "Easy-Laser PLUS", and as the name suggests, it provides added value for your team.



- Collaborate with your maintenance team on job assignments.
- Collect all your team's measurement data in one place for quick overview and analysis.
- Copy your measurement data to a new device if your tablet is lost or damaged.
- Restore accidentally deleted files on your tablet.
- Receive information about the latest software updates.

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Straightforward *by all measures*

Easy-Laser® is the world's leading manufacturer and supplier of laser measurement systems for all types of industry. We provide extreme accuracy and precision. But that's not what sets us apart. Today, when virtually anyone with a decent laser can do "straight", to get ahead, you need to be a bit more forward-thinking.

Because, in the long run, what really counts is neither the absolute straightness of an individual component nor the precise alignment of shafts. It's what these measures add up to: Increased productivity and the saving of resources. Those are the things we ultimately deliver. And from that perspective our most important task is to help you make the road leading there as free from bumps and bends as possible.

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