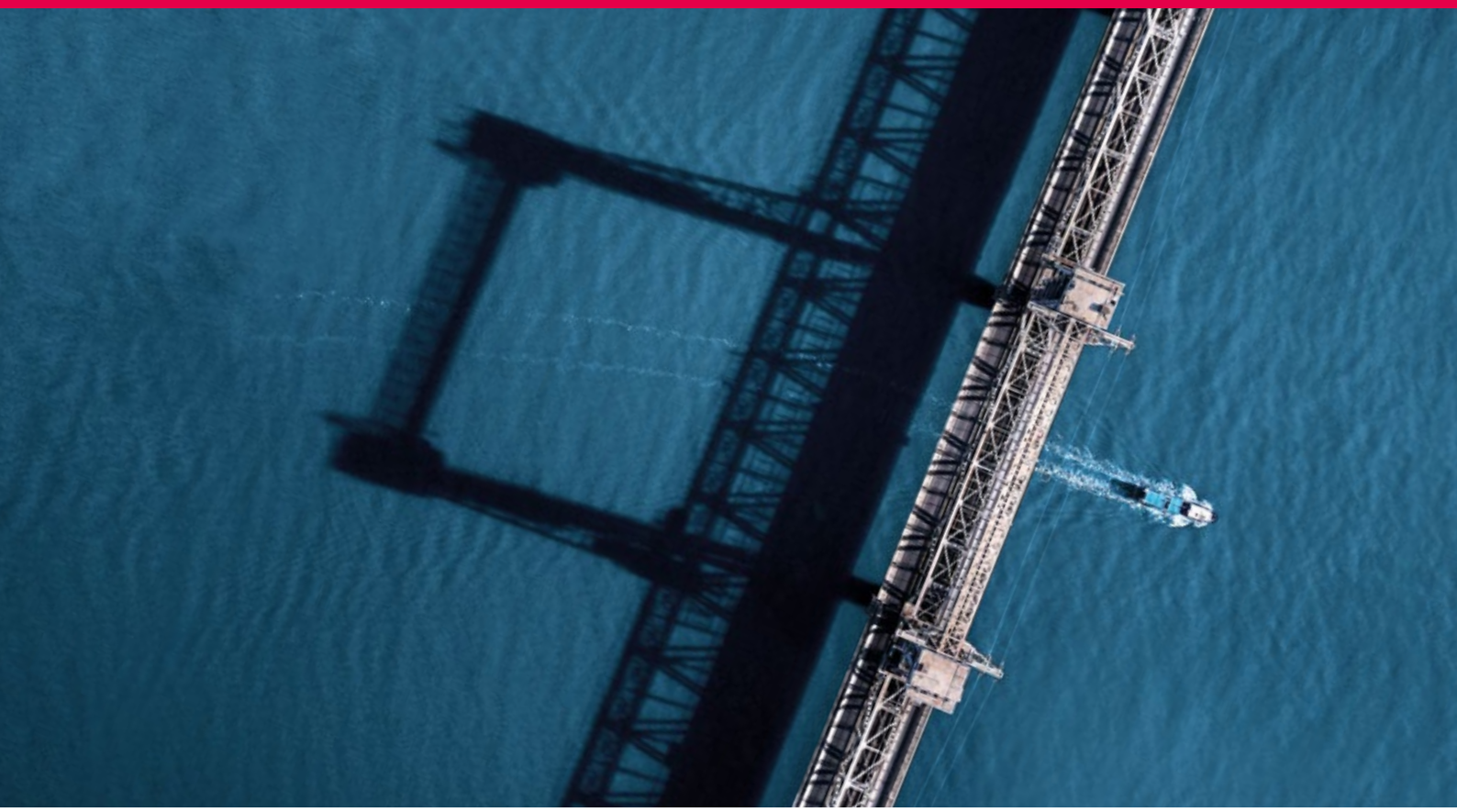
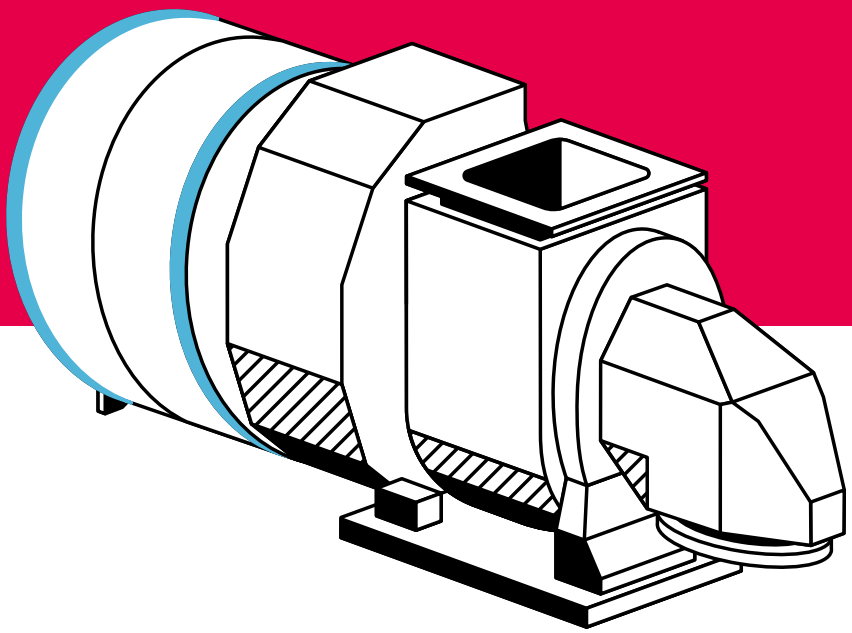
A guide to maximum engine performance

Turbocharger **power systems**



Everllence

Engineering **excellence**



Our engineers and digital specialists focus on crosslinking engineering with the possibilities of today's world: we shape the advancement of power generation, marine transport and industrial engineering.

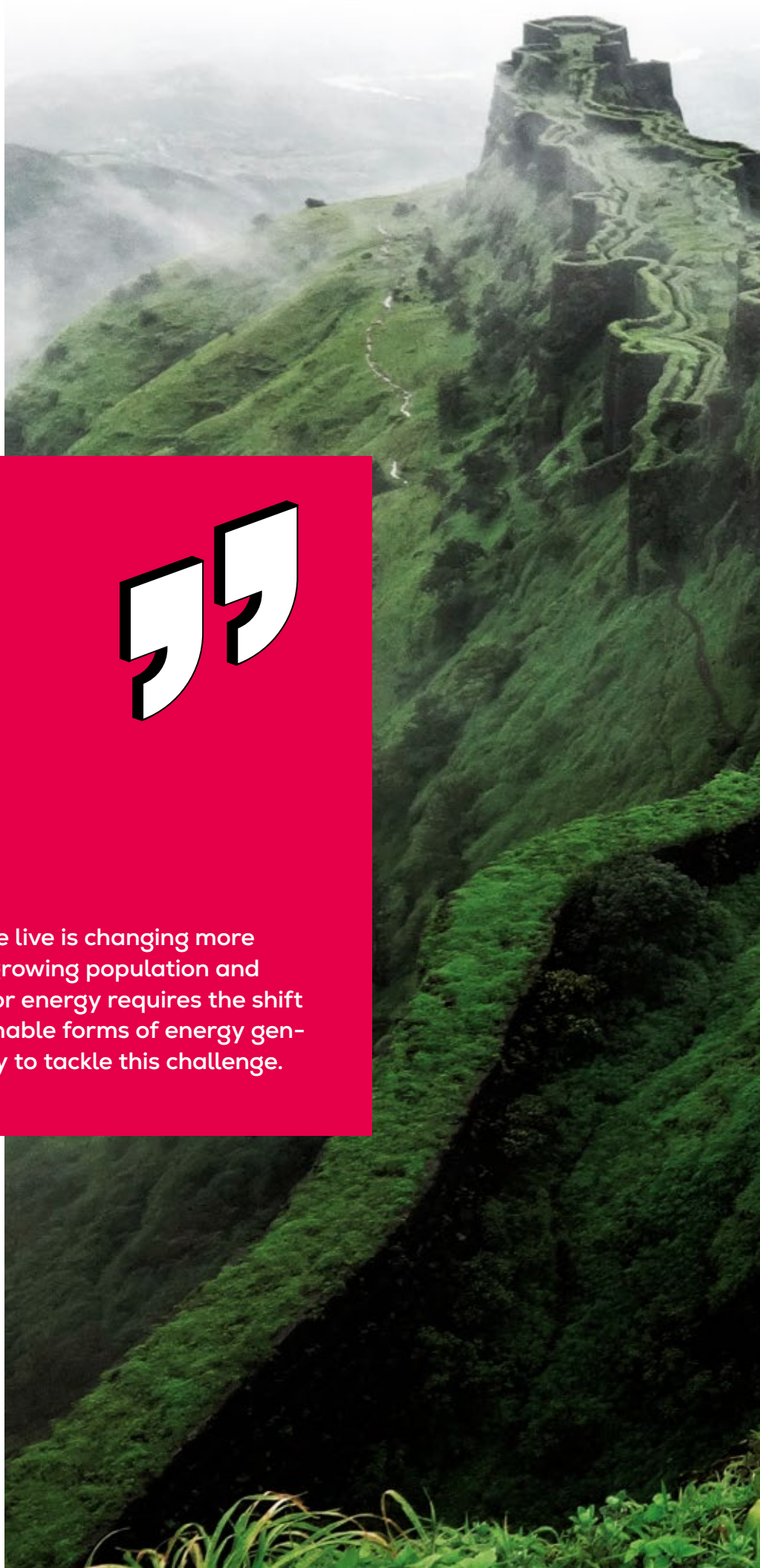
Whether engines, components or complex systems – we aim to deliver intelligent solutions that assure your competitiveness for years to come.

Our products and services utilize the latest technologies. We don't react to trends; we create the next step. As your partner, we connect the dots in an ever-changing world, providing you with long-term solutions that boost your business and help to bring the world a step closer to carbon neutrality.

To follow, **or to lead?**

With the invention of the diesel engine, our visionary founder transformed the entire industry by creating a mechanism of – at the time – unknown efficiency. Transformation is in our genes. Today, the setting has changed, yet our pioneering spirit remains. We lead the industrial world towards a more sustainable future by combining our world-class engines, turbines, turbochargers, compressors, propellers, and reactors with the possibilities of the digital era. And we want you to join us.

As your partner, we create customized solutions for your specific needs and support you in this time of change and transition. Together, we can pave the way for a climate-neutral yet economically successful future. Let's get started.



The world in which we live is changing more rapidly than ever. A growing population and increasing demand for energy requires the shift towards more sustainable forms of energy generation. We are ready to tackle this challenge.

Envisioning tomorrow

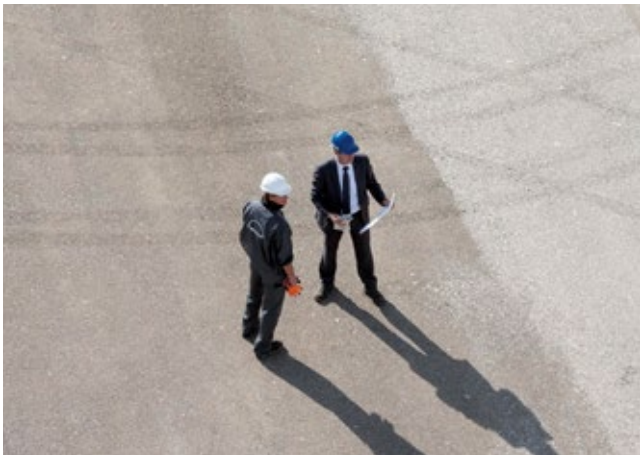
The starting point of all our innovation is you. We focus on the individual requirements and goals of our customers and work on solutions to meet even the most specific needs. We benefit from our in-depth knowledge in the sectors of mobility, transport and energy, and draw from decades of technical and operational experience.

We are known for offering the industry's most advanced products, which boast legendary quality. Closing supporting our customers with expert advice when it comes to developing the best possible solutions is one of our core competencies. When it gets tricky, we start to feel at ease.

Converting companies to more environmentally friendly and cost-efficient operation is a key issue for most of our clients. Our goal is to provide our customers with solutions that gradually reduce the consumption of fossil fuels.

We don't think "product"; we envision holistic solutions that meet our clients' requirements and comply with even the most stringent legal regulations.

If you are looking to make your company future-proof, count us in.



Pushing the limits

To think ahead means to think holistically. That's why we offer complete systems that are uniquely reliable for lasting performance. We support our clients to help them achieve their goals in rapidly changing environmental and regulatory conditions.

Digital and data-based technologies are the cornerstones for the development of future-proof drive and power generation systems. Take our intelligent energy management solutions for example. The energy management system in our battery-hybrid propulsion solutions controls the generation, storage and distribution of power onboard the ship. This optimizes the overall performance, further increases safety and system reliability, and results in maximum efficiency and lower operational costs.

Another application is to improve the availability of renewable energy: wind and solar power can be made more reliable by storing surplus power and using instant power top-ups from engine and turbine gensets fuelled by gas or bio fuels. Renewable energy systems can even be added to power plants to act as fuel savers and hybrid island power systems – digital solutions that will drastically help to reduce the carbon footprint.

The right fit, performance and simplicity

Everllence's turbochargers are designed to deliver peak performance throughout their working lives – under some of the harshest conditions encountered anywhere in the world. This is achieved by combining three elements: simplicity, flexibility and reliability.

Simplicity

We develop and build our turbochargers to make installation, operation, servicing and maintenance as easy and efficient as possible. This reduces your initial capital investment and results in lower life cycle costs.

Flexibility

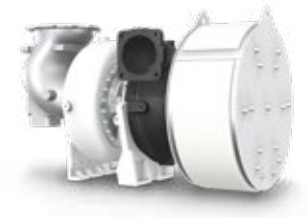
Everllence's turbocharger technology enables exceptional flexibility when striving to find the perfect blend of performance and energy efficiency. Aligning turbocharger specifications with engine requirements plays a key role. But it is not just about the maximum possible product ratings. It is about the best fit. We have a comprehensive product portfolio, and are proven experts in precisely matching the right turbocharger to the engine.

Reliability

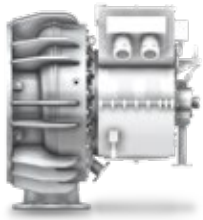
As a global leader in pioneering turbocharger technology, we have built our reputation on the quality, efficiency and reliability of our products. Today, the average turbocharger is designed for ultra-long times between overhauls for maximum flexibility and minimum maintenance requirements and downtimes. We extensively test all our turbochargers before they are launched, ensuring that you enjoy the highest standards of safety and reliability.

Contents

Turbochargers



Exhaust gas treatment



Turbocharger technology

PrimeServ

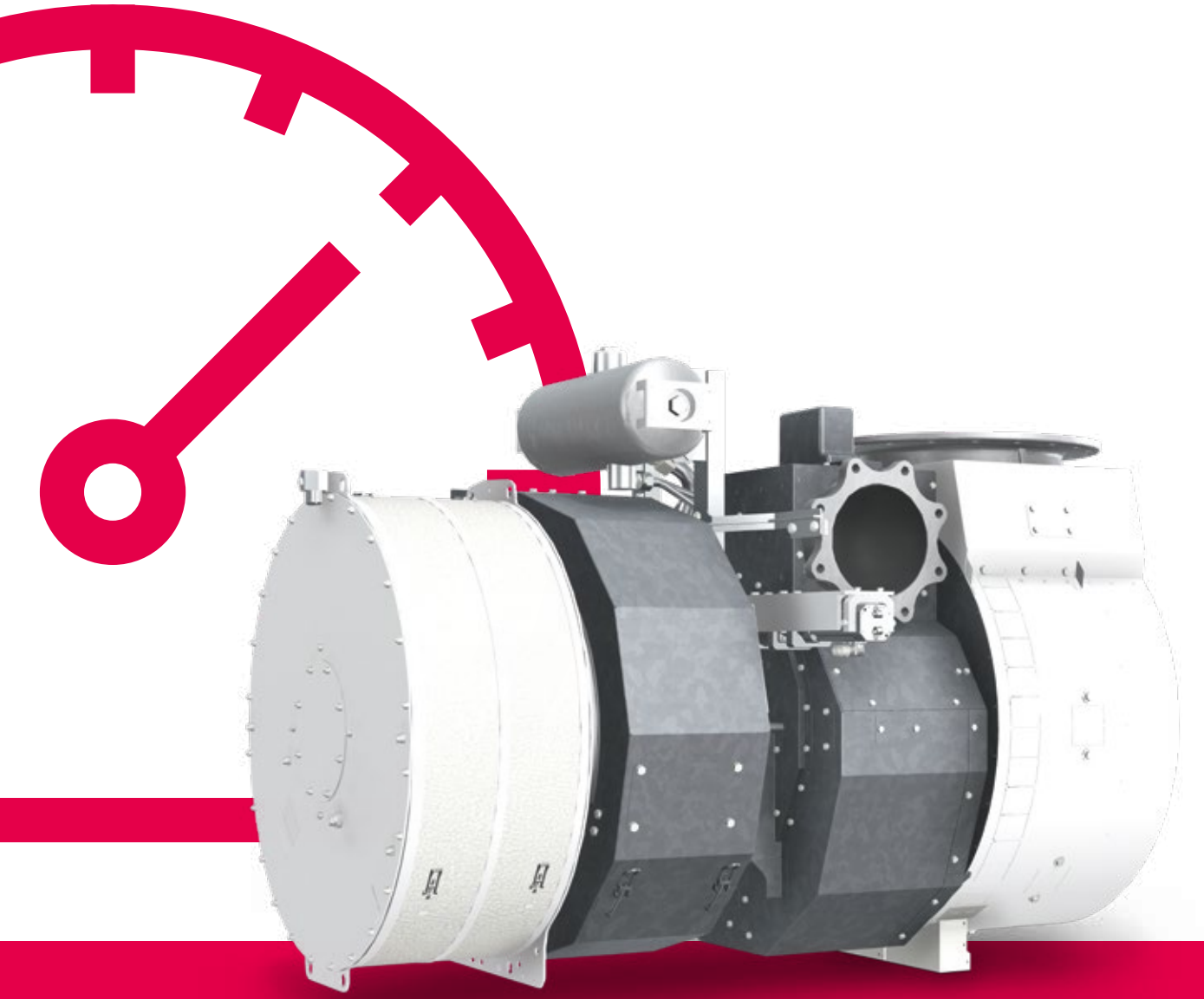
TCR

The specialist performer

Applications

Marine propulsion
Marine GenSets
Power generation
Construction
Mining
Off-road vehicles
Locomotives
Mechanical drives
Industrial
Offshore

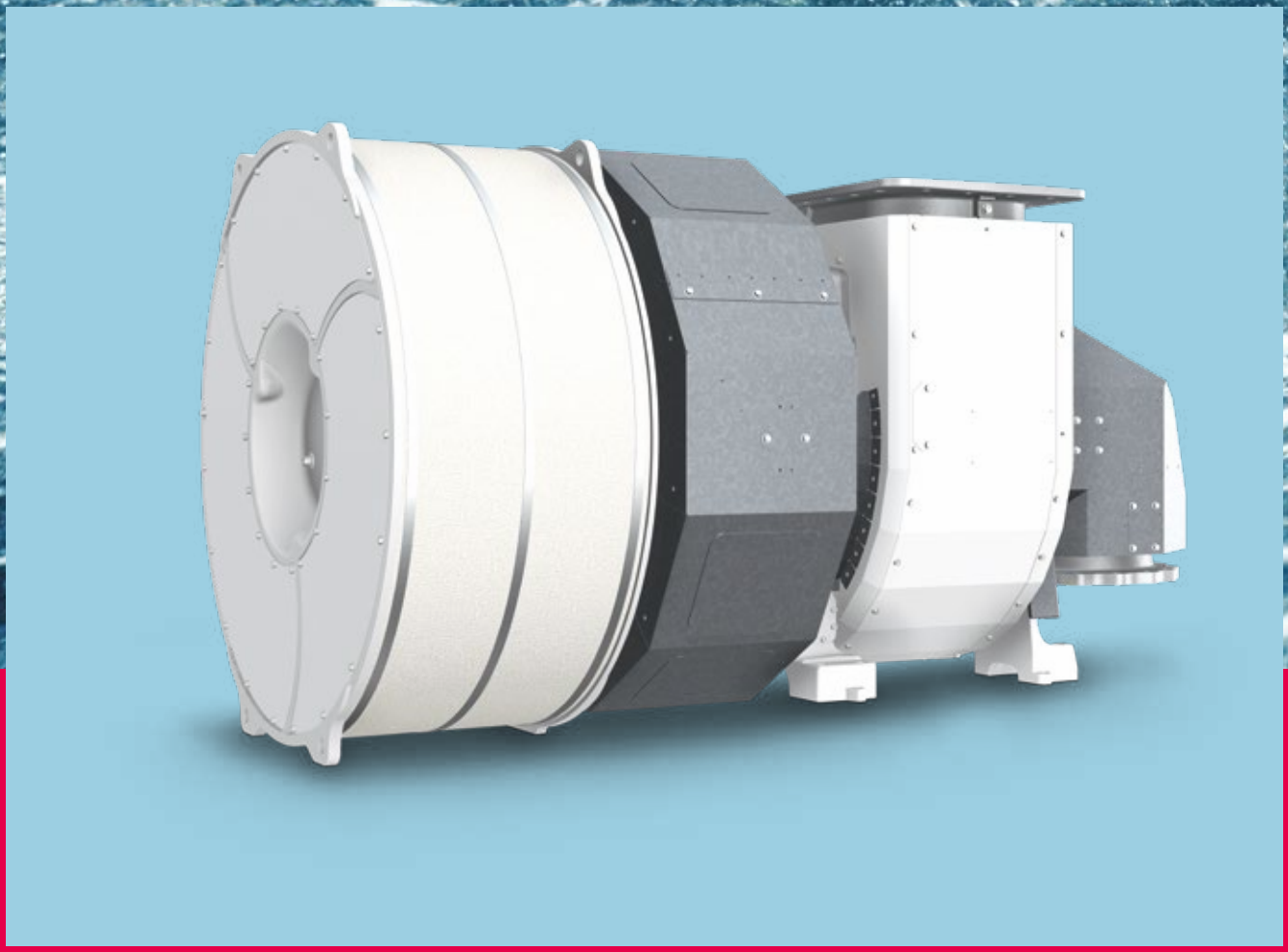
The cutting edge
TCR turbochargers were created to address the very special challenges faced by HFO, MDO, biofuel and gas engines. Products are available for the entire engine power range, from 350 kW to 7 MW per turbocharger. TCR turbochargers are IMO Tier III compliant, and represent a robust, versatile modular platform – suitable for a wide variety of high, medium and low speed engine applications.



Smaller, lighter, more powerful
The latest generation of TCR turbochargers offers reduced size and weight while delivering greater efficiency, performance and reliability. Advanced materials ensure extended overhaul intervals, easier maintenance and a longer life.

Benefits

- **Modular design**
  Fulfills all relevant engine requirements
- **Easy to maintain and service**
  Maintenance can be carried out with standard tools
- **Variable turbine area optionally available**
  Airflow through TCR turbochargers **can be controlled by VTA technology**
- **Condition-based component maintenance**
  Parts are replaced on the basis of component condition, increasing component life and lowering costs
- **Easy installation**
  Compact, pipeless design ensures easy installation



Optimized for two-stroke engines

TCT turbochargers are suitable for conventional fuel and dual fuel two-stroke engines in applications ranging from 6 MW up to 24 MW output per turbocharger. The core components of the TCT are the compressor and the turbine. Everllence's turbocharger experts used computational flow simulations (CFD) that make it possible to achieve multiple targets at the same time: wide compressor maps, high flow rates, high stability margins and exceptionally high efficiencies. The design is optimized for IMO Tier III requirements in whatever solution customers require.

TCT

State of the art solution

Full performance under environmental pressure

The TCT is specifically designed for IMO Tier III two-stroke engines. The latest axial turbocharger generation offers significant downsizing together with easier maintenance and higher charging efficiency.

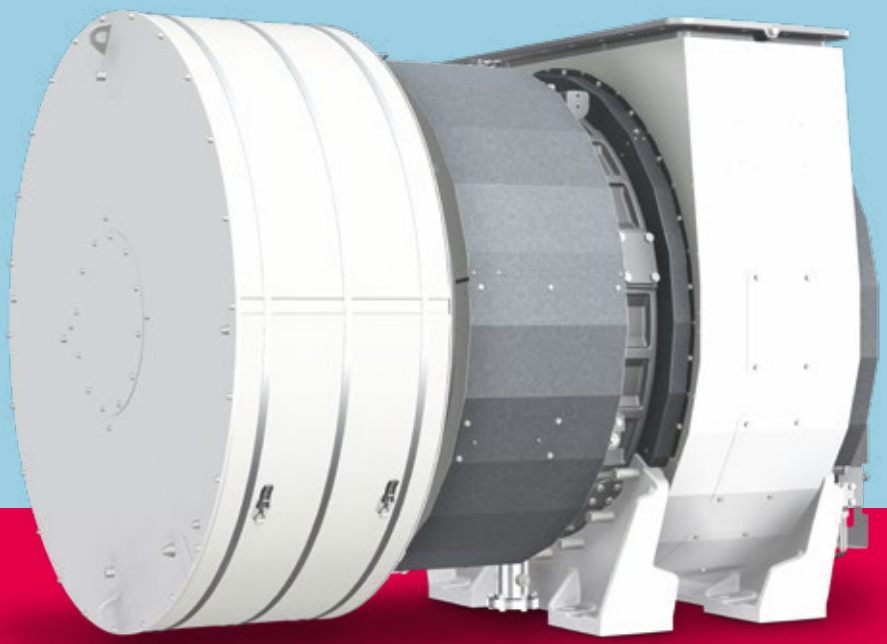
The combination of new and proven design features ensures high charging efficiency, a high specific airflow and a high air pressure.

Benefits

- **Higher performance**
  5 % higher charging efficiency, 10 % higher specific airflow and 25 % increased charging pressure
- **Reduced cost of ownership**
  Extended service lifetime, improved maintenance concept and long service intervals
- **Reliability**
  Building on proven components from 80-year turbocharger heritage such as high-performance plain bearings
- **Compact design**
  Up to 40 % decrease in weight and 30 % decrease in size, compared to previous turbocharger series

Applications

Marine propulsion
Power generation



The benchmark

TCA turbochargers are suitable for four-stroke and two-stroke gas, diesel and dual fuel engines in applications ranging from 3 MW up to 30 MW output per turbocharger. Using fewer parts than any other generation of axial turbochargers has reduced maintenance and service times, ensuring lower life cycle costs. TCA turbochargers meet all the latest environmental emissions standards.

TCA

Power and reliability in one

Hard-wearing simplicity
TCA turbochargers are high-performance solutions characterized by ease of maintenance and long overhaul intervals. Modular design and a reduced number of components, suitable for all fuels and gases, have contributed to outstanding life cycle costs. MAN TCA turbochargers are compliant with IMO Tier II and III.

Benefits

- **Long intervals between overhauls and long component life**
  Drydock-to-drydock operation
- **Condition-based component maintenance**
  Parts are replaced on the basis of component condition, increasing component life and reducing costs
- **Easy to maintain and service**
  Maintenance can be carried out with standard tools
- **Variable turbine area optionally available**
  Airflow through MAN TCA turbochargers can be controlled by VTA technology

Applications

Marine propulsion
Power generation
Marine GenSets
Offshore

Radial turbochargers reinvented

The TCP series of radial turbochargers can achieve maximum pressure ratios of up to 7. A benchmark figure that sets new industry standards. While existing 1-stage turbocharger systems typically deliver pressure ratios of well above 5, the TCP range achieves stable operating points of well above 6. These remarkable figures are thanks to a complete redesign of the aerodynamic stages on both the compressor and turbine side. High- and medium-speed engines, Conventional and future fuels, Seven frame sizes, to cover a wide range of power, marine and off-road applications.

TCP

Get ready for the future

Enhanced performance and efficiency
The TCP range is key-enabler for increases in power output of around 20 %. That translates to increased power at a similar cost, or a smaller engine or fewer cylinders for the same output.

When creating aerodynamic and structural mechanical models for the TCP series, PBST development teams used advanced numerical simulations, which are driven by the ongoing trend towards faster computer processing capability. They were thus able to create highly complex simulations, used as the basis for targeted optimization of flow components, enhanced turbocharger performance and longer working life.

Benefits

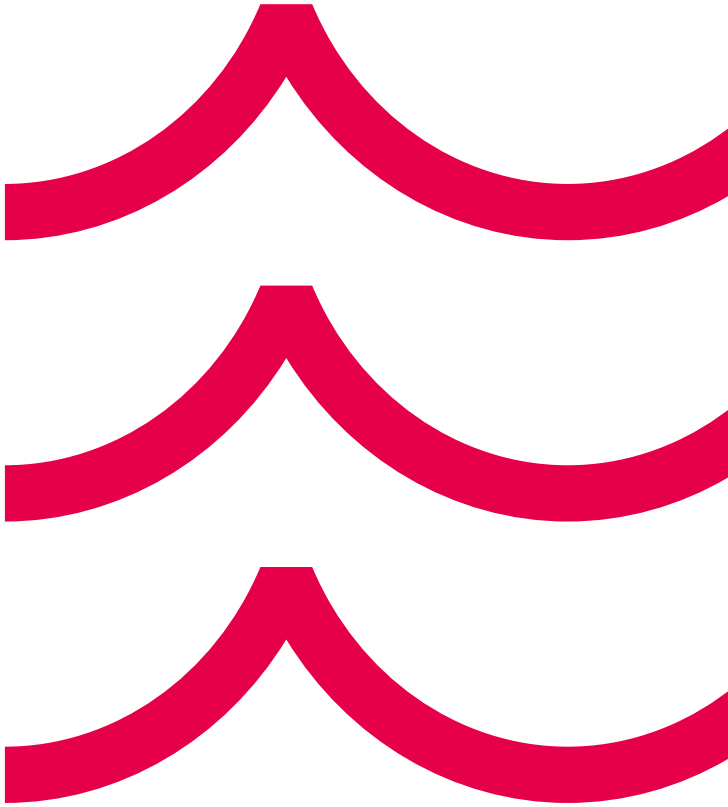
- **Increase in power density**
  of up to 20 %
- **Decrease of specific engine costs**
  up to 20 %
- **Improved efficiency levels**
  of > 70 %
- **Significantly improved dynamic behavior**
  25 % reduction in rotor moment of inertia
- **Plug & play**
  (keep same flange connections as existing turbochargers)
- **Improved cost of ownership:**
  long time-between-overhaul
- **Maintenance-friendly**
- **Future Fuel Readiness/Ready**

Applications

Marine propulsion
Power generation
Mining
Locomotive

TCF

Go with the flow



Applications

Marine propulsion
Power generation
Marine GenSets
Offshore

Making the most of optimized flow
Delivering an impressive 20 % increase in specific flow, the TCF radial turbocharger offers a big potential to use smaller or less turbochargers. Specifically designed to deliver highest efficiencies, the TCF family is particularly suitable for optimization at part load. Initial studies show that significantly improved fuel consumption figures are achievable with TCF turbochargers. High-, medium- and low-speed engines. Suitable for low-speed engines as well as LP-stage for 2-stage turbocharging. Conventional and future fuels. Seven frame sizes to cover a wide range of power, marine, and off-road applications

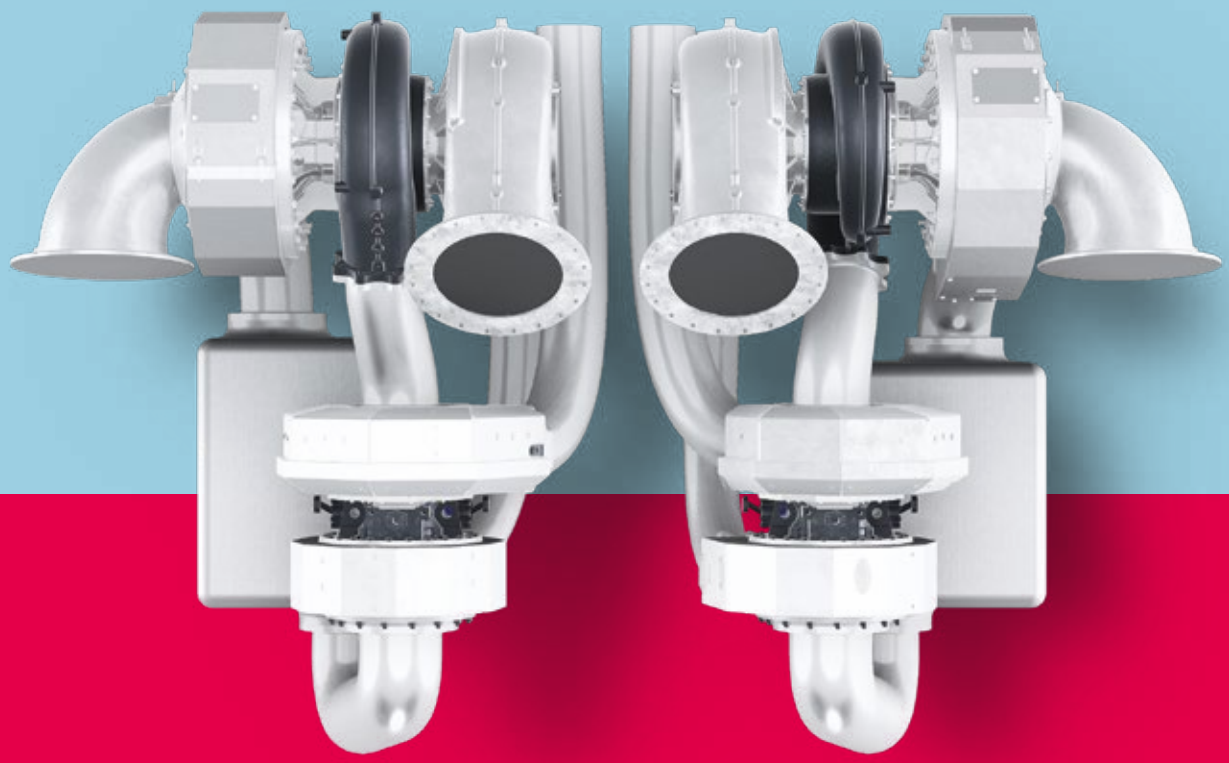
Hard-wearing simplicity
The TCF series is also designed for use as the low-pressure-stage turbocharger in two-stage applications, helping to reduce size or the number of turbochargers required and thereby create potential for cost savings.

Due to the outstanding part load performance the big TCF frame sizes in addition are heading for turbocharging the small bore 2-stroke applications.

TCF turbochargers are easy to retrofit thanks to the modular construction and standard connection dimensions, and can help reduce the cost of ownership, with long time-between-overhaul and a maintenance-friendly design.

Benefits

- **Increase in specific flow**
  20 %
- **Cost savings**
  Potential to use smaller or less turbochargers
- **Highest efficiencies**
  at part load
- **Significant reductions**
  in fuel consumption and emissions
- **Significantly improved dynamic behavior**
  25 % reduction in rotor moment of inertia
- **Future Fuel Readiness/Ready**



Reducing costs and emissions

ECOCHARGE two-stage turbocharging is suitable for high and medium speed engines of all fuel types in applications for all engine power ranges. Extremely high efficiency and pressure ratios enable increased power density and allow improvements to key engine parameters. For example, it is possible to use a smaller engine for the same required power output, or to achieve lower NO_x emissions and lower specific fuel oil consumption (SFOC).

Ecocharge

Kinder to the environment

Two-stage turbocharging
As a compact two-stage unit, the ECOCHARGE delivers outstanding turbocharging efficiency. A variety of product types and sizes are available, ensuring the perfect turbocharger-to-engine fit. Higher scavenging air pressure and efficiency allow improved Miller timing, enabling compliance with IMO Tier III emissions legislation.

Benefits

- **Lower specific fuel oil consumption (SFOC)**
  Increased turbocharging efficiency for reduced SFOC
- **Lower exhaust emissions (NO_x)**
  Higher scavenging air pressures of up to 10.5 bar allow improved Miller timing with lower NO_x emissions
- **Compact design**
  Integrated modular design reduces the overall dimensions of the ECOCHARGE unit
- **Improved dynamic response**
  Smaller high-pressure stage turbocharger with reduced mass inertia for improved dynamic response

Applications

Marine propulsion
Marine GenSets
Power generation
Locomotives
Mechanical drives
Offshore

SCR for two-stroke engines

The SCR-HP is a small and compact NO_x emission reduction system. The compact design allows for easy integration, and the few frame sizes will cover the entire two-stroke portfolio up to 25 MW per SCR reactor. The integrated mixing unit reduces the overall length and volume. The specific honeycombs ensure a compact design. The SCR-HP can be mounted in all positions and is capable of running on all fuels. Auxiliary components like the urea injection lance, urea dosing unit and urea pump module are from Everllence's well-proven SCR-LP system.

SCR-HP

Cutting NO_x in aftertreatment

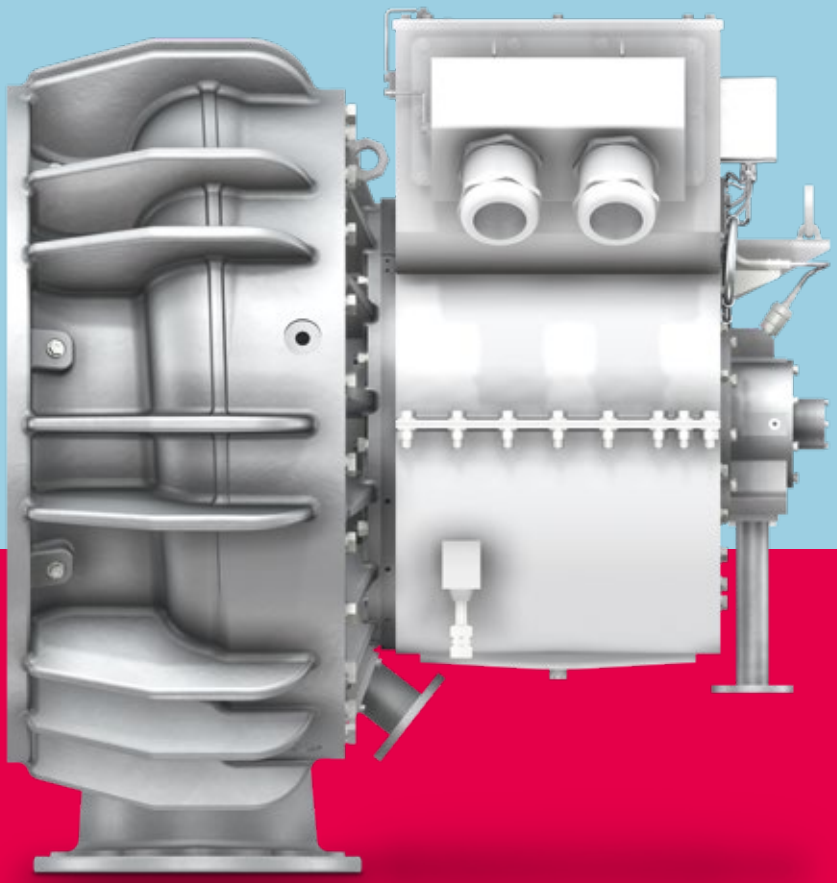
High-pressure selective catalytic reduction
The SCR-HP is available for two-stroke engines of all bore sizes and reduces – through internal catalytic reaction – NO_x exhaust emissions to IMO Tier III limits. With specially developed honeycombs and honeycomb materials, as well as an integrated mixing unit, the overall size of the reactor has been drastically reduced compared to typical market designs and its medium speed counterpart.

Benefits

- **Improved compact design**
  The improved compact design, compared to conventional reactors, leads to considerable benefits for engine builders, shipyards and ship owners
- **One-source solution**
  A perfect fit thanks to MAN's expertise in propulsion systems from funnel to propeller
- **Proven technology**
  Based on MAN's in-house competence with four-stroke engines

Applications

Marine propulsion
Power generation



Exhaust gas recirculation blower

The EGR blower ETB is suitable for exhaust gas recirculation (EGR) engines of all fuel types in all application ranges. Specifically designed for EGR systems, the ETB's active control plays an important role in enabling these systems to reach IMO Tier III emission standards. The required EGR operating conditions are achieved by using a high speed electric motor directly coupled to the compressor wheel and controlled by a frequency converter.

ETB
Electrical turbo blower

Robust IMO Tier III performance

Reducing NO_x through recirculation

The ETB features a highly efficient blower wheel, optimized for low pressure ratios. The materials used are designed to withstand corrosive agents. High blower availability and variable speed operation ensure IMO Tier III compliance in emission control areas (ECAs).

Benefits

- **Low consumption**
  Improved thermodynamic efficiency allows extremely low energy consumption
- **High durability**
  All materials have been designed for highly corrosive atmospheres
- **Smart control for stable EGR flow**
  EGR flow is controlled by a high speed electric motor. The ETB is integrated into the engine control system

Applications

Marine propulsion

VTA

Flexible turbo-charging

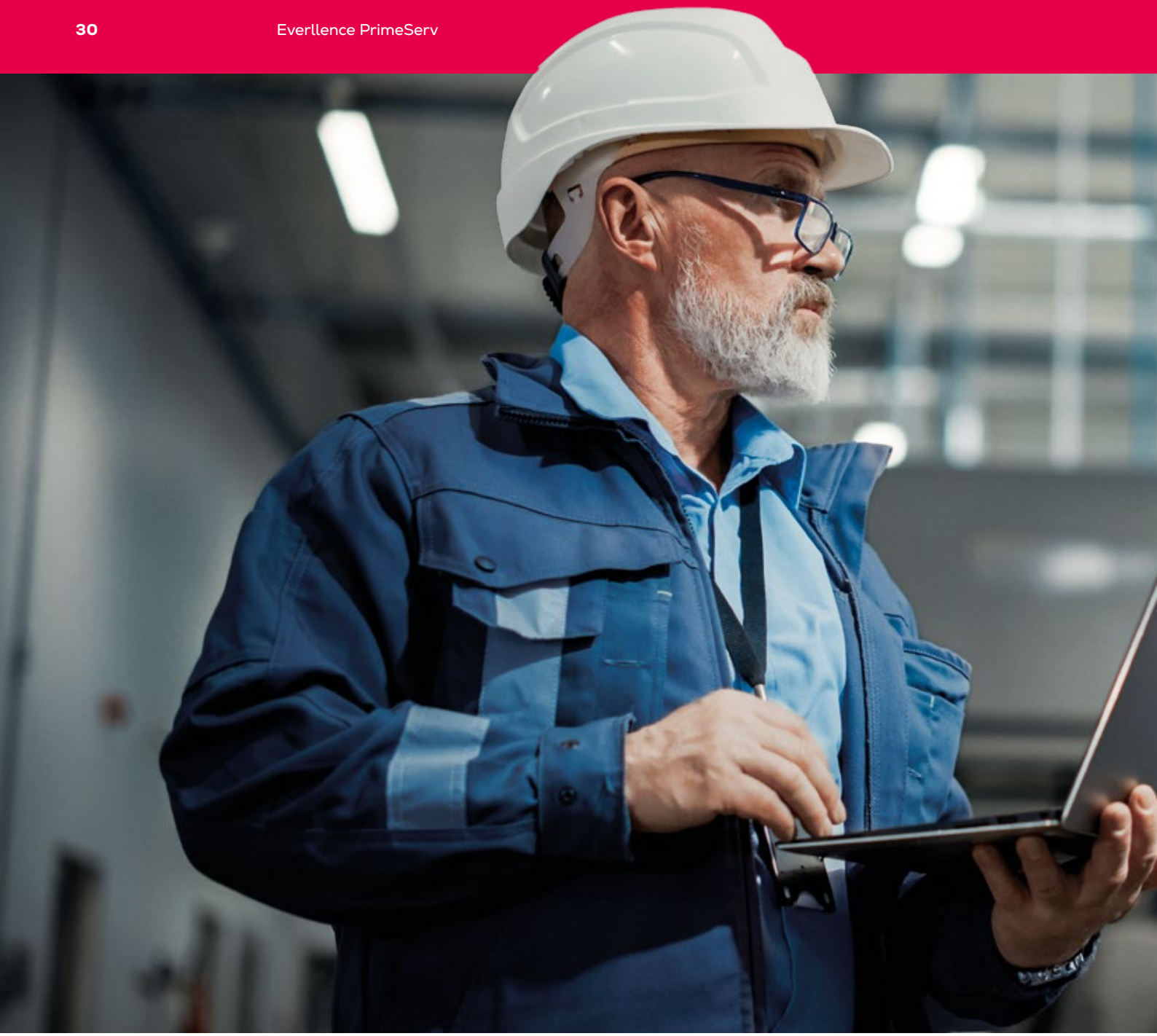
Flexibility for large engines
The VTA system can be optionally fitted to both TCA and TCR turbochargers. It enables the charge air volume to be precisely matched to the quantity of injected fuel across all points of an engine's load and speed range. The result is increased engine efficiency, reduced SFOC, lower HC and CO_2 emissions and improved engine response.

Minimizing consumption and emissions
VTA (variable turbine area) allows charge air delivery to be optimized to demand for charge air precisely, steplessly and continuously at all engine loads and speeds. VTA minimizes fuel consumption and related exhaust emissions.

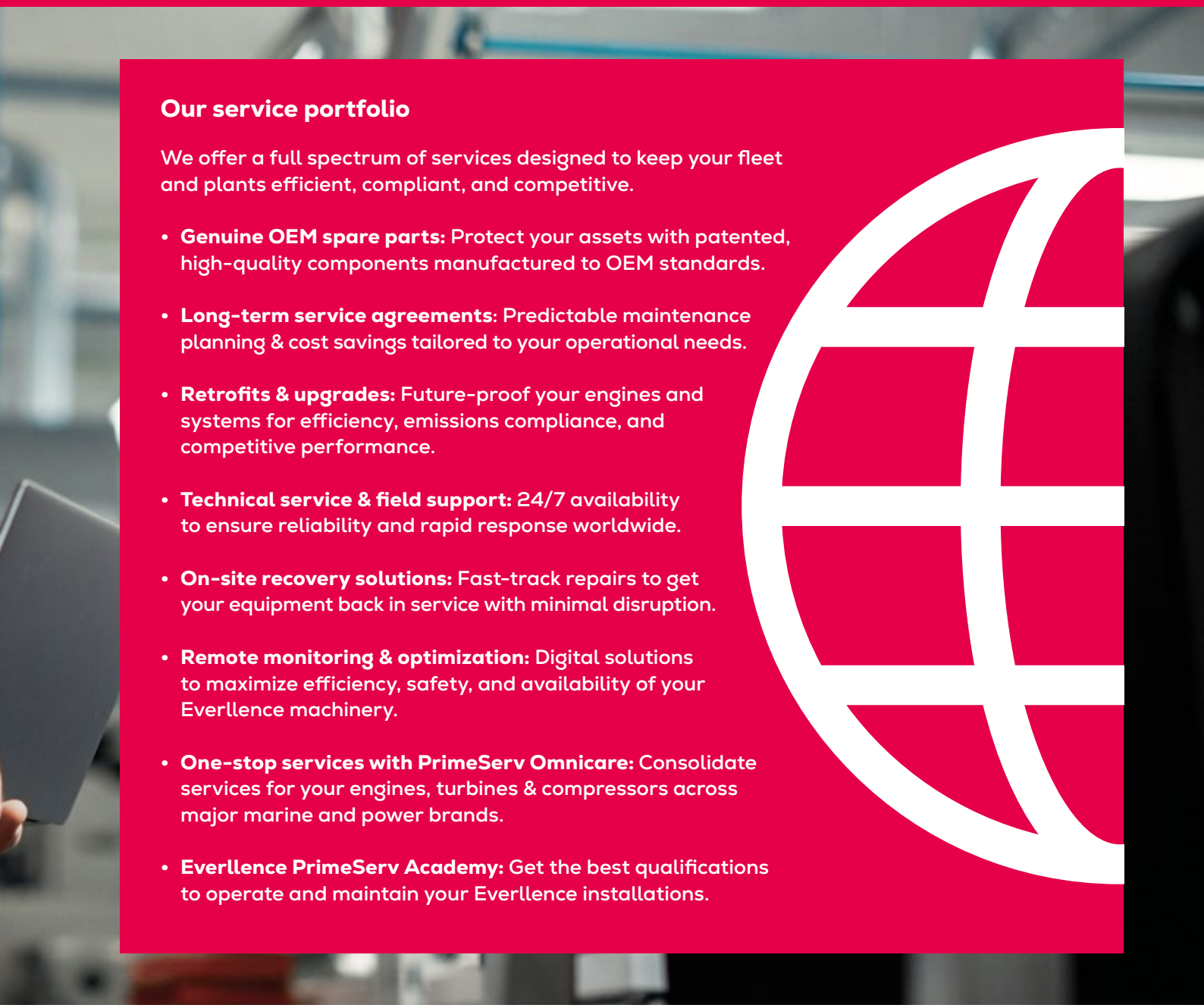
Flexible air and fuel management is key to meeting the emissions legislation of the future while increasing engine performance and reducing specific fuel oil consumption (SFOC). In heavy fuel oil applications, VTA technology has a powerful and positive role to play.

Benefits

- **Reduced consumption**
  Up to 5 g/kWh lower fuel consumption
- **Reduced emissions**
  Lower soot and smoke emission and lower particle emissions
- **Easy application**
  Suitable for TCA and TCR turbochargers and retrofit packages



From dock to deep sea and on any site – your trusted service partner



Our service portfolio

We offer a full spectrum of services designed to keep your fleet and plants efficient, compliant, and competitive.

- **Genuine OEM spare parts:** Protect your assets with patented, high-quality components manufactured to OEM standards.
- **Long-term service agreements**: Predictable maintenance planning & cost savings tailored to your operational needs.
- **Retrofits & upgrades:** Future-proof your engines and systems for efficiency, emissions compliance, and competitive performance.
- **Technical service & field support:** 24/7 availability to ensure reliability and rapid response worldwide.
- **On-site recovery solutions:** Fast-track repairs to get your equipment back in service with minimal disruption.
- **Remote monitoring & optimization:** Digital solutions to maximize efficiency, safety, and availability of your Everllence machinery.
- **One-stop services with PrimeServ Omnicare:** Consolidate services for your engines, turbines & compressors across major marine and power brands.
- **Everllence PrimeServ Academy:** Get the best qualifications to operate and maintain your Everllence installations.

Our global service network ensures fast response, expert support and maximum efficiency for your engines and systems – helping you stay ahead with reliability you can trust.

We offer comprehensive service solutions:

Sales & spare parts: Genuine OEM parts, expert consulting, and CRM-based support to optimize availability and performance.

Technical service & maintenance: Precision repairs, reconditioning and lifecycle optimization for long-term efficiency.

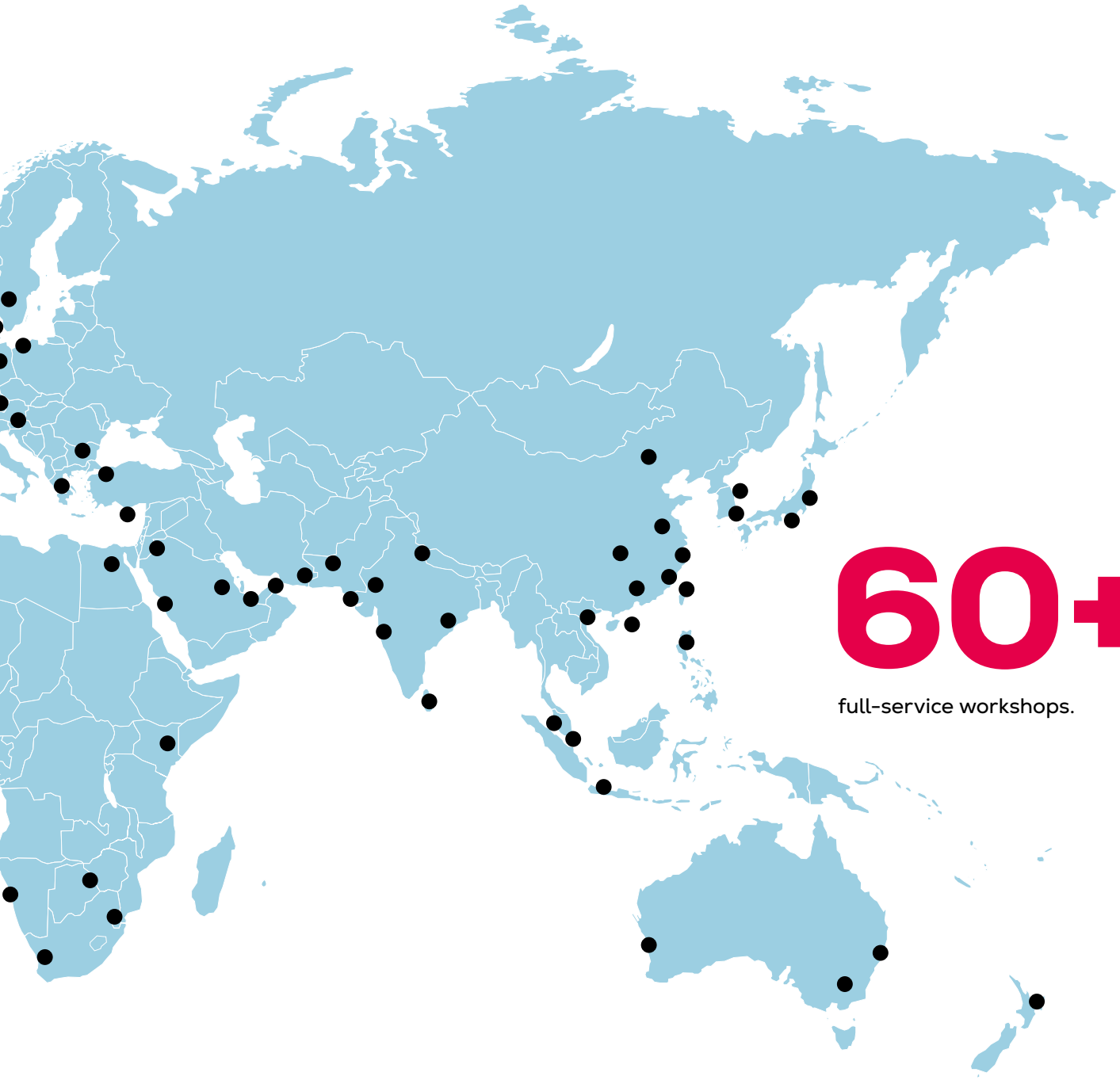
On-site recovery & field service: Emergency response and proactive service, wherever you need us.

100+

locations worldwide.

Our global service at a glance

Did you remember to order spare parts? No problem – we did. We also checked lube oil, engine condition, scheduled maintenance and installed updates. As your service partners, we keep your business running smoothly, securing efficiency and safety 24/7, around the world, on-site and online. We're here for what matters most: your peace of mind.



60+

full-service workshops.

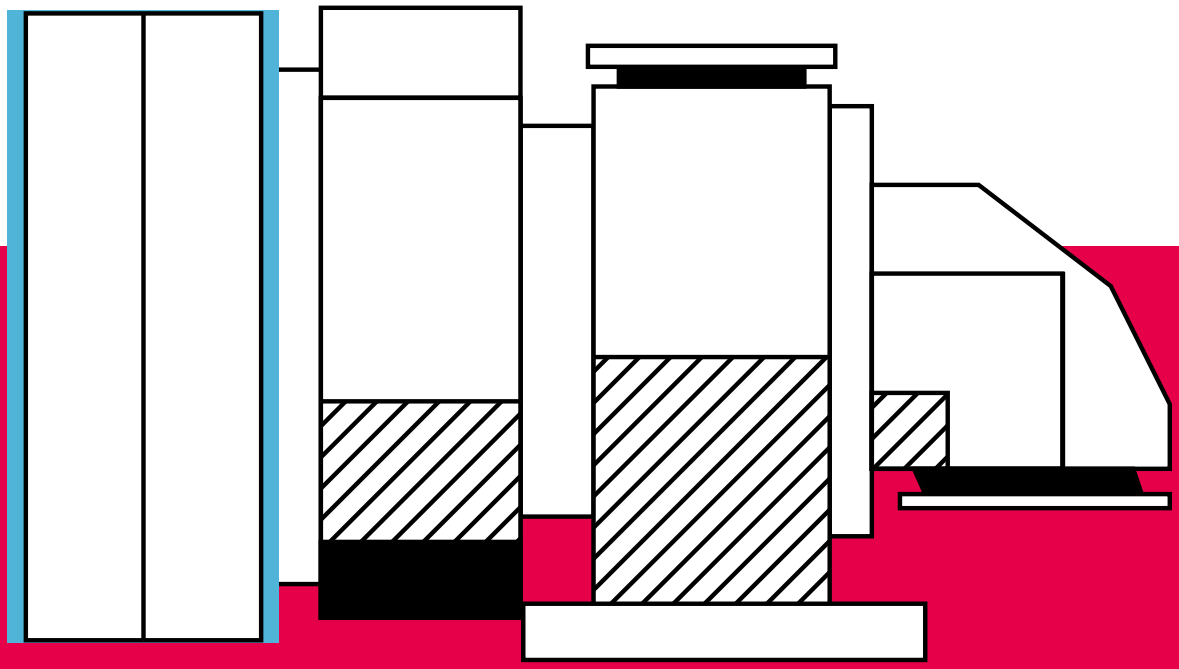
Service is digital – service is smarter
Service has evolved, and so have we. Everllence PrimeServ doesn't just help you maintain your assets, we help you future-proof them. As you navigate the shift towards carbon-neutral operations, our digital service solutions ensure that your technology delivers on its promise.

Powered by expert insight, our real-time support and analytics based on remote monitoring keep your equipment performing at peak efficiency – year after year, without interruption. Because service isn't just about fixing problems – it's about preventing them.

Our location types:
- Sales offices – Spare parts sale & consultation.
- Workshops – Maintenance & repair.
- Flagship service centers – Full spectrum of all services, sales & reconditioning.

Find out more
www.everllence.com/services/service-locations

The heart of your engine ...



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