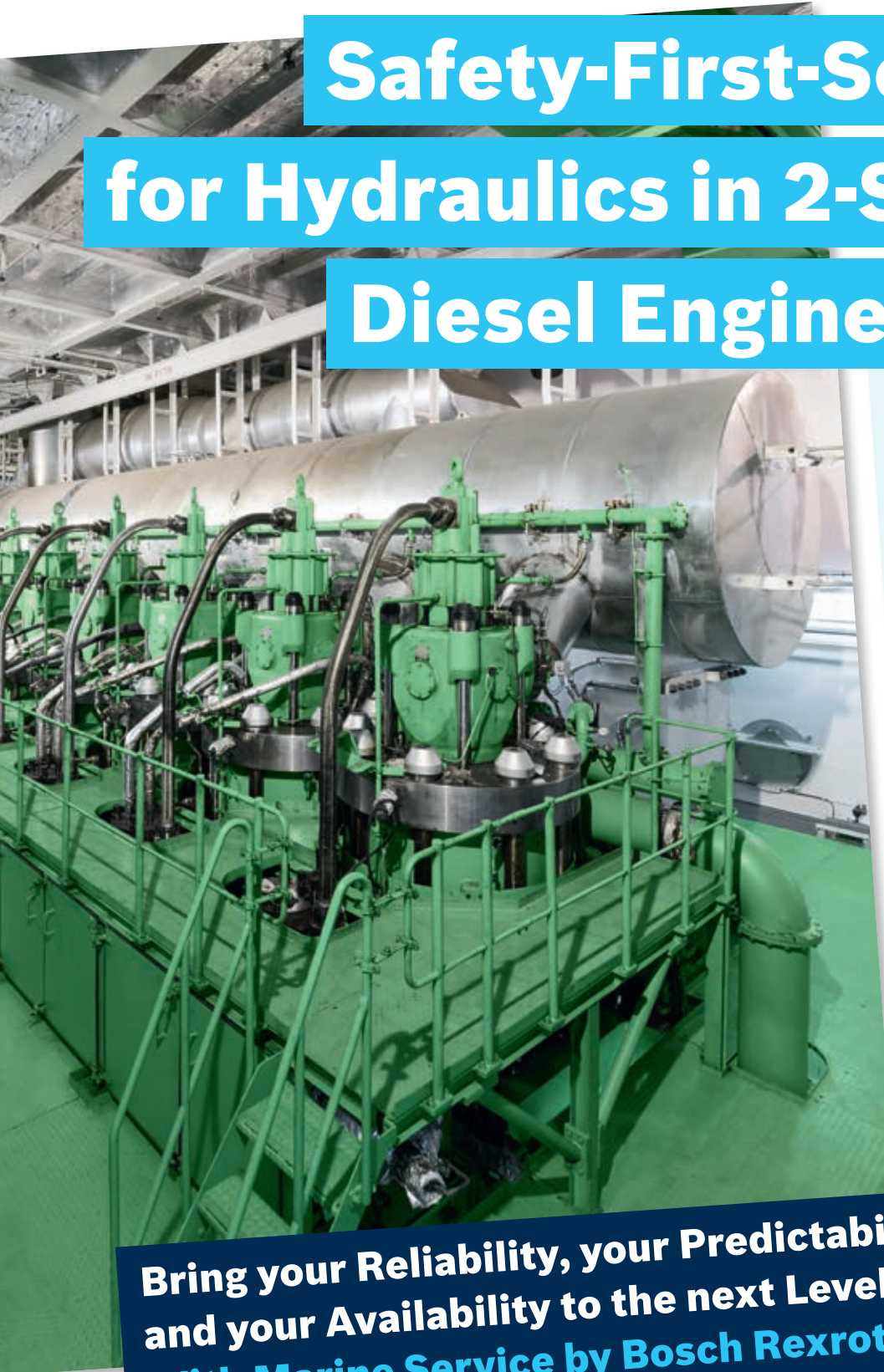
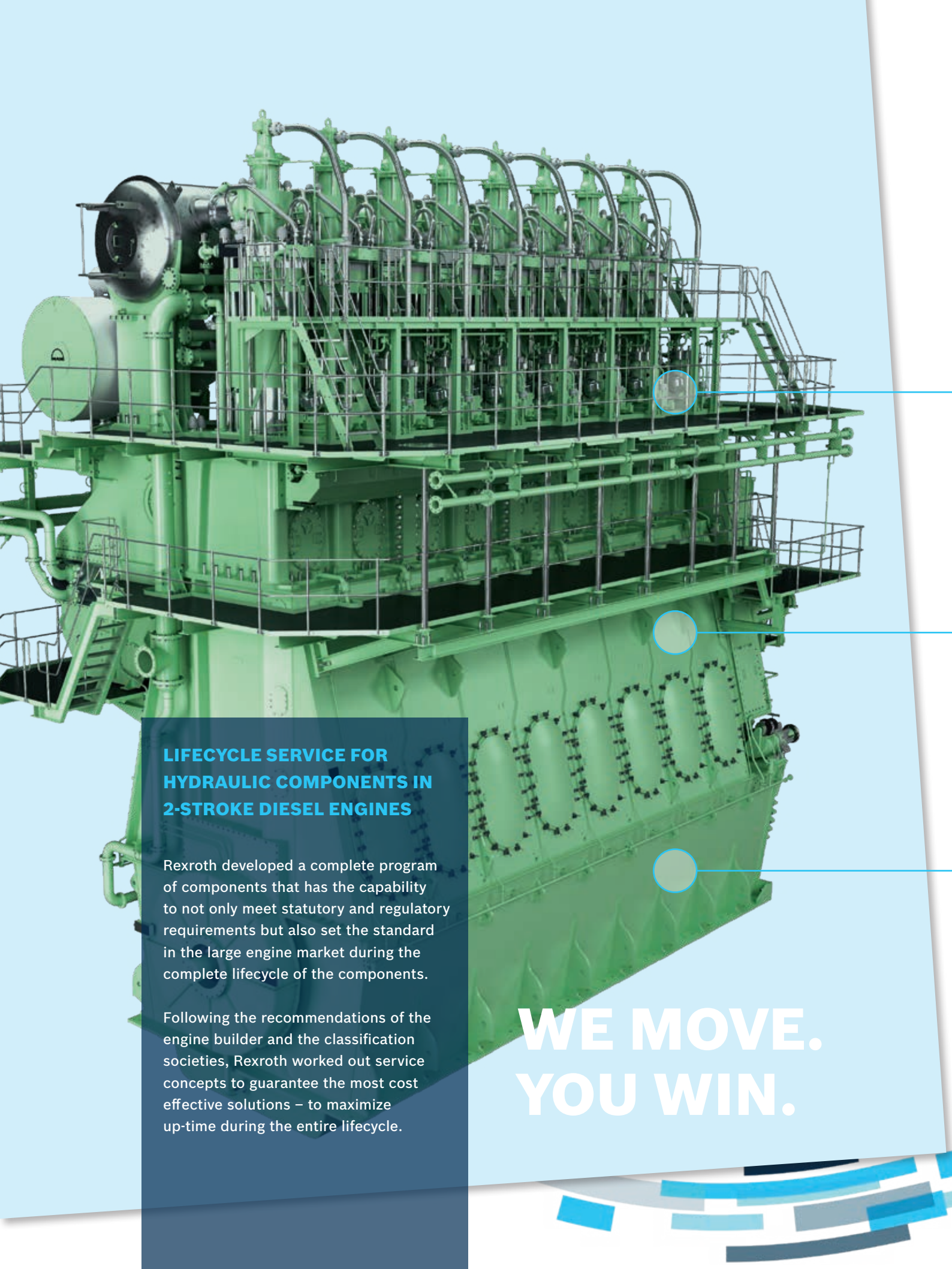


Safety-First-Service for Hydraulics in 2-Stroke Diesel Engines



**Bring your Reliability, your Predictability
and your Availability to the next Level.
With Marine Service by Bosch Rexroth.**



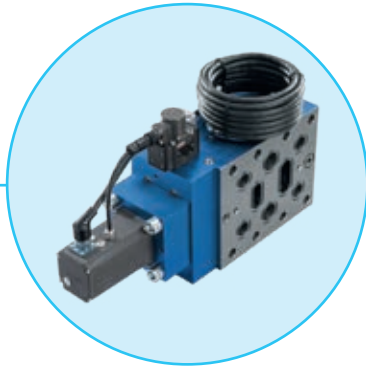
LIFECYCLE SERVICE FOR HYDRAULIC COMPONENTS IN 2-STROKE DIESEL ENGINES

Rexroth developed a complete program of components that has the capability to not only meet statutory and regulatory requirements but also set the standard in the large engine market during the complete lifecycle of the components.

Following the recommendations of the engine builder and the classification societies, Rexroth worked out service concepts to guarantee the most cost effective solutions – to maximize up-time during the entire lifecycle.

WE MOVE. YOU WIN.

Keeps Ships Moving: Rexroth Global Marine Service



◀ **Rexroth FIVA valve – the core component for optimal fuel consumption and low emissions**



◀ **Rexroth axial piston pump A4VSO – the most approved and durable pump for a reliable oil supply**



◀ **Rexroth start-up unit – efficient and space-saving for supplying the hydraulic pressure and volume flow before and during engine start-up**

▶ **Rexroth Service means Lifecycle Service: Anytime, anywhere – we are always close-by with concepts, parts and experts.**

OUR SERVICE – YOUR BENEFITS

- ⊕ Global service network
- ⊕ Single point of contact for global execution
- ⊕ Rexroth "Back to New" warranty
- ⊕ Only genuine Rexroth spare parts are used
- ⊕ Overhaul according to current classification rules
- ⊕ Service according to engine builder guiding overhaul intervals
- ⊕ No liability risks for owner
- ⊕ Fixed price for planable maintenance cost

SERVICE CONCEPTS

- ▶ Customized
- ▶ ME Ship Diesel Engines
- ▶ 5 years uptime program
- ▶ Fleet Maintenance Concept
- ▶ Spare Parts Logistics & Management

MAINTENANCE PORTFOLIO

- ▶ Spare Parts
- ▶ Repairs (flat, light)
- ▶ REMANufacturing
- ▶ Replacement
- ▶ Retrofit



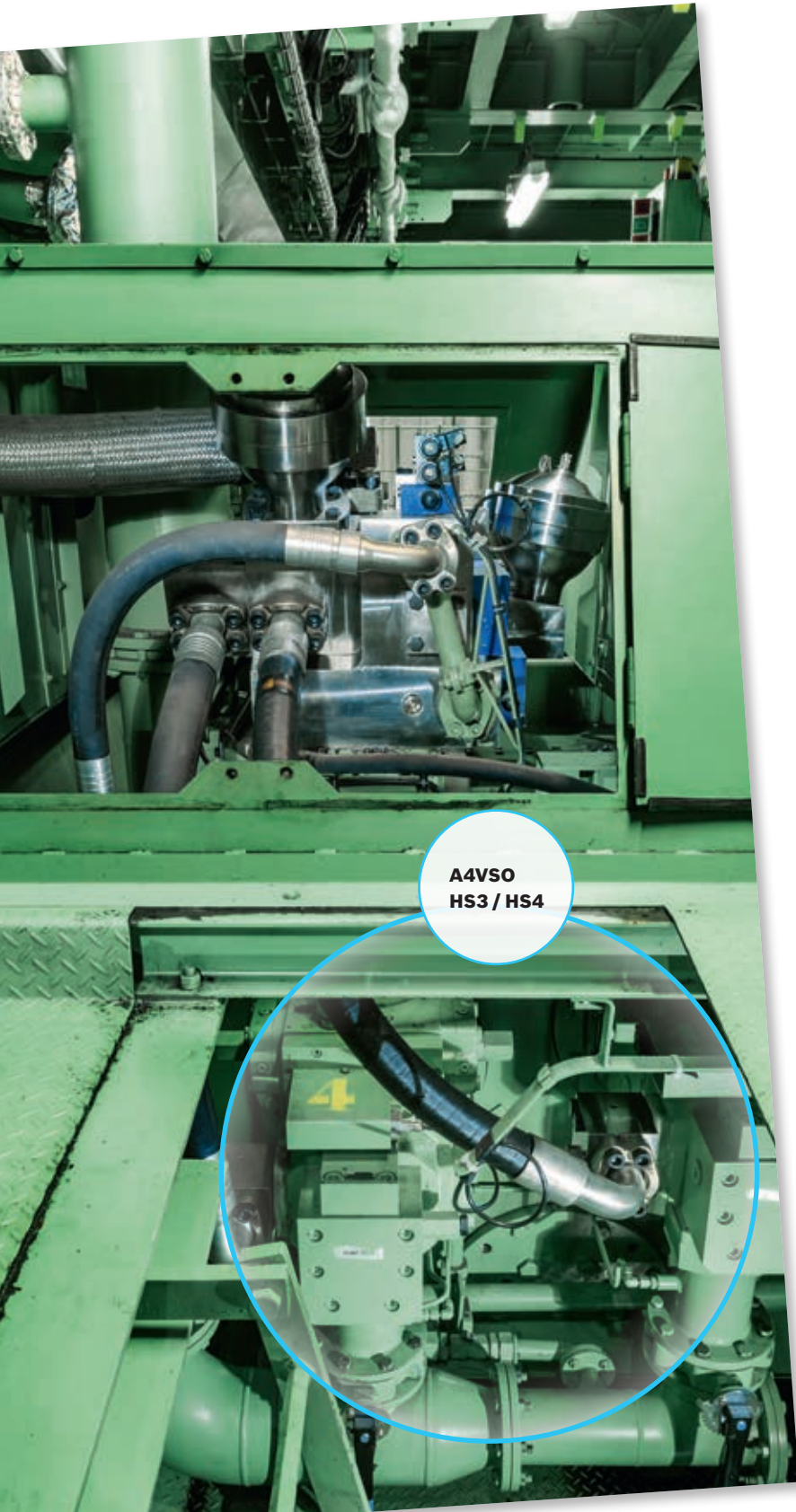
DIAGNOSTIC & CONDITION MONITORING

- ▶ IoT Gateway
- ▶ Condition Monitoring

GLOBAL SERVICE NETWORK

- ▶ Service Centers close to all important ports
- ▶ Marine Repair Centers in important marine hubs

Safety-First-Service for Hydraulic Power Supply A4VSO



**A4VSO
HS3 / HS4**

A4VSO - THE CONTINUOUS OPERATOR: MORE THAN 10.000 PUMPS IN SERVICE WORLDWIDE

Regarding supply of pressurized oil for the electro-hydraulic control of the combustion process in a large engine, ruggedness and a high level of efficiency are the critical factors: With the proven swashplate design of the A4VSO axial piston pump, Rexroth has established itself as market leader for large 2-stroke engines.

A4VSO provides variable volume flow adjustment and very good priming properties with low noise level and rapid control response. The pump is very reliable and minimizes unscheduled downtimes – together with the Rexroth preventive maintenance concepts.

Preventive Maintenance

Following the recommended service intervals of the engine builders and the classification societies (at 32.000 hours runtime) Rexroth offers three options for maintenance on the pumps:

- ▶ **REMAN**
- ▶ **OVERHAUL FLAT**
- ▶ **OVERHAUL LIGHT**

All offers are available at fixed price. Depending on operating hours and execution of the service during port call or docking, the best solution can be chosen. Users of these services benefit from fixed projectable budget for defined maintenance operations.



SERVICE PRODUCTS OVERVIEW

	REMAN	OVERHAUL FLAT	OVERHAUL LIGHT
Age of pump	any	< 65.000 hours	< 65.000 hours
Returned pump	A4VSO HS4, A4VSO HS4E, A4VSO HS3	A4VSO HS4, A4VSO HS4E, A4VSO HS3	A4VSO HS4, A4VSO HS4E, A4VSO HS3
Replacement pump	A4VSO HS4	A4VSO HS4, A4VSO HS3	A4VSO HS4, A4VSO HS3
Renewal	bearings, sealing elements, proportional valve, position transducer, complete rotary group parts	bearings, sealing elements, proportional valve, position transducer, more parts if needed are included	bearings, sealing elements, proportional valve, position transducer, more parts if needed will be invoiced on top
EOL test Service report	included upon request	included upon request	included upon request
Register classification	RINA included, others upon request	not included upon request	not included upon request
Painting	included	not included upon request	not included upon request
Delivery time	overhauled exchange pump is shipped prior to returning of the used pump	minimum 1 week in local service plant, depending on parts availability	minimum 1 week in local service plant, depending on parts availability
Warranty	"as new" – 2 years on complete unit	1 year on exchanged parts	1 year on exchanged parts
Incoterms	DAP destination airport	FCA service plant	FCA service plant
Place of execution	Bosch Rexroth plant in Horb, Germany	Bosch Rexroth Marine Repair Centers, worldwide	Bosch Rexroth Marine Repair Centers, worldwide

Rexroth can offer the most effective service solutions

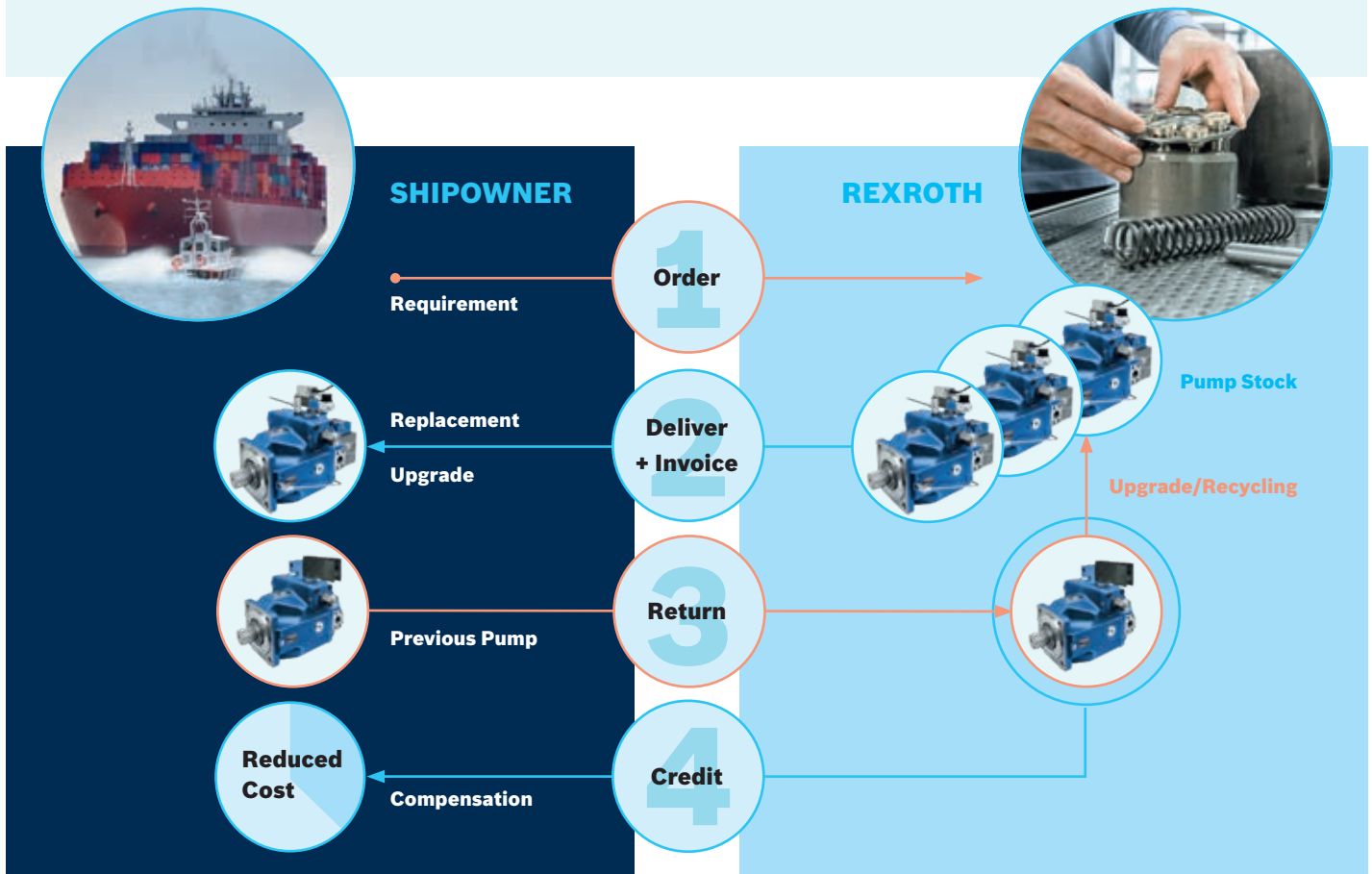
- ▶ **Pump Reman:** during port calls or docking (min. 36 hours) – exchange, 1 month call time
- ▶ **Pump Upgrading:** during docking (min. 48 hours) – HS3 to HS4, 1 month call time
- ▶ **Pump Overhaul:** during docking (min. 2 weeks) in Marine Repair Centers – 3 pumps in 5 days, 1 month call time

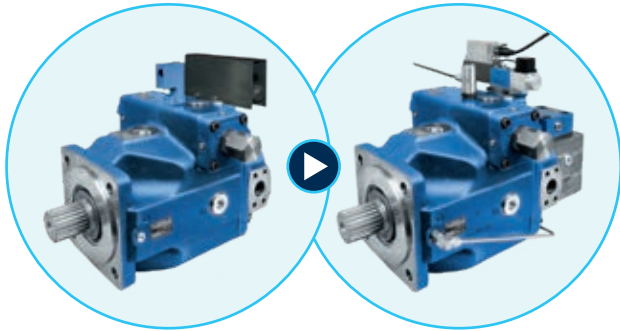
Safety-First-Service

REMAN, Upgrade and Overhaul

REMAN(UFACTURING) – THE ADVANTAGES

- + Easy to organize for the owner
- + Short and planable lead time
- + Installation of pump ex-stock
- + Reduced downtime for the vessel
- + No risk of delay in repair process
- + Exchange service for complete set of pumps or one-by-one/step-by-step
- + Installation and commissioning services
- + Detailed inspection & condition report
- + Full renewal of life expectancy of your application and hydraulic component
- + 100 % quality approved with warranty 24 month
- + New classification approval
- + Significant credit value for used pumps
- + Low total cost of ownership
- + Ecological: saves resources





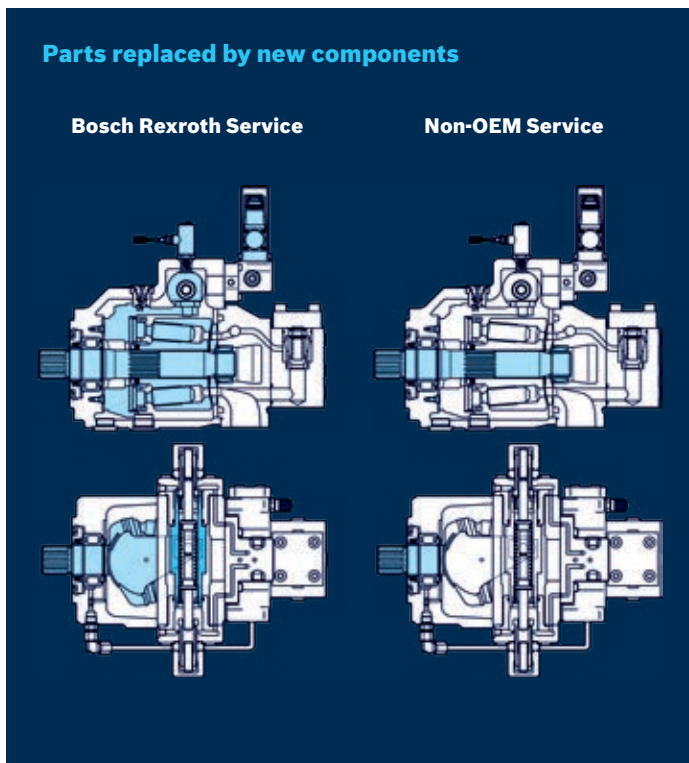
UPGRADE FROM HS3 TO HS4 FOR ME ENGINES

- ▶ Availability of replacement units and spare parts only for HS4 (HS3 in phase out)
- ▶ State of the art technology
- ▶ Improved controller/proportional valve, inductive positional transducer
- ▶ Amplifier cards in HS3 design will be made redundant in HS4 design
- ▶ All pump use same engine control software due to same design
- ▶ HS4 pump set vs. single HS4 pump + upgrade kits HS4 (proportional valve 4WRPE + ind. positional transducer)
- ▶ Rewiring, terminal box and parameter setting from engine builder needed

OVERHAUL – THE SCOPE

OVERHAUL	FLAT	LIGHT
Disassembly, cleaning and inspection	●	●
Renewal of bearings, seals and springs	●	●
Renewal of position transducer	●	●
Renewal of proportional valve	●	●
Rework of rotary group	●	–
Rework of control piston	●	–
Additional parts if necessary included	●	–
Only original parts	●	●
Testing according to current specifications	●	●
Classification	option	option
Painting	option	option
Service report	option	option
Warranty: 12 month on parts exchanged	●	●

Parts replaced by new components



The Overhaul-Services in comparison

Rexroth Marine Service offers significantly more comprehensive pump services than any market repair suppliers, that usually only overhaul seals and bearings.

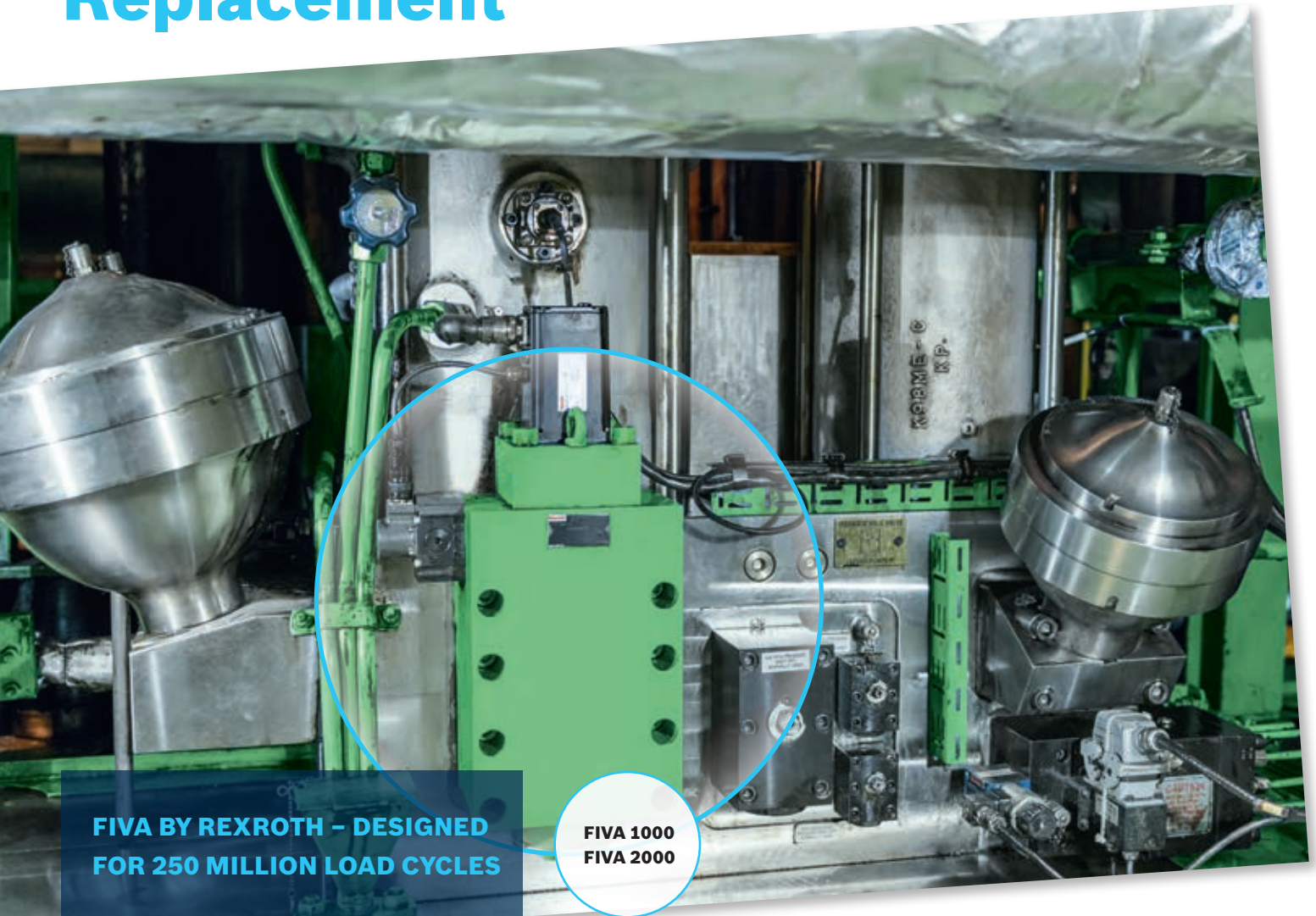
The Rexroth philosophy is: If the pump has to be opened, why not immediately replace all other critical parts in a cycle? For more quality, more efficiency and more reliability.

Compare our service offerings:

- ▶ **Overhaul Light** offers the lowest price, but bears the risk of extra billing and longer repair time if more work and parts are needed. **This is customer's risk.**
- ▶ **Overhaul Flat** offers a slightly higher price, but includes all necessary parts (e.g. rotary group, control piston) **at the expense of Bosch Rexroth.**

For more reliability, predictability and availability always a detailed comparison of price and scope of overhaul vs. risk is necessary.

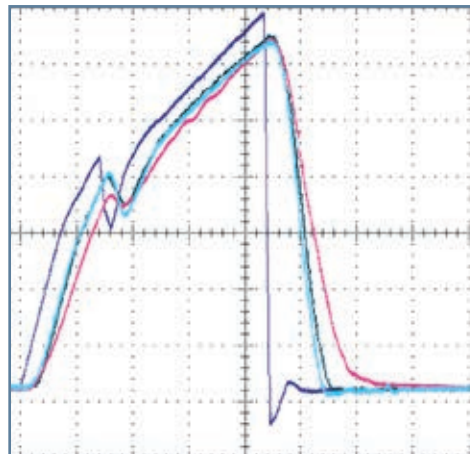
Safety-First-Service with FIVA overhaul and Rexroth FIVA Replacement



FIVA BY REXROTH - DESIGNED FOR 250 MILLION LOAD CYCLES

FIVA 1000
FIVA 2000

The Rexroth FIVA valve carries out the injection profiles specified by the control system with absolute precision. This enables fuel consumption to be reduced and ultra-low emissions to be achieved – even in extreme conditions: These servo valves are designed for more than 250 million cyclical changes of load, which means a service life of at least five years. This results in significant reduction in maintenance intervals, downtime and unproductive idle times, and therefore containment of maintenance costs.



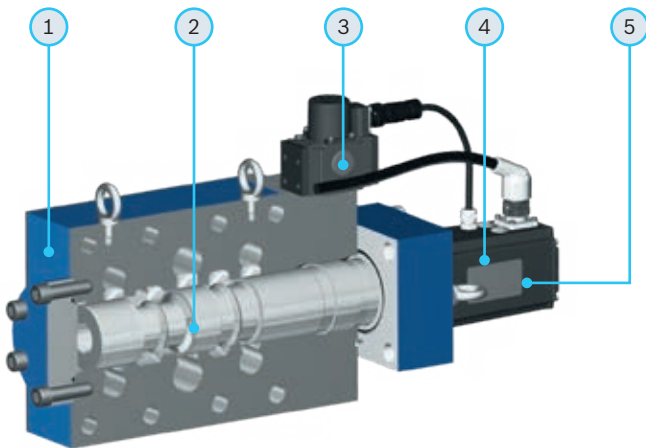
◀ The extreme injection profile (split profile) is specified by MAN. It consists of a theoretical profile and a nominal value. The Rexroth-FIVA follows this value excellently and much more accurately than any other brand.

- MAN theoretical profile
- MAN nominal value
- Rexroth FIVA
- other



Overhaul scope for FIVA valves:

- ▶ Incoming test at test bench
- ▶ Disassembly and visual inspection of all parts
- ▶ Detailed inspection report
- ▶ Rework of housing¹ and main control spool²
- ▶ Renewal of pilot valve³, inductive position transducer⁴ and control electronics⁵
- ▶ New sealing
- ▶ Adjustment and testing at the test bench
- ▶ New paint
- ▶ 12 month warranty on all exchanged parts



Exchange or Replacement

Rexroth FIVA 1000 or FIVA 2000 are completely compatible to the following valves:

- ▶ MAN MBD FIVA I – 45 and FIVA II – 60
- ▶ Nabtesco FIVA I – 45 and FIVA II – 60
- ▶ Curtis-Wright FIVA I (Si) and FIVA II (Si)

Conversion to Rexroth FIVA

Rexroth FIVA requires only one cable due to on-board electronics while other provider's valves need two – power supply and external electronics. New and less cabling from motor controller or junction box to the FIVA can be installed during passage or dry docking.

REXROTH FIVA ADVANTAGES



Plug & Play solution

- ▶ Easy to exchange pilot valve or complete valve by ship technician, only connect one cable
- ▶ Rexroth FIVA is a closed-loop-system with parameter and zero-point setting inside the loop
- ▶ Settings are secured at Rexroth test stand and need no action on board



Low Friction

- ▶ nearly no friction of the main stage
- ▶ higher reliability
- ▶ longer lifetime



Excellent dynamics, optimal control and high flexibility

- ▶ Fail-safe philosophy



Following split profile

- ▶ very precise following of the extreme injection profile (split profile)



Cable connection & electronics

- ▶ less installation due to one instead of two cables
- ▶ Preset zero-point adjustment thru Plug & Play by internal electronics
- ▶ longer lifetime because of less heat inside the electronics

Safety-First-Service for Start-Up Units



A10VSO

REXROTH A10VSO – ALWAYS READY TO GO

Reliable and optimally matched to the other components, start-up units fill the accumulators and provide the volume flow required to start and operate the engine during engine start-up. As the main pumps only come online once the engine is up and running. The sizes of the A10VSO axial piston pumps are highly efficient and comply with all regulations and certifications of maritime classification societies.

Exchange of A10VSO pumps

- ▶ All-purpose medium pressure pump
- ▶ Size 18, 28 or 45
- ▶ Nominal pressure 280 bar
- ▶ Maximum pressure 350 bar
- ▶ Open circuit

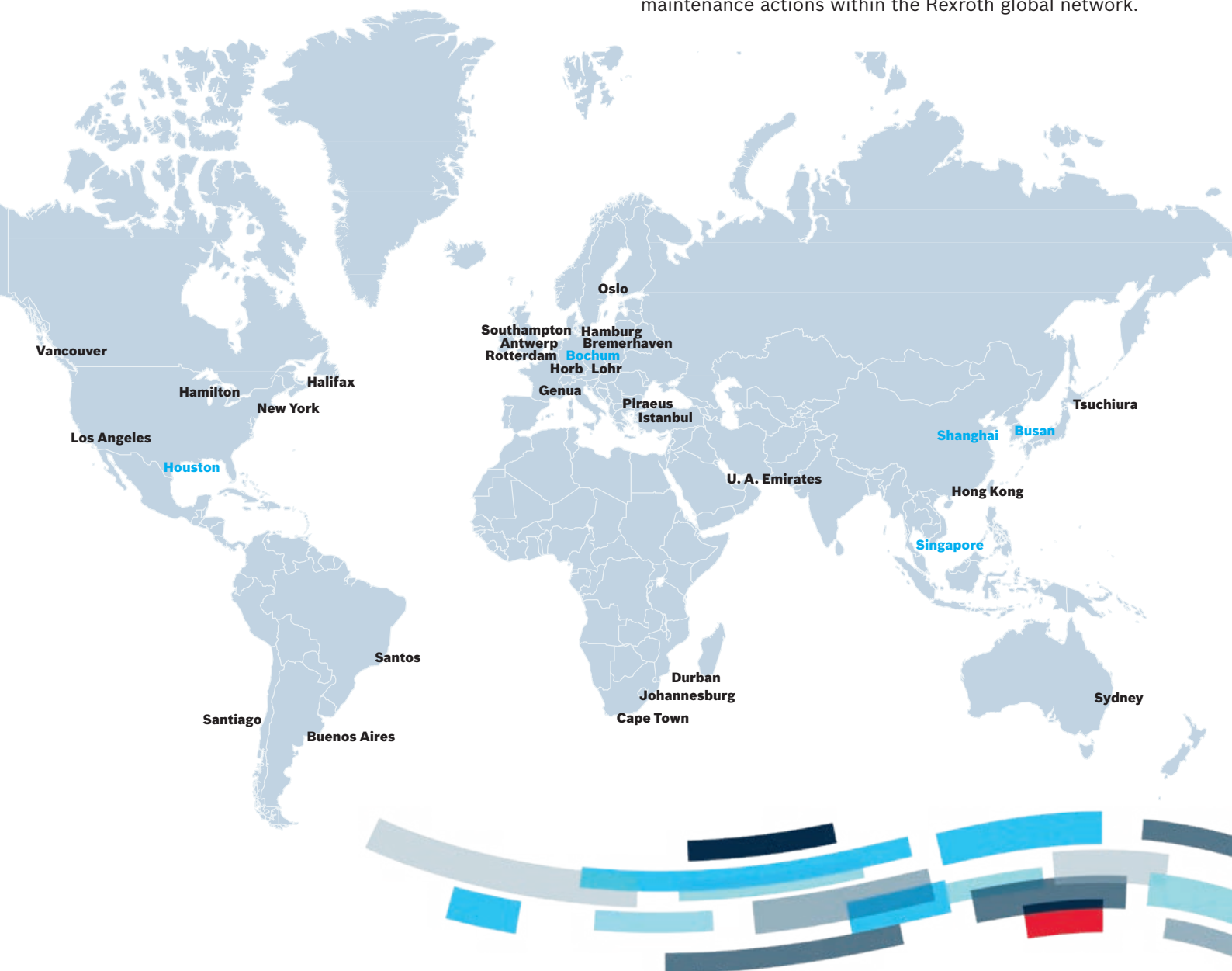
Safety-First-Service with a Global Network

Wherever you need us

Bosch Rexroth operates **Service Points** in or near by almost all relevant ports in the world. From there Field Service Support is available and component exchange can be executed reliably and fast.

In addition close to the major ports and docking areas Rexroth has five specialized **Marine Repair Centers** at Bochum (Germany), Busan (South Korea), Singapore, Shanghai (China), Houston (USA).

Rexroth is offering a competent single point of contact to every Fleet Manager or Superintendent to organize the maintenance actions within the Rexroth global network.



Bosch Rexroth AG

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97816 Lohr, Germany
www.boschrexroth.com



Your local Rexroth service contact

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