

Moving Wheel Loaders Ahead – Drive and Control Systems from Rexroth

The Drive & Control Company





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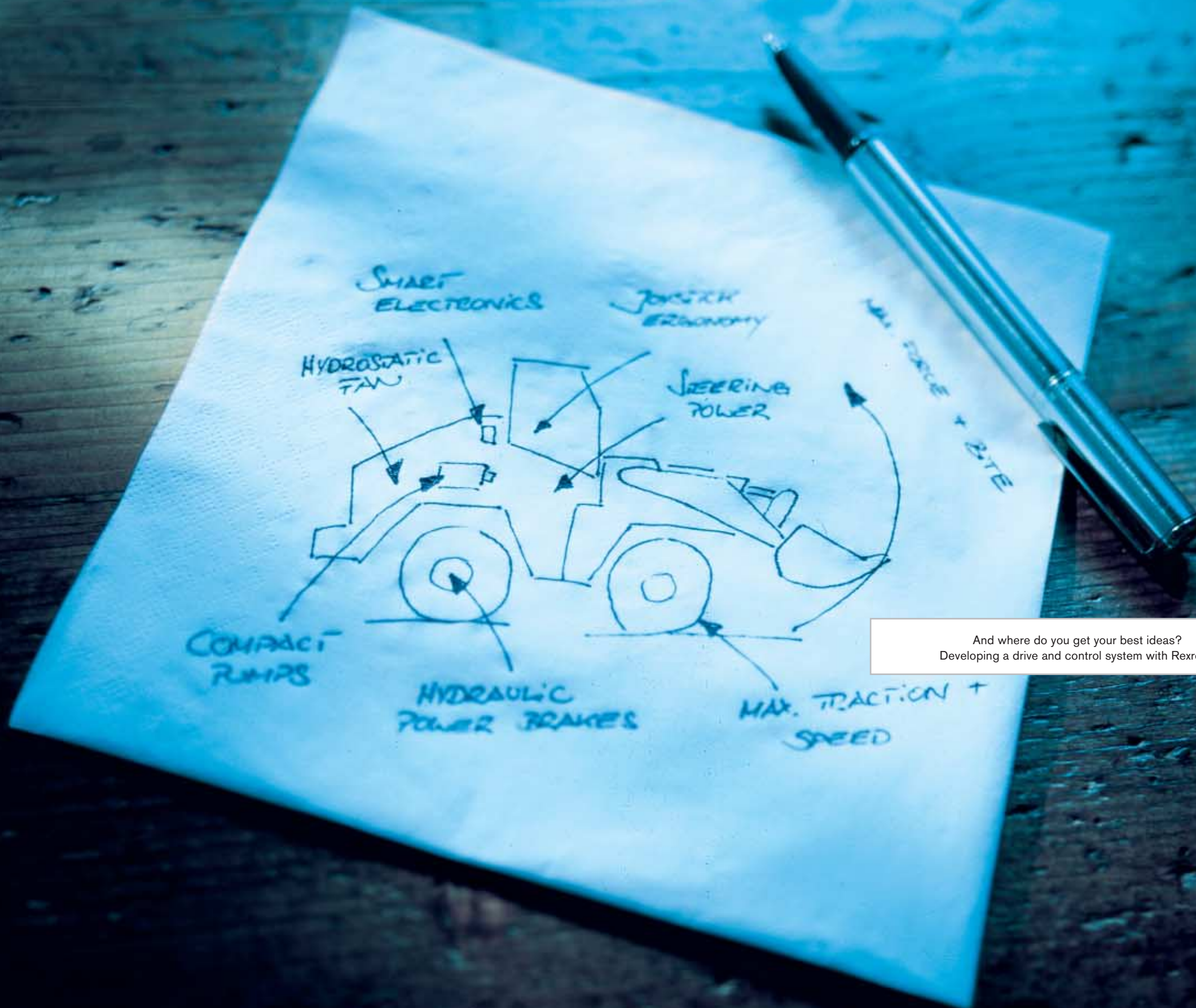
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Wheel loaders can do virtually anything. It goes without saying that they are maneuverable, have an enormous tear-out, a high handling capacity and low operating costs. Wheel loaders are today also expected to offer a smooth, comfortable ride, low fuel consumption and a compact design coupled with the greatest possible degree of safety and environmental friendliness. At Rexroth we have made it our goal to optimize the use of wheel loader technology in each of these areas and to offer all-embracing solutions.



And where do you get your best ideas?
Developing a drive and control system with Rexroth.

Do You Have Something to Write With?!

It's a well-known fact: Brainwaves usually occur when there's not much you can do about them. You start turning a "problem" over in your head and the penny drops just when you least expect it. Anyone who has pen and paper to hand at that precise moment is fortunate indeed. In such a situation, a paper napkin may be the starting point for a ground-breaking development. But where do you then go with this unlikely gem?





Good ideas need the direct approach

A table. And sitting around it: you and your team of consultants. With your paper napkin. An unusual picture to be sure, but your idea is worth it. The specialists in the Rexroth wheel loader application center are used to trying out good ideas, new designs and innovative systems, carrying out further development, trialing and implementing them. This applies equally to travel drives, braking systems or working hydraulics. There will be talking, discussion, sketching, discoveries and rejections. A problem? A good job that we at Rexroth have a direct line to application specialists and development engineers. This enables any new design to be checked out rapidly to see whether or not it is feasible. Direct lines, rapid decisions. You can breathe a sigh of relief. We're on our way.

A mechanical system can only work properly if the chemistry is right

The idea's good. You can sense that the engineers have reached certain views and initial positions about your idea. This generates confidence and security. The chemistry's right. The direct lines at Rexroth clearly simplify complicated development and decision-making processes. Even the clearest of structures is no use without the input of a dedicated team. Collective thinking, getting involved with the customer, making their aims your own, these aspects are part of the process of putting ideas into practice at Rexroth.

Inside the wheel loader

It's gradually getting serious. Solutions are being looked at more closely. Sketches are developing into more detailed drawing. Bosch's and Rexroth's unique range of hydraulic drives and controllers and their combined expertise in vehicle electronics means dependable planning and reliable systems. We have also discovered that many of our results are complete system solutions that set new standards in this field.

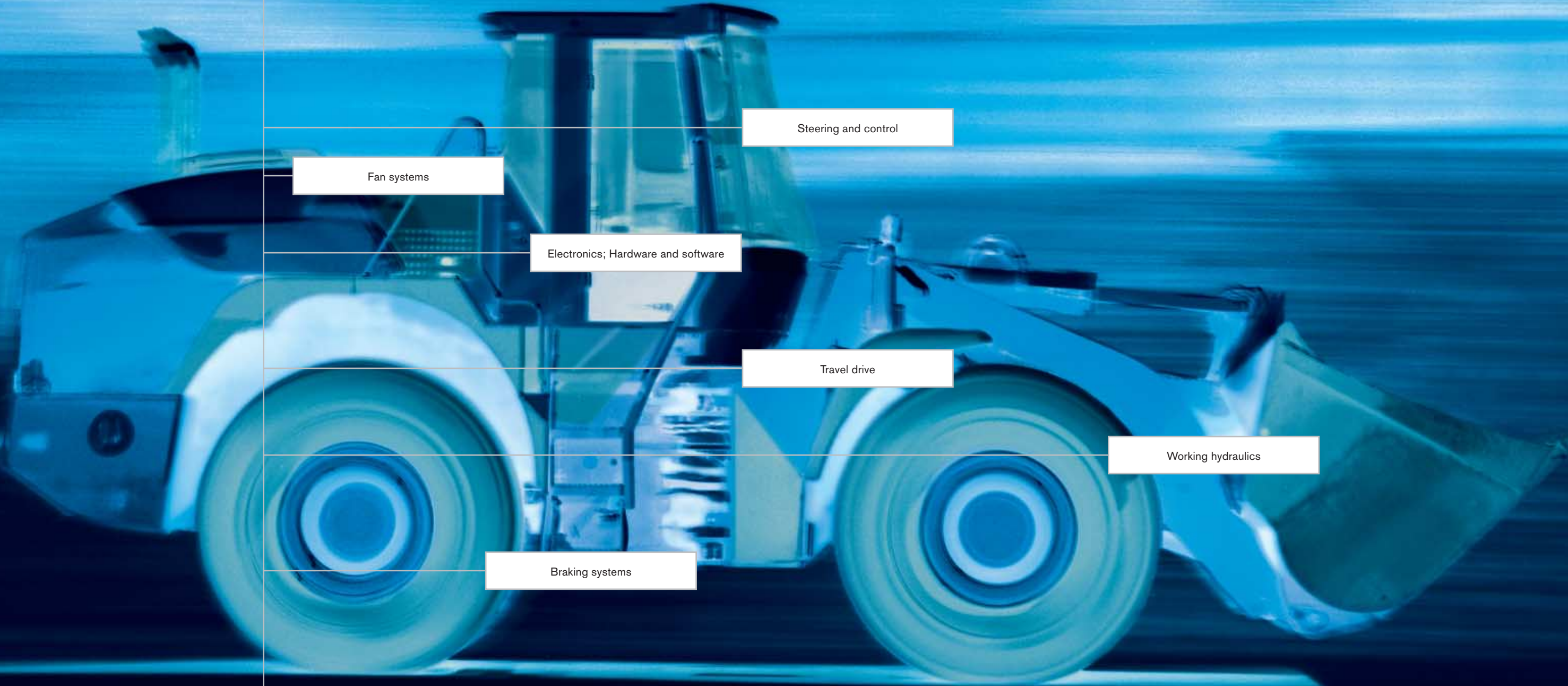
One of the best when it comes to the test

The best possible idea, the most innovative teamwork, the most inspired solution – all will be to no avail unless you can successfully turn the idea into reality and test the result. That's just how it is. An idea remains an idea and the paper napkin no more than a nice story. That's why your wheel loader is exhaustively checked out on Rexroth's in-house roller test stands. Needless to say, all under defined conditions combined with state-of-the-art measuring technology and including a wireless local area network (WLAN) in the test stand area. Is everything going to plan?

Continued at the end of the brochure.



Solutions from Rexroth for the Individual Subsystems in a Wheel Loader



Fan systems

Steering and control

Electronics; Hardware and software

Travel drive

Working hydraulics

Braking systems

Our comprehensive product range enables us to meet any form of challenge with the perfect solution. This is because the range includes every kind of hydraulic drive and controller imaginable, as well as both the hardware and the software for all the electronic open- and closed-loop control systems.

Driving – What Gives Wheel Loaders a Kick

Hydrostatic travel drive or hydrodynamic converter? A question that is often on the lips of the specialists, and Rexroth responds with a clear answer: Hydrostatic drive. The vast number of applications equipped testifies to the superiority of this drive design – also in higher performance classes and speeds.

Advantages of the hydrostatic travel drive

Few if any switching steps. The large conversion range allows travel to be carried out smoothly and in a controlled manner. Additional advantage: this allows simpler and thus a better cost effected transmission solution.

High performance even at low engine speeds. This delivers powerful tear-out and tractive forces, reduces operating costs and gives a fuel saving of up to 30% as demonstrated in tests by leading manufacturers.

Faster to respond, more maneuverable. Simple, fast, smooth reversing and full torque in both travel directions with no reversing transmission.

Optimum distribution of power between travel drive and working hydraulics. Any power that is not required on one side is made available to the other consumer.

Less switching. Since this machine is easier to operate, it leaves you free to concentrate more on the essentials.

Power exactly where it's needed. The highly efficient drive provides maximum traction when it is needed – when burying the bucket into a load or moving over heavy ground.

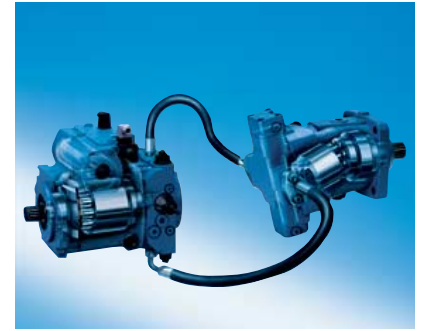
Low heat development in operations involving high tractive force and low speeds.

Installation wherever you wish. With a hydrostatic travel drive you can place the diesel engine anywhere there is sufficient space, since hoses are easier to route than shafts.



Hydrostatic travel drive for wheel loaders up to approximately 60 kW

Price and overall size are the determining factors with compact wheel loaders. Optimum solutions make the best possible use of the available power from the diesel engine. One possibility is the A4VG reversible displacement pump in conjunction with DA control and A6VM variable displacement motors. Together these produce perfect, high torque and high travel speed throughout the large, common control range. The feed pump and necessary valves for the closed circuit are already integrated.



Details can be found at www.boschrexroth.com/axial-piston-pumps and www.boschrexroth.com/axial-piston-motors

DA control – user-friendly drive and anti stall control even with no electronics

The proven, engine-speed-dependent DA drive control makes driving as easy as having an automatic transmission in an automobile. The DA controller ensures that the pump power is matched perfectly to the available engine power. The continuous, speed-dependent buildup of torque gives the wheel loader pushing force in

the pile and allows the bucket to be filled efficiently. The hydro-mechanical pump controller, which operates completely independently, significantly simplifies integration into the vehicle.

Find out more at www.boschrexroth.com/da-control

Hydrostatics and summation gearboxes for wheel loaders above 60 kW

For larger machines we offer in conjunction with leading gearbox manufacturers dual motor packages on switchable or non-switchable summation gearboxes. Rexroth can also supply electronics applications packages comprising robust controllers RC, sensors and turnkey software solutions. This way, an electronic travel drive control DRC can be implemented quickly and inexpensively which readily includes power shift, cruise control and speed limitation.



Details of our electronics solutions can be found on pages 18/19 – Electronics – Making Wheel Loaders Smart

Hydrostatics and continuous variable transmissions for wheel loaders of all classes

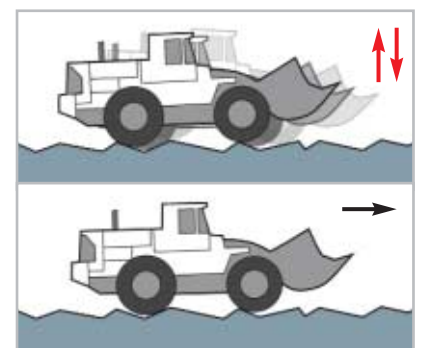
For continuous acceleration there are also, as an alternative to summation gear boxes, continuous variable transmissions with hydraulic motors.

We offer custom made hydraulic and electronic solutions that are specially developed and designed by Rexroth project teams in collaboration with experts from the vehicle and transmission manufacturers.

Stabilization module for a comfortable drive

Vibration-free driving thanks to the new-generation Rexroth RSM stabilization module. This reduces pitching independently of the travel drive. The advantages are:

- Faster transport speeds
- Improved handling performance
- Improved driving safety
- Shorter braking distances
- Reduced stress on driver and machine



Details: www.boschrexroth.com/control-blocks, category stabilizing module

Steering and Braking – Bringing Control to Your Wheel Loader

A light touch is all you need for steering and braking – even for a 30-ton machine. And that's not all. The steering movements should be transmitted precisely and directly. The brakes should respond quickly and directly, and yet be sensitive and easy to regulate. The wheel loader as a work place thus becomes safer and more comfortable, the wheel loader as a work tool gets more efficient and maneuverable.

In the LAG steering units from Rexroth you have what is probably the most versatile steering system on the market. Its large number of variants enables it to be matched perfectly to the vehicle. This is the case whether open-center or closed-center, and whether with standard or special emergency steering function. The right module for every situation. All versions officially approved, and successfully tested thousands of times. Rexroth steering sensors on the steering column reliably combine steering and electronics. To meet legal requirements, very heavy wheel loaders also have the A10VWO emergency steering pump or the EHP compact unit.

The LT31 inch brake valve which like many other Rexroth power braking valves has a proven record and a modular and compact design provides a smart combination of diesel-engine braking via the travel hydraulics and delay from the friction brake.

When the brake pedal is actuated, the hydraulic pump reduces the flow rate from the travel drive. Braking thus takes place using the diesel engine's support torque. Only if the pedal is pressed harder does the brake valve ensure that the brake linings make contact.

This hydraulic power brake, which is integrated in the overall design of the vehicle, offers a number of advantages for wheel loaders:

Advantages of hydraulic power braking systems

- Supplied from existing hydraulic system
- Brake system immediately ready with start of diesel engine
- Brake system can be regulated sensitively, even in heavy machines
- Quick response time
- Space saving through modular design
- Minimal pipework required due to compact design (pedal and all brake components combined in a single block)

Find out more at
www.boschrexroth.com/power-brakes and www.boschrexroth.com/steering



Steering system LAG



Power brake valve LT 31



Emergency steering pump A10VWO

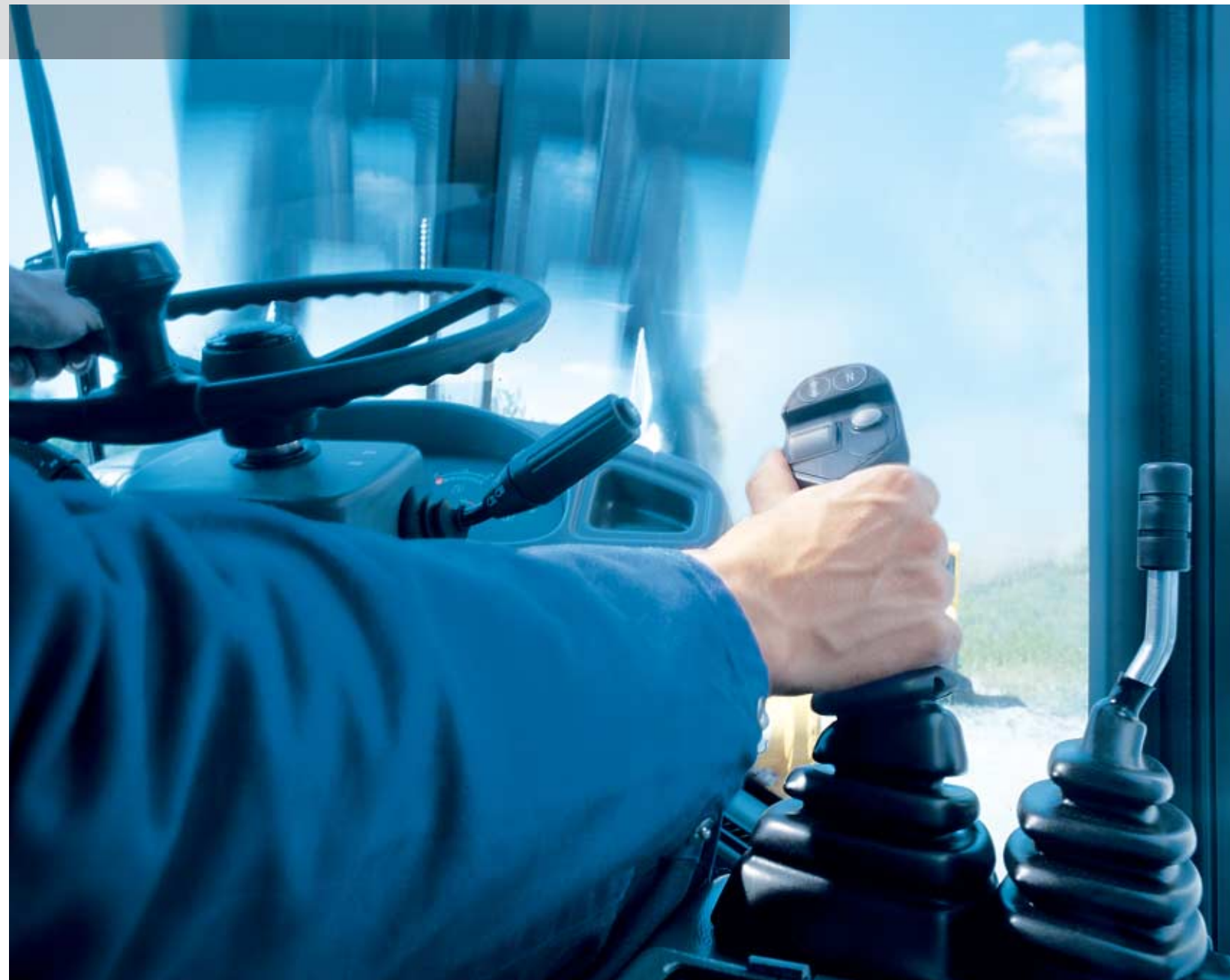


Working Hydraulics – The Ups and Downs of a Wheel Loader

The challenges for working hydraulics range from basic functions to, in the case of top-of-the-range models, complex requirements and supplementary features. Rexroth can meet all these challenges. No matter which wheel loader size, no matter which functional scope.

For working hydraulics, too, the criteria of break-out, operating cost, work output, safety and ease of operation become ever more important. This means new challenges in the development of new working hydraulics systems.

Alongside conventional systems – gear pump with mechanical throttle control – other increasingly user-friendly technologies are developing with many useful additional functions: variable displacement pumps combined with sensitive, load-pressure-independent flow distribution (LUDV technology) from Rexroth enable supply to be matched to demand for several simultaneously actuated work functions. It additionally minimizes energy consumption.

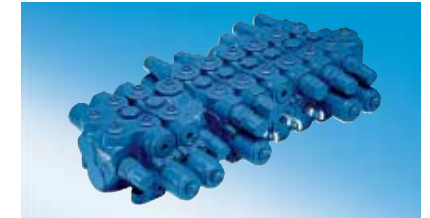


From small but precise ...



AZP gear pump

The so-called open-center working hydraulics are perfect for the less expensive wheel loaders. It is a tried-and-tested technology for economical, robust solutions. This system is based around gear pumps AZP together with the control block SM12.



SM12 throttle control block

The advantages of this system are its simple layout, compact design and the ease of adding functions later-on.

... to the comfort version ...

Three central elements make up this user-friendly system: Pump, valves and controls. It's knowing how these different areas interact with one another that determines the system's practicality.



A10V0 variable pump for open circuit

The A10V0 variable displacement pump offers a large number of different methods for optimizing energy consumption – such as regulation of pressure and flow combined with higher-level power regulation or electro-proportional swivel-angle adjustment. This pump is directly attached to the travel pumps or the diesel engine's power take-off.

The SX and M6 valve systems are the basic units of the high-quality LUDV flow sharing technology for the various different types of



Flow sharing control block M6

wheel loaders. In addition to load-pressure-independent regulation of the flow rate, which enables more than one simultaneous working function to be supplied according to demand, these two systems also offer a number of other advantages: The zero-leak seat valves prevent the bucket from lowering in an uncontrolled manner, while the integrated priority control for the steering reduces the amount of pipework. A special design prevents cavitation when lowering and tipping out the bucket.

... everything under control



THF5 joysticks, handles EC2000+ and EC4000

The hydraulic and electronic joysticks THF and MHVEJ with the ergonomic EC 2000+ and EC 4000 handles make everyday use of the loader easier and more effective: Low actuation forces and proportional control behavior permit sensitive control, while various characteristic curves ensure optimal matching to the working hydraulics. Lock-in positions and reference positions for identifying working points simplify the task of the operator. The handles offer a wide selection



Control oil supply MHTSE

of switches, rollers, rockers and buttons. For control blocks with no integrated control oil supply there is the compact control oil supply unit MHSTE for serving up to three independent high-pressure circuits. This offers integral pressure limitation valves and shuttle valves as well as various safety functions.

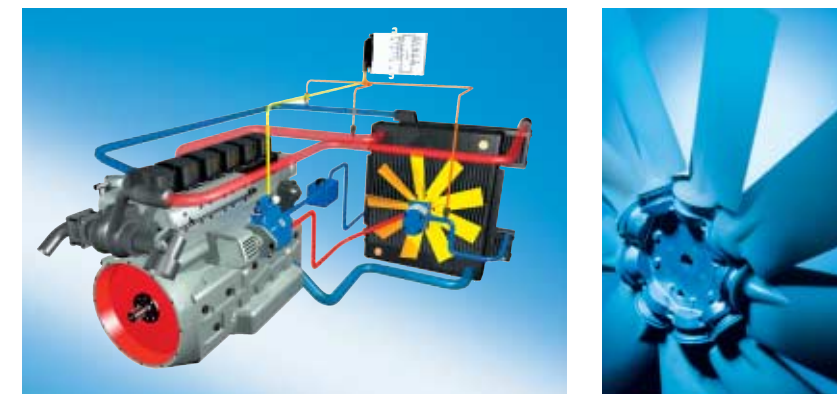
Find out more at
www.boschrexroth.com/control-blocks and www.boschrexroth.com/joy-sticks

Fan Systems – Fresh Air for Your Wheel Loader

From a technical point of view, ventilation systems are a thankless task. Spending further energy for already lost energy. This hurts less if the demand can be kept low and the unavoidable expenditure minimized. The experience of the fan system specialists at Rexroth ensures the ideal solution for any size of wheel loader.

Rexroth fan drives reduce the energy requirement to a minimum. Depending on the fan output required, either constant pumps or variable displacement pumps A10V0 will be used. Regulation is either purely hydraulic or electronic. Rexroth offers both. This also includes complete software solutions based on Rexroth electronic controllers RC. This wide range of proven standard modules and concepts enables fan systems to be developed quickly and cost-effectively.

From sensors, analog and digital controllers to pumps and motors – Rexroth can supply the right fan system for any type of wheel loader, from simple to complex.



Electronics – Making Wheel Loaders Smart

Drive control, load limiting, automatic gear shifting, electronic parallel guidance of bucket – these are just a few of the elements of a control system in a modern wheel loader. Rexroth has worked in close cooperation with Bosch to produce a comprehensive range of electronic hardware and software, specially developed and tailored for hydraulics and the rugged conditions found on construction sites. Where could you find a greater collection of expertise in vehicle electronics and drive management than at Bosch and Rexroth?

The Rexroth hardware module

Electronic hardware in wheel loaders has a lot to endure: vibration and shock up to 25 g, temperatures ranging from -40°C to $+85^{\circ}\text{C}$ (-40°F to 185°F), not to mention dust, gritting salt, mud and electromagnetic radiation from the neighboring transformer station. It must therefore prove in the Bosch laboratories that it can withstand these demands long-term and according to standard test procedure. This is why we carry out production ourselves. Our hardware is manufactured on highly automated production lines at Bosch plants. And all this with maximum flexibility in the application. You will only get this from Rexroth. The Rexroth hardware module incorporates all the components for the electronic control of a wheel loader.

- RC control unit for 2 to 12 proportional solenoids and 2 to 18 switching functions, with Rexroth I/O modules virtually expandable as required. Moreover, the protection class is IP65 and IP69K.
- Sensors for measuring engine speed, direction and angle of rotation, pressure, temperature and oil cleanliness.
- One of the few displays for tough outdoor use with protection class IP69K can be found at Rexroth – the DI2. Of course, it is CAN-bus compatible and can even be operated safely with gloves.



The Rexroth software module

Turnkey, affordable software solutions that can be adapted to your wheel loader without any programming skills: This is exactly what we can provide you, upon request extended by individual software customizations or even tailor made software solutions according to your specs. All software packages will have been tested, trialed and provided with detailed operator instructions to enable quick and simple integration. The user-friendly service software is, of course, also included.

We supply the most important basic and supplementary modules for your modern wheel loader off the shelf in the form of standard software packages:

- DRC Drive control
- AGS Automatic gear shifting
- ASR Anti-slip control
- EDP Electronic drive pedal
- ADC Automotive drive control
- ECO Ecodrive
- LLC Load limiting control
- AFC Automatic fan control



Find out more at www.boschrexroth.com/mobile-electronics



Services for Wheel Loaders – Wherever There's a Wheel Loader, There is Rexroth

A wheel loader has a long service life. If support and service are right. Our mobile hydraulics service department is at your service as a specialist partner for all aspects of drive and control solutions for wheel loaders. At over 80 sites around the world.

So you can have confidence not only in a product range that is unique in the marketplace, but in individual consultation and comprehensive services that leave nothing to be desired.



Service – Support during commissioning



We have a comprehensive range of services for making the decisive moment a successful moment:

- Engineering support provided by a specially-trained field service team
- Comprehensive prototype testing
- Commissioning of systems and equipment
- Measurements and troubleshooting as service support

Repairs



Retrospective supply says a lot – if not everything – about the quality of a system developer. We offer:

- Rapid and reliable repairs and modifications
- International network of modern repair workshops with qualified engineers and online access to the latest design data.
- On-site repair by our field-technicians
- Warranty as for new parts
- Replacement system Reman

Spare parts service



This Rexroth service is known for its prompt and skilled response:

- Quality original replacement parts from the manufacturer
- Pre-assembled subassemblies and kits
- Well-developed worldwide logistics system
- Spare parts also after the series has been discontinued

Training and consultancy



He who knows a lot can move a lot – this statement sums up our basic and advanced training courses in mobile hydraulics.

At www.boschrexroth.com/mobile-training you can find out about courses currently on offer.

Reaching the Goal Means Starting Again



Your wheel loader is ready. Your idea has been turned into a reality. Everyone now has some exciting weeks to look forward to. How will the prototype prove itself in practice? Are there any possible problems? Is everything true to the inventor's original design? This commissioning procedure is to be carried out exhaustively and with great precision; we monitor it with the greatest care and attention. Always ready to provide and implement solutions rapidly.

Where there's a wheel loader, Rexroth will be there

You can feel the tension. But you can also detect optimism and pride. This is a highly significant phase for everyone involved in the project. This is why Rexroth has experienced commissioning engineers on hand to make sure nothing goes wrong at the last minute. And we do all this on site. At your premises. As a global player with service and production sites in more than 80 countries, we can guarantee more than just local knowledge. One thing soon becomes clear: whenever you come up with a good idea for your wheel loader, we won't be far away. Talk to us.



www.boschrexroth.com/addresses

Bosch Rexroth AG
Mobile Hydraulics
Glockeraustraße 4
89275 Elchingen, Germany
Tel. +49 (0) 73 08-82 0
Fax +49 (0) 73 08-72 74
info.brm@boschrexroth.de
www.boschrexroth.com/brm