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Components, Systems and Service for Wheel Loaders

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Note: The information in this brochure relates to the operating conditions and applications described. For applications and operating conditions not described, please contact the relevant technical department. All technical details are subject to change without prior notice.
HYDAC has been one of the leading suppliers of fluid technology, hydraulics, electronics and cooling equipment for more than 50 years and has over 8,000 members of staff worldwide.

With our wide range of products, and with our acknowledged expertise in development, manufacturing, sales and service, we provide solutions for the entire range of requirements in the machine tool industry.

For use in various wheel loader applications, HYDAC offers a wide range of sector-specific components and systems from the areas of hydraulics, cooling, electronics, software and control technology in addition to its standard products. Intelligent integration of products also creates innovative and technologically advanced subsystems and complete systems for the increased requirements of special machinery.

Customer benefits:
- Cost optimisation achieved by customised system solutions which use standard components
- Reduction in number of models through standardisation and modular construction
- Global yet local
  - More than 45 overseas companies and over 500 sales and service partners
- Fluid engineering and service: Support in technical design for commissioning, maintenance and training and in the event of claims
- Customised solutions: Designs can be tailored to individual customer requirements, made-to-order solutions for your machines
- Advice on and implementation of the safety requirements in accordance with DIN EN ISO 13849

Wheel loader versions

- **Farm loaders**
  - up to 37 kW
  - Hydrostatic transmission drives
  - Hydraulic supply via gear (fixed-displacement) pumps
  - Manually with hand-lever control, direct wiring
  - Quickcoupler systems (mechanical & hydraulic)

- **Compact & swing loaders**
  - 38 – 74 kW
  - Hydrostatic transmission drives
  - Hydraulic supply via fixed-displacement or variable-displacement pumps (also in combination)
  - Direct hand-lever control and pilot-operated 2 stroke-way main control manifolds with joystick
  - Quickcoupler systems (mainly hydraulic)
  - Simple hoist suspensions (mainly for high speed loaders > 30 km/h)
  - Hydraulic start/stop system

- **Mid-sized & industrial wheel loaders**
  - 75 – 120 kW
  - Hydrostatic or hydrodynamic transmission drives
  - Hydraulic supply via LS pump systems (also in combination with fixed-displacement pumps)
  - Pilot-operated main control manifolds (2 stroke-way) with joystick (hydraulic or electrical)
  - Demand-controlled fan control (hydraulic & electrical)
  - Hydraulic quickcoupler systems
  - Load-pressure-adjusted hoist suspensions

- **Large loaders**
  - 125 – 275 kW
  - Mainly hydrostatic transmission drives
  - Hydraulic supply via LS pump systems (multiple-pump combinations)
  - Hydraulically pilot-operated main control manifolds (2 stroke-way) with joystick (hydraulic or electrical)
  - Demand-controlled fan control (hydraulic & electrical)
  - Hydraulic quickcoupler systems (the larger the loader, the less frequent the application)
  - Load-pressure-adjusted hoist suspensions — standard in larger loaders
  - Increasing use of additional joystick steering (with 20 km/h approval/no road approval)

- **Mining loaders**
  - >280 kW
  - Hydraulic transmission drives
  - Hydraulic supply via LS pump systems (multiple-pump combinations)
  - Hydraulically pilot-operated main control manifolds with electrical joystick control
  - Demand-controlled fan control (hydraulic)
  - Load-pressure-adjusted hoist suspensions — standard
  - Joystick steering mainly used

- **Wheel dozers**
  - Mainly hydrostatic transmission drives
  - Hydraulic supply via LS pump systems (multiple-pump combinations)
  - Hydraulically pilot-operated main control manifolds (2 stroke-way) with joystick (hydraulic or electrical)
  - Demand-controlled fan control (hydraulic & electrical)
  - Increasing use of additional joystick steering (with 20 km/h approval/no road approval)

Wheel loader applications

- Digging, excavation & levelling work
- Transporting loose material
- Handling & transport work
- Municipal services
Energy efficient, safe, comfortable.

Challenges in the various wheel loaders

The development of modern machinery is interconnected: wheel loaders across the various wheel loader size classes must compete in the same market. This requires compact and robust design as well as efficient performance characteristics, which are best achieved through the use of modern electronic technology.

Changes in the regulatory framework result in increased investment in the functional safety of the assistance and visualisation systems. Ever more complex open-loop and closed-loop control processes go hand-in-hand with the enhancement of the productivity and efficiency of the machines. The machine operators, too, must be supported and the work process is optimised in this context with the aid of modern electronic technology.

HYDAC’s contribution

HYDAC offers a variety of components and systems that meet these requirements and help your customers to meet the ever-increasing demands. HYDAC’s modular system approach allows a customer-specific solution for your device.

HYDAC’s key issues

Our development team and application engineers are working continuously to further develop our products. The focus of these developments is on the following key topics:

- **Electro-hydraulic system solutions** as the interface between actuators and sensors.
- **System intelligence**
- **Electro-hydraulic control technology**

The demands of modern wheel loaders are leading to ever-increasing complexity of control systems. Modern machinery requires a variety of assistance and control systems wherever simpler operating concepts and a better overview and controllability of the machine functions become necessary.

**Electro-hydraulic control technology**

From component to intelligent drive solution.

HYDAC offers everything from a comprehensive range of components and systems to complete solutions, including the corresponding application software.

**Your benefits**

- Energy efficiency
- Reduced fast wear
- Lower hydraulic losses
- Energy saving and increased productivity
- Reduced temperature control
- Reduced electrical power requirement
- Reliability
- Certified software modules
- Systems for functional safety
- Available in two versions by protecting materials
- Noise reduction
- Customised control
- Health & safety
- Reduced exposure by dust to the driver
- Reduced noise exposure for the driver
- Taken up less space
- Combined functional units
- Minimum floor space
- Reduced electrical power requirement
- Reduced installation space
- Increased functional safety
- Reduced fast wear
- Reduced weight
- Reduced oil and leakage points
- Confirmed
- Validation by the customer itself
- Reduced oil and leakage points
- Quality assurance
- Extended warranty for the driver
- Reduced machine performance on longer jobs
- **NOX**
- **Compliance with the Emissions Directive**
- Reduced pollutant (impact and NOx)

**System intelligence**

Electro-hydraulic system solutions as the interface between actuators and sensors.

The demands of modern wheel loaders are leading to ever-increasing complexity of control systems. Modern machinery requires a variety of assistance and control systems wherever simpler operating concepts and a better overview and controllability of the machine functions become necessary.

**System development**

Based on the customer’s requirements, HYDAC offers support across the spectrum with developing electro-hydraulic system solutions or complete machinery. The scope of development is determined together with the customer according to the task.

**Software development**

Depending on the tasks at hand, the following programing languages can be used to program the application software:

- **C/C++**
- **Java**
- **MATLAB/Simulink**

**System development support**

HYDAC offers extensive consultation and support for customer projects with regard to:

- **Planning and test (mobil test)**
- **Definition and description of safety functions**
- **Seating safe system architectures and user interfaces (hibi)
"MATCH" development environment

**MATCH** Mobile Application Tool Chain

With the "MATCH" (Mobile Application Tool Chain) development environment, HYDAC offers a tool chain for system-level software development by the customer that is specially suited to the requirements of mobile machinery. "MATCH" supports development from defining the system at the vehicle level and creating the application software to start-up, testing, and documentation.

"MATCH" offers modules for:
- Defining the system at the vehicle level
- Starting up and servicing the machine
- The software level (e.g. on basis of HYDAC Electronic RTB Box)
- Documentation

Furthermore, an "embedded MobileWare" is offered which permits a hardware-independent programming of the application which contains a multitude of basic functions. A comprehensive selection of library modules (e.g. for sensor and valve drives) is also available for an efficient development of the application software.

**Functional safety**
"MATCH" can also write application software with increased functional safety according to the following safety standards with TÜV certification:
- "SIL 2" to "SIL 3"
- "PL d" to EN ISO 13849

**Software library**

In order to make software development significantly easier for the customer, HYDAC offers software libraries with ready-made modules as part of its "MATCH" development environment. The library modules can be configured and parameterised as desired.

Examples of library modules include:
- Sensors
- Switches
- Proportional and switching valves
- Relays, LEDs
- Transfer functions/signal elements

Special error modules can also be used to detect system errors.

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**SENSORS, SYSTEM ELECTRONICS AND CONTROL SYSTEMS**

Solutions perfectly tailored to the application—all from one single source.

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**Sensors**

The range of sensors includes products for measuring pressure, temperature, distance, position, level, flow rate, speed, inclination and angle as well as contamination and oil condition. In addition to products for standard applications, the product portfolio covers special applications such as potentially explosive atmospheres or applications with increased functional safety.

- Electronic sensors and controls to complement the system electronics.
- Max. load regulation
- Electro-hydraulic load sensing
- Working hydraulics
- Positioning
- Controls of special equipment
- Switch-off devices
- Safety systems

**Function**
The function of "MATCH" family of controllers, HYDAC offers the right platform for a wide variety of requirements and applications—always efficient, safe, reliable and flexible. The controllers are designed for use both in complex centralised control architectures and in decentralised ones.

HYDAC supplies the right controller for each machine size, based on the number of inputs and outputs, the controllers can be classified into the following groups:
- The HY-TTC 30 with up to 30 I/Os, the middle group HY-TTC 50/90 with up to 50 I/Os and HY-TTC 500 family, covering a wide scope, with even up to 96 I/Os. The highly flexible configurations of inputs and outputs make solutions possible for all kinds of functions and machine types. Thanks to their internal diagnostic and monitoring functions, the controllers are also suitable and certified for basins with increased safety requirements up to SIL 2 PL d.

**Features**
- The sensors are available with a variety of output signals, connectors and fluid port connection options
- Robust design
- ECE type authorisation
- Approved for potentially explosive atmospheres
- Separate product portfolio, especially for applications with increased functional safety ("SIL 2.3","PL d")

**Mobile controller HY-TTC series**

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**Features**
- Depending on version, certified to SIL 2 PL d
- Programming in C/CH+, CODESYS
- 62 kB, 128 kB, 256 kB or 3MB RAM
- 30, 50 or 96 inputs and outputs
- All inputs and outputs are configurable and are provided against parameterisation changes
- Stabilised sensor voltage supply with internal monitoring
- No reset caused by dip in voltage when starting engine
- Aluminium die cast housing with waterproof connection plugs, including a waterproof Gore-Tex membrane for hydraulic balance
- E12 type approval

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**I/O Expansion Module HY-TTC 30X / 30XS**

**Function**
The HY-TTC 30X series of I/O expansion modules provides an outstanding power balance combined with extremely compact design. The HY-TTC 30X series expansion modules are integrated very easily.

They provide a simple extension of on-board electronics.

The communication and integration of the extension modules takes place via CANopen according to CiA DSP 401. It enables inputs and outputs to be configured and parameterized via the control configuration of the available control device in a simple and uncomplicated way.

The different I/O modules provide a large number of high performance switching outputs or diverse PWM outputs with internal current measurement as well as configurable analogue and flexible digital inputs.

Our product range includes two additional safety-oriented versions for the implementation of distributed applications with enhanced functional safety (Safety PL C, EN ISO 13849).

**Features**
- PLc (HY-TTC 30XS)
- Freely configurable Node-ID via pin
- 30 I/Os, up to 8 PWM outputs, 6 of these with integrated current measurement
- Robust, very compact housing

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**Mobile display HY-TTC eVision²**

**Function**
The compact background-lit TFT colour displays with integrated high-end display controller are characterised by a very high image quality, low reflections and high colour saturation as well as optimal readability, even under the most unfavourable light conditions.

The displays are protected by a robust aluminium or plastic housing and can be either built directly into the instrument panel or surface-mounted in the field of vision of the driver/operator using a RAM Mount® system in the cockpit.

Ten programmable illuminated control keys along with the optional touchscreen feature create an easy-to-use human-machine interface.

Two external cameras can be connected to the display via the two integrated composite video ports, and controlled via software.

**Features**
- User-friendly, self-explanatory and time-saving graphical design and operation interface
- Good portability via CoDeSys platform
- High image brilliance
- High refresh rate
- Fast boot-up times
- Impressively displayed option such as 3D, picture-in-picture, overlapping effects, etc.
- Two picture can be displayed simultaneously
- Up to 4 CAN, USB and Ethernet interfaces
- Reliable housing with appealing design, suited for mobile applications
- WLAN-compatible
- Standby & wake-up

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See catalogue 18.500 – Control Technology for Mobile Machinery

See catalogue 18.000 – Control Technology for Mobile Machinery

See catalogue 18.500 – Control Technology for Mobile Machinery

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![System intelligence](image)
Hydraulic systems
The optimal working hydraulics for fast, precision and efficient control.

Open center directional control valves
HYDAC's open center directional control valves offer a modular system with robust, energy efficient and cost-effective solutions for mechanical, pneumatic and hydraulic systems.

Features:
- Available in monoblock, multi-section and sectional designs
- Key data: Qmax, pmax = 100 l/min; 350 bar
- Energy efficient O-ring option
- Robust, high-quality and maximum controllability
- Low internal leakage
- Inlet selector for safe flow distribution
- Electrical shut-off of pump volume
- Main consumer in parallel, series and tandem sections
- Simple integration of secondary valves
- Optional spool position indication of the main spool control
- Optional also for use with LS variable displacement pumps

Load-sensing directional control valves
HYDAC's load-sensing directional control valves offer you a modular system with which to design load-compensated, energy-efficient and cost-effective solutions for mechanical, pneumatic, hydraulic and electro-hydraulic systems.

Features:
- Multi-section and sectional designs
- Key data: Qmax, pmax = 100 l/min; 350 bar
- Extralow 10 mm stroke apron for high-precision control
- Independent of the load, parallel operation is possible without mutual interaction
- Simple integration of secondary valves
- Inlet selector for safe flow distribution
- Electrical shut-off of pump flow
- Optional speed-position indication of the main spool control
- Possible to shut down individual sections while maintaining full functionality in remaining sections

Key data for load-sensing directional control valves (see photos on right):
- RS 160 directional control valve Qmax = 70 l/min; pmax = 250 bar
- RS 210 directional control valve Qmax = 140 l/min; pmax = 350 bar

Mobile cooler combinations (EMC) for demand-driven cooling of all kinds of media (oil, air, water, air, oil, etc.): Available customized to individual requirements and installation conditions, and as external chillers.

Mobile control elements, such as hydraulic or electro-hydraulic controls, for the speed control of wheel loaders and all-terrain forklifts, for example: Available for all hydraulic system versions and all function groups: Not only for simple pressure control, but also for steering or the vehicle braking system. The fan drives can be realized on the basis of electric or electro-hydraulic controls. A pressure cut-off is ready for installation, which is already integrated into the fan motor. To prevent any drop in the fan motor.

Our directional control valves offer you a modular system that is suitable for design complex control systems. Particularly suitable for design load-sensing valve systems, with manual, electro-hydraulic or proportional control. The number of additional valves can be reduced by using of special spacers.

Optimally, our electro-hydraulic additional steering control can be realized in all-wheel steering systems with various steering types with various steering modes, thus for all excavators and wheel loaders. For larger wheel loaders and industrial loaders, we can also realize additional steering control for the steering system.

Our energy storage blocks are used in wheel loaders for hydraulic oil supply to safety or safeguard functions, such as the vehicle steering or the vehicle braking system.

For medium-sized wheel loaders and back can be used for load distribution to supply a motor-pump assembly for steering or the vehicle braking system, as well as a multi-pump assembly with pressure control of oil that is ready for installation, available in a 12-volt or 24-volt version. An integrated temperature switch provides protection from overheating.

The hydro-mechanical braking system (HHS) is used in wheel loaders with internal or external braking (braking air to the front). Wheel loaders prevent pitching vibrations from occurring during transport journeys. It can be adjusted to suit any machine, and any load can be used for simultaneous braking or for braking only, which significantly increases the driving stability, steering performance and overall driving safety of the wheel loader. Various systems can be provided, depending on the wheel loader size.

Our electrical control valves are used for additional control of further actuators from one single oil supply. Frequently used as a steering control, in addition to the electrical system or multifunctional attachments (such as winches, lifting buckets, bottom-pump or grapple buckets and lifting gripper jaws). Available in various power ranges.
Robust sensors work-hydraulics pump. The energy re-
after an automatic “idle stop”, the diesel 
hydraulic motors. A modified form can also be used as
example, work-hydraulics pumps in 
infrastructure can normally be used to 
in mobile machinery, existing hydraulics 
systems have already become 
required for this is taken from a hydraulic 
machine operation.
The hydraulic start-stop solutions gene-
for energy efficiency, available space and safety, the 
to satisfy the requirements in modern working machinery 
loaders or other material 
wheel loaders and industrial 
modern working machinery 
applications.

### Pilot control manifolds/ PCM

- Amber valve: electronic control
- Preselect control: electronic control
- Flow rate changepump: ball, piston, etc.
- Flow-optimised valve design
- Low hysteresis and high resolution due to innovative
- The result is a precision controllability.

### Cartridge valves for gear applications

- Meshing in gearboxes in construction machines 
- Ideal for clutch applications
- Boost function: possible for higher torques

### Mobile valves for compact wheel loaders

- The S400 is a pneumatics- and- hydraulic valve 
- The hydraulic start-stop solutions can be combined in one space-saving unit that is optimised for 
- Charge brand: central manifold
- Maximum pressure setting with high mechanical 

### Cooler-filter-tank combination & fan drive

- According to legislation, an emergency steering system 
- 12.5 kW
- 23 kW
- 50 kW

### Emergency/safety supply

- In mobile machinery, existing hydraulics 
systems have already become 
required for this is taken from a hydraulic 
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For modern working machinery 
loaders or other material 
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Hydraulic supply
Optimal solutions from the HYDAC technology platform.

Electro-hydraulic steering

- Axial piston pump PPV100S
- Internal gear pump PGI
- External gear pump PGE
- External gear motor MGE

HYDAC offers a wide portfolio of accumulators and pulsation dampers, with the HSE series being of particular interest. These are equipped with position monitoring of the main spools, redundant pilot valves for load-pressure adjustment and turning on the lifting cylinders, as well as shock valves in the steering cylinder connections to protecting the driving stability. This makes it possible to achieve higher capacities and higher driving stability. The HSE-10 to HSE-16, depending on the lifting cylinder sizes.

Hoist suspension

- Hydro-pneumatic cab suspension
- Floating bearing suspension systems
- Pulsation damping
- Damping tasks
- Functionality of the machines and thus minimising stress for both machine operators and mobile machines. This enhances the working comfort and safety of the machines and thus minimises stress for both machine operators and mobile machines.

Applications, suspension, steering

- Flow rate up to 15 l/min
- Savings on both space and weight
- Efficient cycle times
- Protection of system components
- The filters can also be used in explosion-hazard areas (ATEX).

Electro-hydraulic auxiliary steering for all-wheel & crab steering

See brochure 10.116.5 - Hoist Stabilising Unit HSE-16

- HYDAC variable displacement pumps for main functions:
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- External gear pump PGE
- Axial piston pump PPV100S
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## Cooling

- **HEPA filter**
- **Active carbon filter**

### Properties
- Variational temperature control
- High performance air filters with very good air contamination properties
- Low maintenance

### Additives
- **Inversely proportional pressure relief valves** (fail-safe valves)
- **Directional control valves**
- **Hydraulic and electro-hydraulic controls** for regulating fan motor speed with optional reversal

The efficiency of a cooler also depends greatly on the fan control. The cooling system is considered as a whole. Installation resistances and additional heat are cumulative factors. The dimensioning and simulation software KULI, which is also used in automotive technology and guarantee optimal operation of the piston rod. FE simulations or fatigue strength calculations also come under our expertise. With our clean room in the FluidCareCenter, we promise you exceptional cleanliness, even in stainless steel.

### Accessories for every sector

**For the competition of hydraulic systems**
- **Fuel filtration and intake valves**
- **High pressure, low pressure, coaxial valves**
- **Cylinders and joint modules**
- **Pressure measurement, service and control concepts**

**Customer benefits:**
- Fast initial startup (option)
- Early detection and prevention of damages

### Cylinder systems

- **CabinAirCare**
- **CabinAirCare**

**Customer benefits:**
- Easy to install and expand
- High performance air filters
- Robust and simple connection

### FluidCARE Center

- **CabinAirCare**
- **CabinAirCare**

**Customer benefits:**
- Greater system availability
- Versatile design – can be used on a variety of systems

### Condition Monitoring and Service

**Customer benefits:**
- On-going continual development of expertise and processes to meet the increasing requirements and needs of customers
- Reduction in Life Cycle Cost
- Increased system availability
- Greater system availability
- Versatile design – can be used on a variety of systems

## Manufacturing 

- **Steering cylinder with integrated distance measuring system**
- **Hoses and lines, pipes and cables**
- **TS (clamping band + console)**

**Customer benefits:**
- Sufficient system reserve (fan power, media sizing)
- Easy to install and expand

## Fluid Conditioning Systems

**Customer benefits:**
- Clean filling and flushing
- Versatile design – can be used on a variety of systems
- Customised design
- Production in Life Cycle Cost

## HYDAC Filter Technology

**Customer benefits:**
- High performance air filters
- Variational temperature control
- Low maintenance

**Additional solutions**

- **CabinAirCare**

**Customer benefits:**
- Sufficient system reserve (fan power, media sizing)
- Easy to install and expand

## HYDAC Fluid Care Center

**Customer benefits:**
- On-going continual development of expertise and processes to meet the increasing requirements and needs of customers
- Reduction in Life Cycle Cost
- Increased system availability
- Greater system availability
- Versatile design – can be used on a variety of systems

### Hardware and software

- **CS 1000**
- **HYDACLAB®**

### Monitoring and control

- **Level (SMS)**
- **ANALYSIS**

**Customer benefits:**
-在现场使用专用软件（HMG series），可以使用专有的数据分析工具，为客户提供先进的数据管理解决方案。