

# **HYDAC** INTERNATIONAL

**Systems and components  
for construction  
machines**







HYDAC Head Office in Sulzbach/Saar



HYDAC China



HYDAC Japan



HYDAC Korea



HYDAC USA



HYDAC France



HYDAC Italy

# HYDAC in mobile and vehicle applications.

Fluid power and electronics systems and components for mobile and vehicle technology applications.

Since we were founded in 1963, our constant innovative development has helped us to become a company group with some 8,000 employees, with a presence in nearly all sectors.

In addition to existing components, HYDAC can provide system solutions customised to suit your specific fluid power and electronics requirements.

To help us with this, we have established a mobile technology engineering team that can use our company's expertise to assist you.

HYDAC can thus provide you with worldwide comprehensive engineering services, both in consulting, joint development and trials and in the realisation of your projects and in service.

All of this is based on our extensively tried-and-tested, top-quality hydraulics and electronics programme.

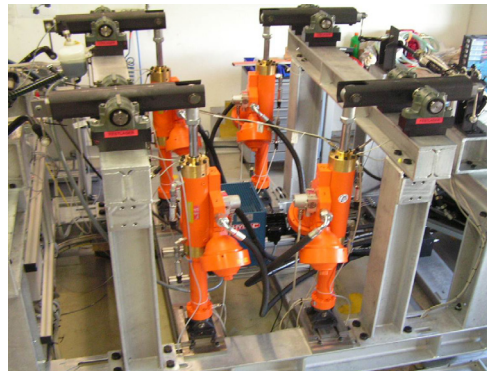
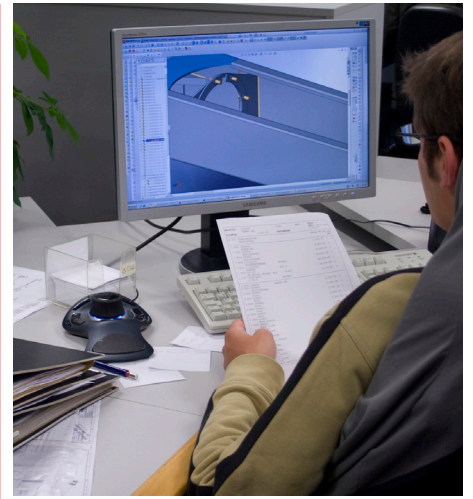
We also perform work to DIN ISO 9001 as a matter of course.

For detailed information on our products, please do not hesitate to contact us directly. For joint project drafting and systems, please get in touch.

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.









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

## Electro-hydraulic control technology

From component to intelligent drive solution.

HYDAC offers everything from a comprehensive range of hydraulic and electronic components to subsystems, right through to finished functional solutions that can also include the corresponding application software.

### USER LEVEL

- Displays for the most demanding visual requirements
- Peripherals, e.g., joysticks

### CONTROL LEVEL

- Controllers in various classes
- I/O expansion modules
- Standard version and versions with increased functional safety

### SENSOR LEVEL

- Pressure, temperature and level
- Distance, position, angle, inclination and speed
- Flow and oil level
- Standard version and versions with diagnostics and increased functional safety available

### ACTUATOR LEVEL

- Pilot-controlled and direct-acting valves
- Control blocks (monoblock/sandwich)
- Pilot and primary control systems
- Intelligent axes
- Cylinders, pumps and motors

► See catalogue 18.500 – Control Technology for Mobile Machinery

## Functional safety

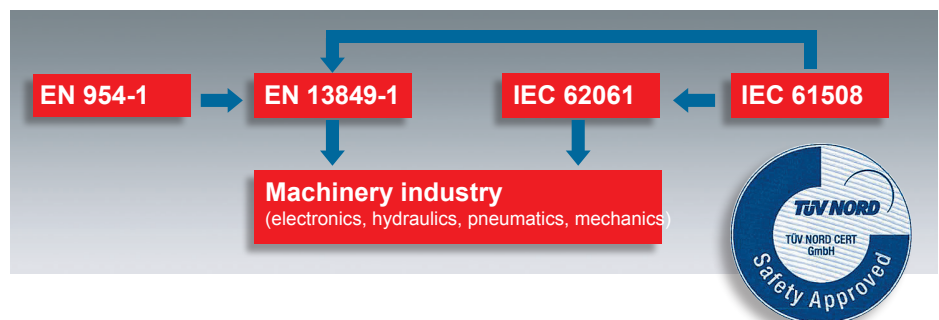
The technical requirements with regard to functional safety are derived from the standards IEC 61508 and EN 13849.

HYDAC provides:

Controllers and I/O modules certified to  
- IEC 61508, SIL 2 (3) - EN 13849, PL d (c)  
Other components for applications  
with increased functional safety

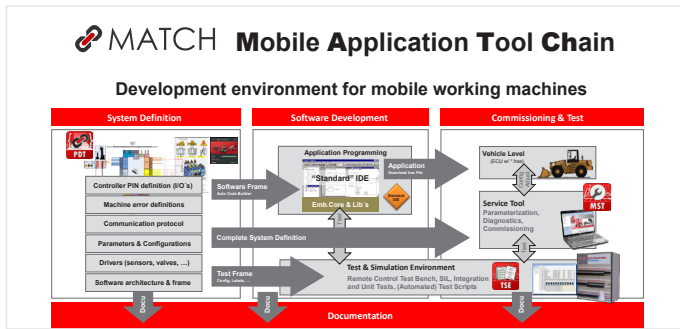
- Sensors - Valves  
Support provided throughout, from risk analysis  
to certified machine function

► See brochure 18.700 – Functional Safety in Mobile Machinery





## "MATCH" development environment



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
- Testing software
- Documentation

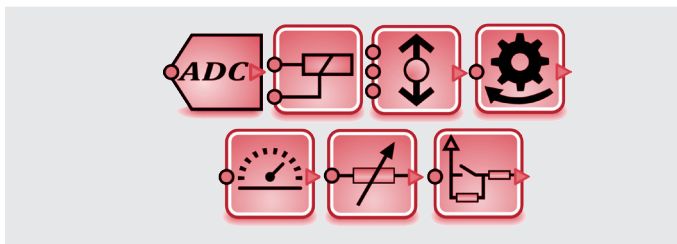
Furthermore, an "embedded Middle Ware" is offered which permits a hardware-independent programming of the application and which contains a multitude of basic functions. A comprehensive selection of library modules (e.g. for sensor and valve drives) is also available for an efficient development of the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

### Functional safety

"MATCH" can also write application software with increased functional safety according to the following safety standards:

- "SIL 2" to IEC 61508
- "PL d" to EN ISO 13849
- "AgPL d" as per ISO 25119 or EN 16590

## Simulation technology

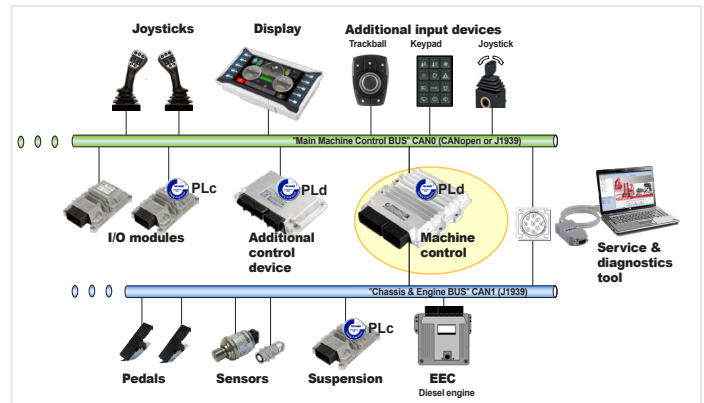


The quality of a hydraulic system is determined by a well-coordinated interplay of a number of single components, often very many, such as pumps, cylinders, motors, valves, accumulators, line systems and electronic components. Particularly when strict requirements apply for the system dynamics, the precision of control processes and safety-relevant functions, it is vital for detailed information on expected operating behaviour to be made available as early on as possible.

Hydraulic simulation makes it possible to perform extensive analyses and optimisations of the systems in early development phases, minimising time-consuming and costly adjustment work and work in the trial field.

Using hydraulic simulation in conjunction with the simulation of multi-component systems also makes it possible to take into account the effect of complex kinematic structures and their retroactive effect on drive behaviour.

## System development



Example of control architecture

Based on the customer's requirements, HYDAC offers across-the-board support in developing electro-hydraulic control systems for mobile machinery. The scope of development is determined together with the customer according to the task.

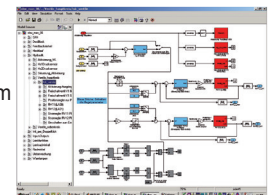
Services can include:

- Creating customer-specific application software (according to specification)
- Integrating intelligent subsystems into the customer's machine (e.g., suspension systems, secondary steering systems, fan controls)
- Complete control solutions for mobile machinery (safety functions, electrical/electronic control architecture, application software)

## Software development

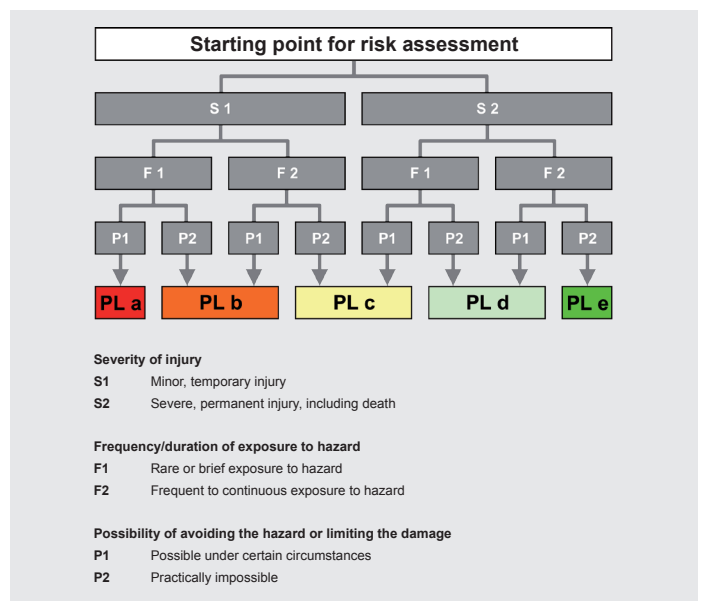
Depending on the hardware, the following programming languages can be used to program the application software:

- CoDeSys 2.3 / 3.5 / 3.5 SIL2
- C
- MATLAB/SIMULINK



Programming languages

## System development support



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

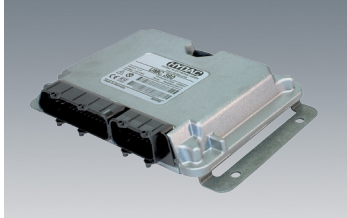
- Hazard and risk (H&R) analysis
- Definition and description of safety functions
- Drafting safe system architectures and user interfaces (HMIs)



# Sensors, system electronics & accessories for your control systems

The main components for controlling the vehicle's precision hydraulics.

## Controllers for general applications



16-bit controller

HY-TTC 50  
(Standard controller)  
HY-TTC 60  
(Extended controller)  
HY-TTC 90  
(Extended controller  
with SIL 2 PL d)

Simple to high-end controls for complex and safety-critical applications (SIL 2-3)

The HY-TTC 500 controller series is based on a 32-bit processor with a modern micro-controller platform.

The controller is notable for its impressive 96 inputs and outputs and for its high performance capability. This new HY-TTC 500 controller series is therefore especially suitable for complex control tasks in centralised and decentralised control architectures.

The controller has three alternative PWM shut-off groups for differentiated safety functions.



32-bit Controller

HY-TTC 500  
(Extended controller  
with SIL 2 and PL d)

Functional Safety  
PL d  
SIL 2

## I/O expansion modules



HY-TTC 30X

Functional Safety  
PL c

### HY-TTC 30X

- 30 inputs and outputs with very flexible configuration
- For work functions with increased functional safety to Performance Level c

### HY-TTC 48XS

- 48 inputs and outputs with flexible configuration
- For work functions with increased functional safety to Performance Level d

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 extension 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).

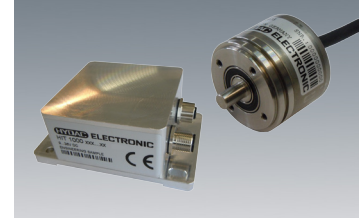
## Sensors



Linear position/distance sensors



Pressure transducers/  
pressure measurement switches



Linear position and distance sensors



Sensors for increased functional safety  
requirements (e.g. PL d, SIL 2)

Functional Safety  
PL d  
SIL 2

The range of sensors includes products for the measurement of pressure, temperature, distance, position, level, flow volume, speed, inclination, 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



## Mobile display HY-TTC eVision<sup>2</sup>



Displays with integrated HY-eVision<sup>2</sup> controller

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<sup>®</sup> system in the cockpit.

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

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

## Operating elements / HMI



G-Pro joystick



Electronic operating elements

An innovative HMI, fitted with a thumb joystick, with optional operator keypads and an integrated controller combined with a modular HYDAC control unit. Up to 6 current-controlled PWM output signals for up to 3 prop. axes can be controlled directly and max. 3 further S/W outputs can be controlled via the keys. This HYDAC HMI G-Pro unit is ideal for controlling additional units or for equipping/retrofitting add-on units.

- Electronic operating elements available with integrated or external keypad or integrated display

## Measurement Technology



Fluid level sensor



Oil condition sensor HYDACLab<sup>®</sup>



Portable data recorders HMG 2500 / HMG 4000

For over 30 years, HYDAC has supplied portable data recorders and various sensors for monitoring hydraulics circuits in stationary and mobile machinery applications. The two new portable data recorders HMG 2500 and HMG 4000 represent the next evolutionary step, achieved on the basis of the latest technology. With their intuitive user prompting, they are perfect for maintenance, start-up and service.

## Radio remote controls



- Complete remote control systems for proportional operation in different applications



# Hydraulic hybrid technology

In many construction machines, the typical work cycles involve phases of high dynamics with pronounced load peaks. This makes it possible to save fuel by implementing hybrid systems on the machines.

These hybrid strategies allow the diesel engine to be downsized, for example. In such a case, load peaks are covered by the hybrid system (peak shaving).

Having a "smaller" diesel engine then results in reduced fuel consumption.

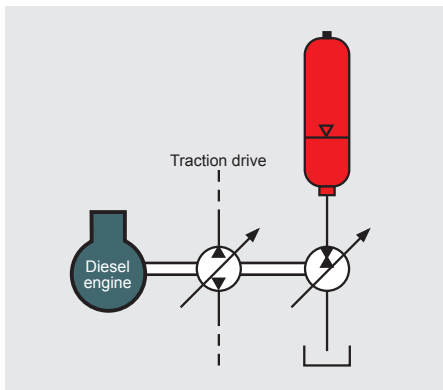
Hydraulic hybrid technology can also be used, however, to recover kinetic or potential energy. Kinetic energy is found, for example, in the rotary movement of an excavator's upper carriage or in moving mobile machinery. Potential energy is created when boom arms are lifted. In such cases, load compensation systems can significantly increase the machine's energy efficiency.

In all hydraulic hybrid systems, hydraulic accumulators are used to store energy temporarily. Enormous power flows are often required. Hydraulic accumulators in particular, but also other hydraulic components, are predestined for these tasks because of their outstanding power density.

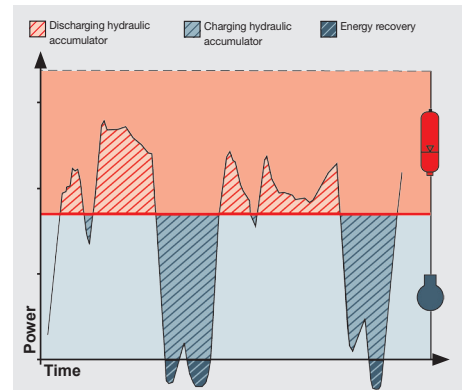
HYDAC offers its customers a wide product portfolio when it comes to hydraulic hybrid technology, providing optimum support even in the initial development steps.

Our many years of experience in designing, developing and producing hydraulic accumulators combined with our simulation expertise form the foundation of successful joint hybrid projects performed in close collaboration with the customer.

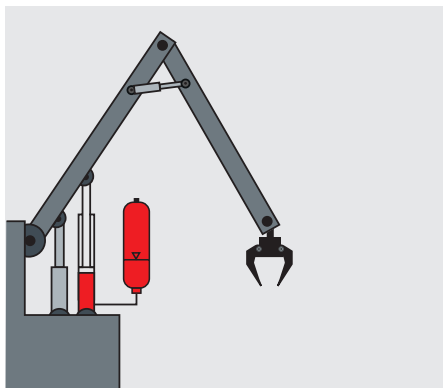
With our extensive number of valve variants, we can realise customised control blocks that minimise pressure loss. Established safety devices, sensors and fastening technology are typical components used in connection with hybrid systems. HYDAC's product range includes hybrid modules with their own controller, connected to the machine's ECU. HYDAC's hybrid range is rounded off with innovative hybrid solutions such as double-piston accumulators that can be used for parallel hybrid concepts and also for load compensation.



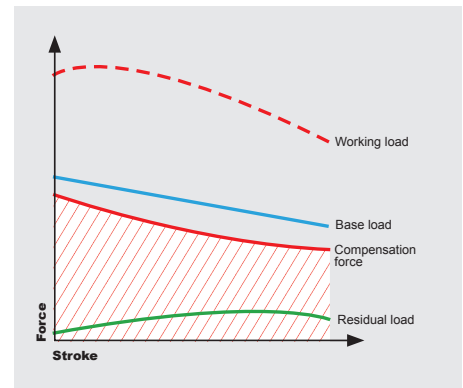
Example of parallel hybrid structure



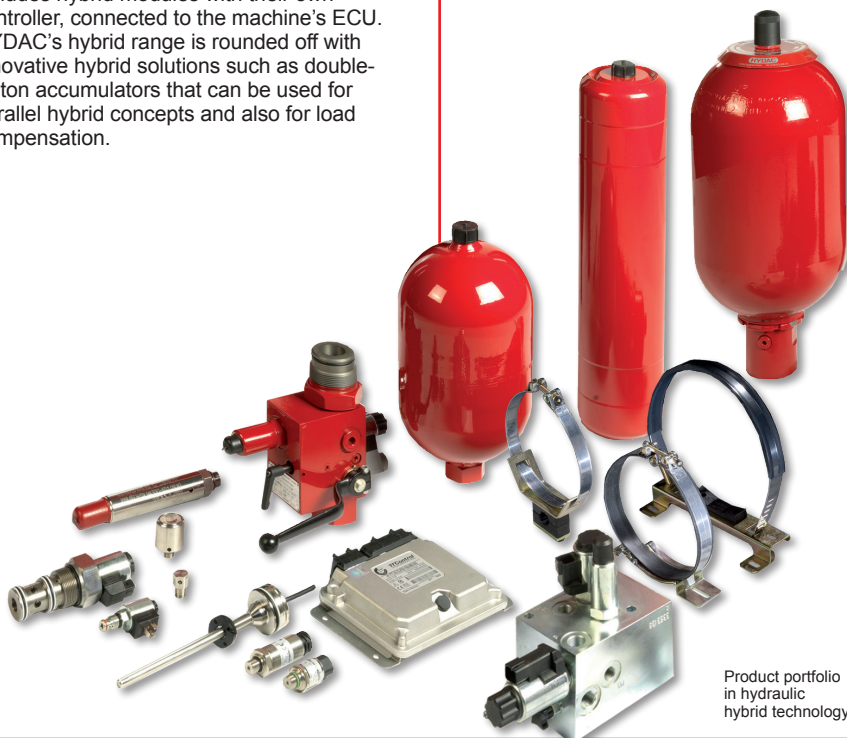
Smoothing load peaks



Example of load compensation



Force/stroke graph



Product portfolio in hydraulic hybrid technology

- **All accumulator designs**  
Bladder, piston and diaphragm accumulators and nitrogen pressure vessels (as back-up) from a single source
- **Control blocks**  
Based on customer specifications with maximum energy-efficiency
- **Extensive valve portfolio**  
Directional, proportional, flow-control and pressure valves
- **Established safety devices**  
Safety and shut-off blocks, gas safety valves, burst discs and fuses
- **Sensors for monitoring**  
Pressure sensors, distance measuring systems and oil condition sensors
- **Actuators**  
To EN 13849 for almost all requirement levels (SIL2/3 or PLd)
- **Fastening technology**  
Swivel band and bracket clamps, consoles

► See brochures 10.140 – Hydraulic Accumulators in Hybrid Technology + 3.554 – Double Piston Accumulators



# Hydraulic start/stop technology

In cars, electrical start/stop systems have already become established technology. These systems allow considerable fuel savings to be made. In construction machines, switching off the diesel engine when it is idling is also a source of major potential savings.

In mobile machinery, existing hydraulics infrastructure can normally be used to realise start/stop functionalities. For example, work-hydraulics pumps in a modified form can also be used as hydraulic motors.

After an automatic "idle stop", the diesel engine is restarted in engine operation as needed, for example by means of the work-hydraulics pump. The energy required for this is taken from a hydraulic accumulator that was previously charged "in the background" during normal machine operation.

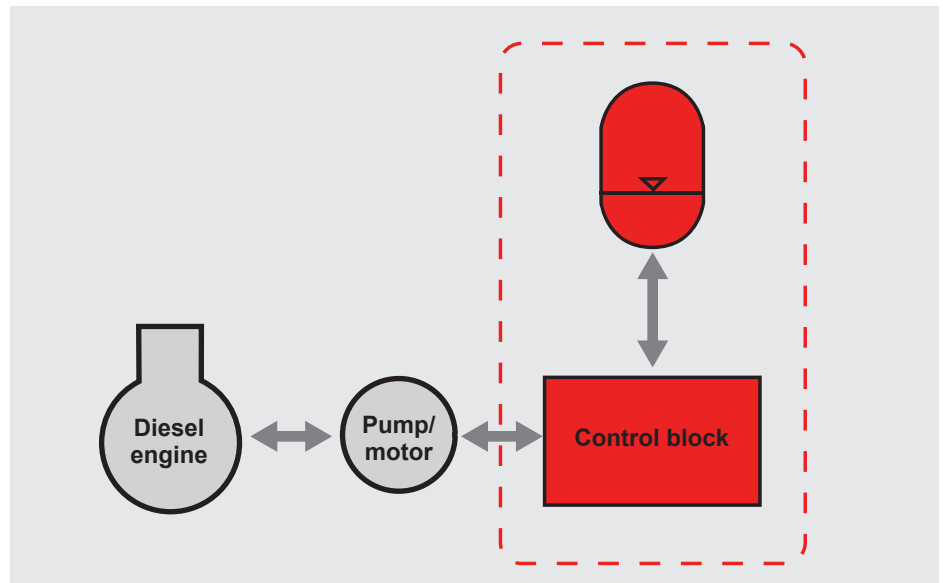
The hydraulic start/stop solutions generally provide quicker starting processes than electrical systems, which above all improves operator acceptance.

HYDAC has extensive experience in hydraulic control blocks and is a specialist in hydraulic accumulator solutions.

With its extensive product portfolio and in-depth know-how, HYDAC has what it takes to be the perfect development partner for hydraulic start/stop solutions:

- Extensive valve portfolio
- Customised control block solutions
- Optimum hydraulic accumulator solutions
- Robust sensors

Even though hydraulic start/stop systems take up very little space in general, it is often useful to have the option of adjusting the accumulator solutions to suit the particular construction machine. HYDAC provides the perfect resources for this, with its wide variety of diaphragm accumulator nominal volumes. For long and narrow installation spaces, for example, piston accumulators from the SK280 series can be utilised to create perfect packaging.



The structure of a hydraulic start/stop system



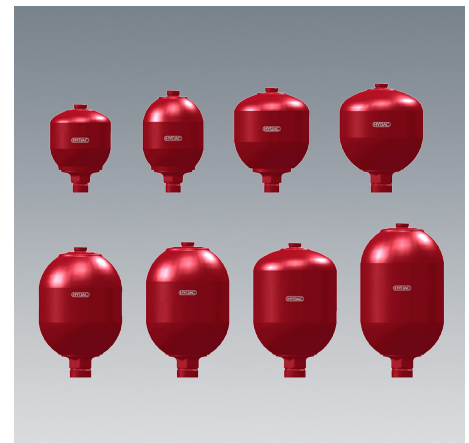
Cartridge valves



Example of a "control block + accumulator" solution



Piston accumulator (series SK280)



Diaphragm accumulator



Pressure sensors



# Valve and control block technology

The perfect work hydraulics for rapid, precise and efficient control.

## Open center primary control valves

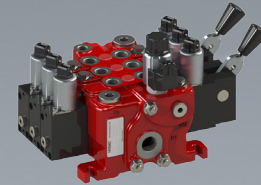
HYDAC's open center primary control valves offer you a modular system with which to design robust, energy efficient and cost-effective open centre controls for mechanical, pneumatic, hydraulic and electro-hydraulic controls.

### Properties:

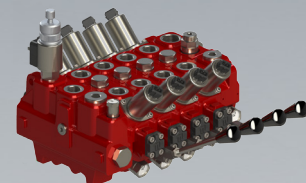
- Structural design as monoblock, multi-section and slice construction
- Key data:  $Q_{\max} \leq 180 \text{ l/min}$ ;  $p_{\max} = 350/420 \text{ bar}$
- Energy-saving Q-inlet option
- Robust, high quality and maximum controllability
- Low internal leakage
- Inlet track switching for safe volume flow distribution
- Electrical pump volume current cut-off
- Main consumer in parallel, series and tandem switching
- Simple integration of secondary safeguards
- Optional switch position monitoring of the main control spool
- Optionally also for the actuation of LS variable pumps

### Key data for open center primary control valves (see photos on right):

- |                              |   |
|------------------------------|---|
| • DI-2 primary control valve | $\Rightarrow Q_{\max} = 60 \text{ l/min}$ ; $p_{\max} = 250 \text{ bar}$  |
| • RS 220 main control valve  | $\Rightarrow Q_{\max} = 80 \text{ l/min}$ ; $p_{\max} = 300 \text{ bar}$  |
| • DX-6 primary control valve | $\Rightarrow Q_{\max} = 140 \text{ l/min}$ ; $p_{\max} = 350 \text{ bar}$ |



**DI-2**  
Open center primary control valve



**RS 220**  
Open center primary control valve



**DX-6**  
Open center primary control valve

## Load-sensing primary control valves

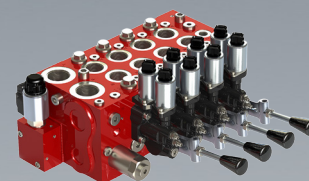
HYDAC's load-sensing primary control valves offer you a modular system with which to design load-compensated, energy efficient load-sensing controls for mechanical, pneumatic, hydraulic and electro-hydraulic controls.

### Properties:

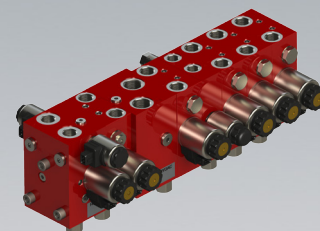
- Structural design as monoblock, multi-section and section construction
- Key data:  $Q_{\max} \leq 180 \text{ l/min}$ ;  $p_{\max} = 350/420 \text{ bar}$
- Extra-large 10 mm piston stroke for optimal high-precision control
- Load-independent parallel actuation without reciprocal influencing possible
- Simple integration of primary/secondary safeguards
- Inlet track switching for safe volume flow distribution
- Electrical pump volume current cut-off
- Optional switch position monitoring of the main control spool
- Optional switch-off of individual sections with complete functionality of the remaining sections

### Key data for load-sensing primary control valves (see photos on right):

- |   |   |
|---|---|
| • HX-1 load-sensing primary control valve | $\Rightarrow Q_{\max} = 120/35 \text{ (prop) l/min}$ ; $p_{\max} = 250 \text{ bar}$ |
| • LX-6 load-sensing primary control valve | $\Rightarrow Q_{\max} = 160 \text{ l/min}$ ; $p_{\max} = 350 \text{ bar}$           |



**LX-6**  
Load-sensing primary control valve



**HX-1**  
Load-sensing primary control valve



## Modular control block system HX1

### Control systems and their advantages

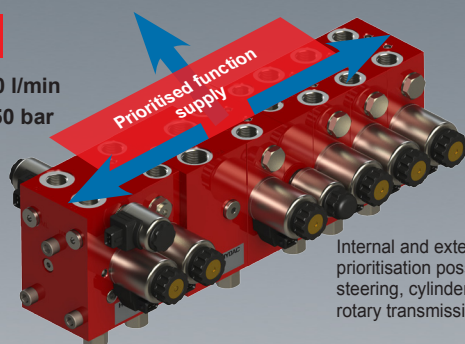
In general, you can choose between positioning the individual hydraulic functions by the slurry container in decentralised individual blocks or in one single place in a modular system as shown here. Both options are available in our product range. Some of the advantages of the complete modular system:

- Very compact system compared to CETOP solutions etc. = size and weight reduction
- Hoses arranged neatly at one single point
- Centralised system means fewer leakage points around the vehicle
- Prioritisation of the various functions – up to three priorities possible
- Affordable large series technology for small producers
- Other machines can also be fitted with the same system, thanks for flexible arrangement options
- Low installation and maintenance costs on site
- Installation and maintenance staff always work with the same technology – this means less learning is required and maintenance is quicker
- Long-term supply of spare parts guaranteed as standard HYDAC installation parts are used
- Numerous hydraulic dealers have the spare parts in stock, which means warehousing is streamlined or in some cases even unnecessary
- Individual customised solutions are still possible

### HX1

$Q_{max} = 80 \text{ l/min}$

$P_{max} = 250 \text{ bar}$



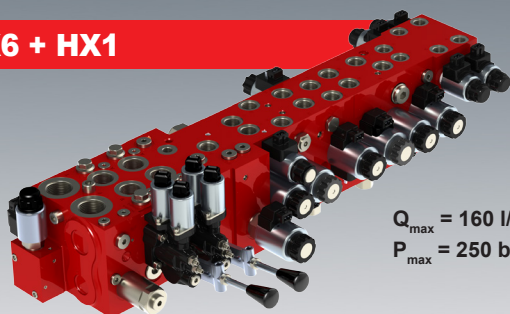
Internal and external prioritisation possible, e.g. steering, cylinder functions, rotary transmission drives

► See brochure 5.256 - HX1

## Modular combination LS systems LX6 + HX1

As the various slurry transport functions are arranged on corresponding modules in the HX1 system, functions can easily be added or taken away – via HYDAC directly or via the tanker manufacturer! The module system is selected in accordance with the litre capacity (see below). If you require only one function above 80 l/min or a hand-lever combination, HX1 can be combined with LX6. Anything is possible!

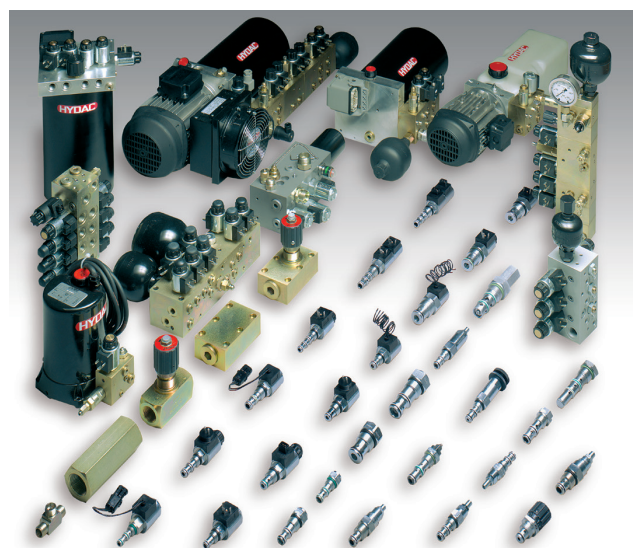
### LX6 + HX1



$Q_{max} = 160 \text{ l/min}$

$P_{max} = 250 \text{ bar}$

► See brochures 5.256 - HX1, 5.282 - LX6



## Compact hydraulics/ valve technology

Components, modules, subsystems as a customised solution.

### Pressure valves

Pressure relief valves, pressure control valves

Pressure sequence valves

Nom. pressure: up to 630 bar

Flow rate: up to 300 l/min

### Pressure compensators

Nom. pressure: up to 350 bar

Flow rate: up to 150 l/min

### Flow control valves

Needle valves, flow regulation valves

Nom. pressure: up to 420 bar

Flow rate: up to 300 l/min

### Shut-off valves

Non-return valves, hydr. pilot operated non-return valves, Check valves, lowering brake shut-off valves, change-over valves, pipe-breakage valves

Nom. pressure: up to 420 bar

Flow rate: up to 600 l/min

### Directional poppet valves

2/2 directional poppet valves, 3/2 directional poppet valves

Nom. pressure: up to 500 bar

Flow rate: up to 150 l/min

### Directional spool valves

2/2 directional spool valves, 3/2 directional spool valves, 4/2 directional spool valves, 4/3 directional spool valves,

Nom. pressure: up to 350 bar

Flow rate: up to 35 l/min

### Proportional valves

Pressure relief valves, pressure control valves, needle valves, flow regulation valves

Nom. pressure: up to 350 bar

Flow rate: up to 250 l/min

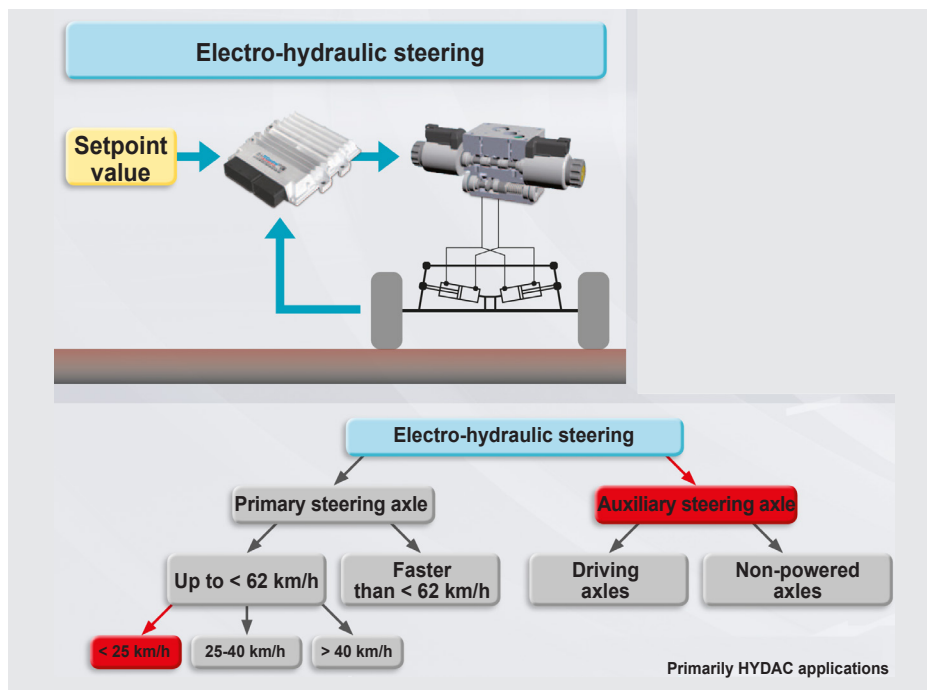
### Longitudinal arrangements, ML control blocks

for customised applications

► See catalogue 53.000 - Compact Hydraulics

# Electro-hydraulic steering and auxiliary steering systems (EHZ)

Our EHZ system modules offer a highly flexible foundation for the electro-hydraulic steering of all kinds of vehicles



Electro-hydraulic steering systems in modular form

Electro-hydraulic steering and auxiliary steering systems enable various types of steering to be realised in self-propelled and trailed working machines. For self-propelled vehicles, various special types of driving (such as all-wheel and crab steering) are possible in addition to the normal driving varieties. In combination with the hydraulic steering systems of the front axles, electro-hydraulic superimposed steering systems and auxiliary steering systems for the rear axles are possible.

For trailed working machines, we can use our modular steering valves to meet the various steering requirements for auxiliary steering in the second axle with optional free wheel or lock-out circuits of the steering cylinders.

## Applications

- Front axle steering
- Rear axle steering
- All-wheel steering
- Unlimited number of controllable axles
- Different safety concepts can be selected



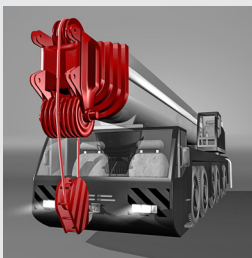
## STEER-by-Wire Main steering

### Advantages:

- Work and steering functions provided by one control element
- Driver's stand easy to move
- Steering sensitivity can be adjusted
- Assistance systems easy to integrate

### Application examples:

- Road rollers
- Road pavers
- Forestry machines
- Off-road vehicles/machines



## STEER Additional Auxiliary steering

### Advantages:

- Turning circle reduced
- Lower tyre wear
- Various steering programs
- Speed-dependent steering behaviour

### Application examples:

- Trailers, forage wagons, field sprayers
- Truck/commercial vehicle trailing axles
- AT cranes
- Vehicles with multiple axles



## STEER Assistance Alternative hydraulic steering (orbitrol steering)

### Advantages:

- On-road = orbitrol steering exclusively
- Off-road = steer-by-wire
- The fallback is always the orbitrol
- Driver assistance systems reduce work for driver

### Application examples:

- Self-propelled harvesting machinery
- Wheel or mobile excavators
- Wheel loaders, backhoe loaders, telescopic handlers
- Mobile machines
- Handling machines

► See brochure 10.116 - HY-STEER Electro-Hydraulic Steering Systems



# Cooling systems and fan controls

Increasingly strict requirements apply for cutting-edge engine technology, and as a result cooling technology has to become increasingly efficient if it is to keep satisfying modern standards for society and for the environment.



OK-ELD with DC motor



OK-ELH / AC-LNH with hydraulic motor



Combination cooler CMS

## Cooling

### Hydraulic oil cooling

Air coolers with DC motors (OK-ELD) or hydraulic motors (OK-ELK) are used to cool hydraulic oil. They are specially designed for mobile applications where high performance and easy installation in confined spaces are required. HYDAC offers electrically powered and hydraulically powered fans. They regulate the speed of the fan depending on the temperature of the medium. As an option, these controls can also be supplied with a reversing function, to "purge" the cooler of dirt (e.g. dust and debris).

- Cooling capacity up to 34 kW (OK-ELD) and 140 kW (OK-ELH)
- DC motor with 12 V or 24 V
- Hydraulic motors from 6.3 to 22 cm³/rev
- Robust aluminium plate construction
- High performance air fin with very good anti-contamination properties
- Low-noise fan

### Advantages

- Compact construction for cramped spaces
- Efficient - due to individually controlled cooling circuits
- Low-noise fan
- ATEX version available for operation in explosive gas and explosive dust atmospheres

### Combination coolers

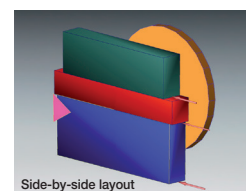
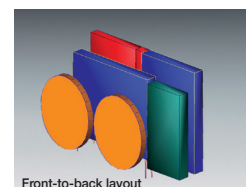
- CMS combination coolers for hydraulic oil, transmission oil, charge air, coolant, diesel fuel

The following cooling circuits can be combined together in various ways in a CMS mobile cooler:

- Charge air cooling (CAC)
- Coolant cooling (RAD)
- Oil circuits: transmission, hydraulics, fan drive
- Fuel cooling

With the aid of our cooling calculation software (KULI), and on the basis of available data, it is simple to adjust for pressure losses and heating of the cooling air which will also occur as a result of installing a condenser.

- Drive: direct, electrical or hydraulic



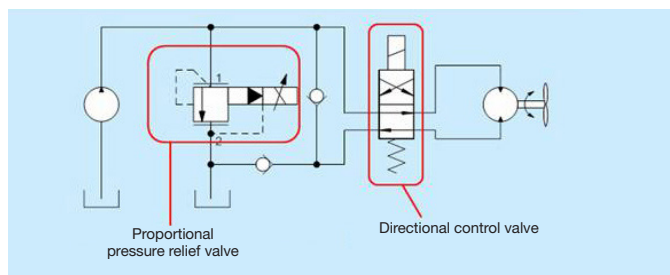
Individual cooler requirements for combination cooler systems – oil, water and charge air cooling

### Fan controls

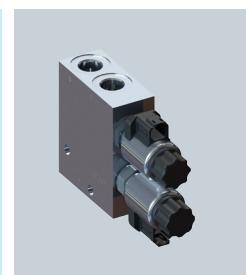
Hydraulic and electro-hydraulic controls for regulating fan motor speed with optional reversal of rotation direction for use with various types of pumps.

#### Valves specially developed for the application:

- Directional control valves
- Non-return anti-cavitation valves
- Manually adjustable pressure relief valves
- Inversely proportional pressure relief valves



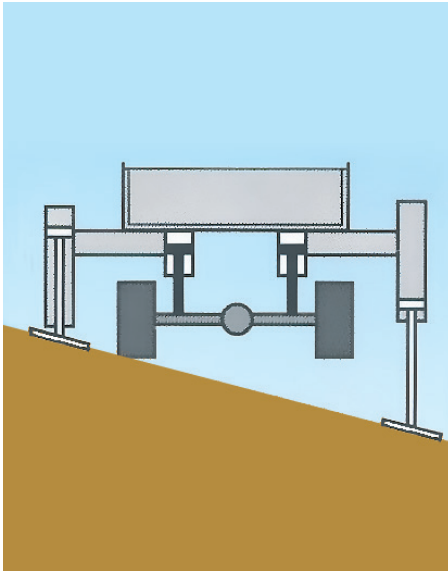
Example of fan control application



See catalogue 57.000 - Cooling Systems  
See brochure 5.812 - CMS Mobile Coolers

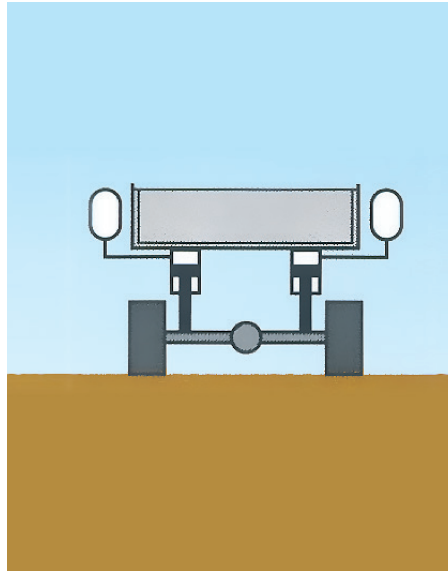
See brochure 5.315 - A Breath of Fresh Air in Electro-Hydraulic Cooling Control

# Support, levelling and hydropneumatic suspension



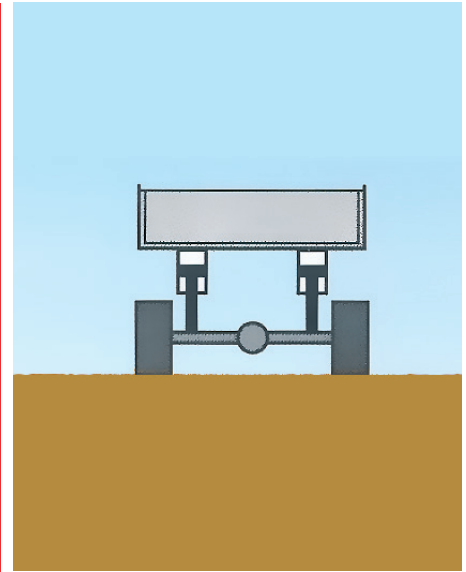
## Levelling

Levelling involves our regulation system carefully keeping the mobile machine in a horizontal position, regardless of the incline.



## Hydropneumatic suspension

No matter what load conditions apply, the hydro-pneumatic suspension smooths out any bumps to provide consistent comfort.



## Level control

Regardless of the load state or the smoothness of the ground, the level control ensures that clearance from the ground remains constant at the perfect operating point.

## Support and levelling

Using component modules scaled to safety requirements for support systems, we can develop, in partnership with you, almost any outrigger system for your application.

If required, HYDAC offers support throughout the process of selecting the best control concept.

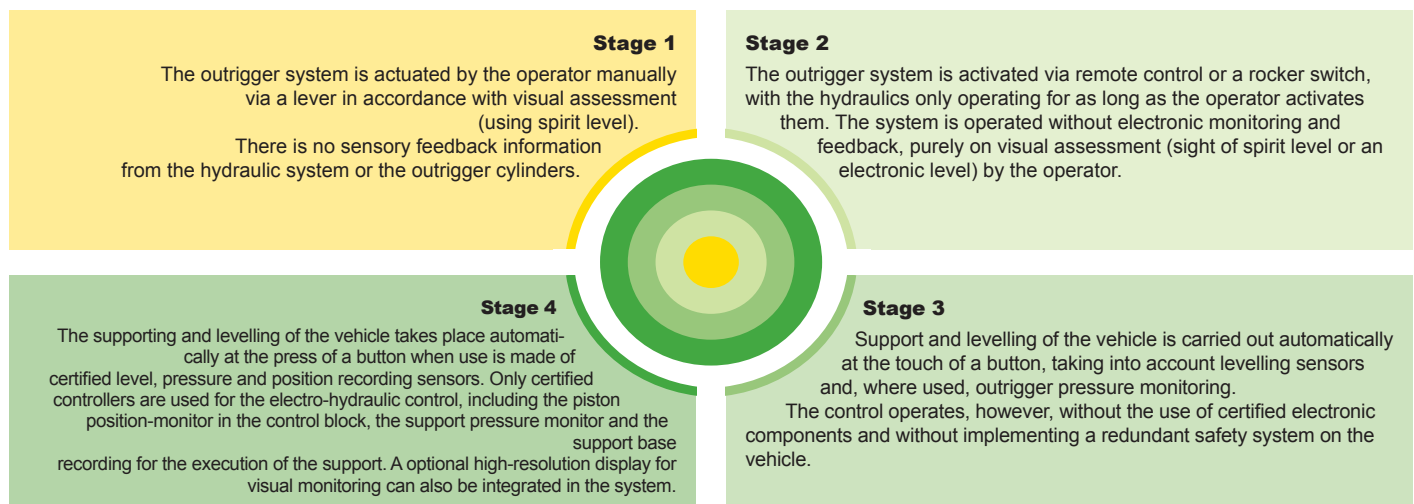
**Modules can be used to depict PL b to PL d:**

- For different performance classes
- For different safety requirements
- For different control types
- Interfaces for working area restriction and load moment limitation

### In 4 stages:

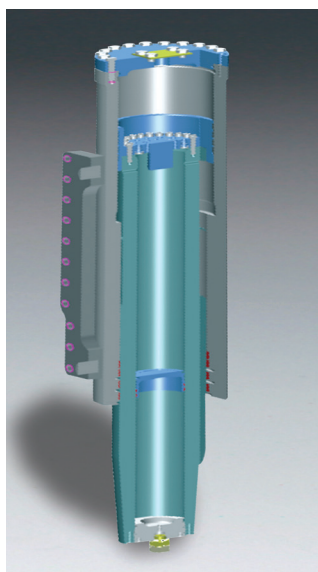
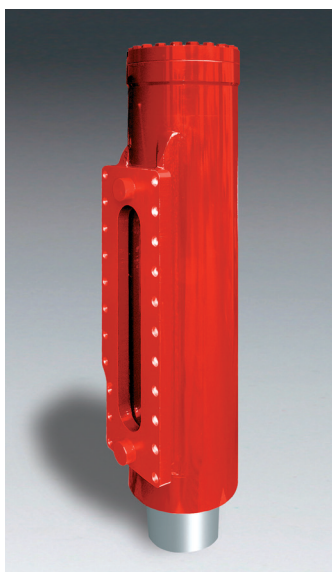
#### Design examples\* for controlling an outrigger system

The control examples\* in stages 1–4 differ depending on the type of machinery and the statutory standards and directives. The functional safety in the control increases with each stage. The machine builders' product ideas and designs form the basis for designing an appropriate control. The manufacturer defines the requirements, supported by advice from our application engineers on selecting suitable hardware components.





## Hydropneumatic suspension systems



### HYSTRUT

HYSTRUT strut for dumpers.  
Self-supporting, compact independent suspension  
with integrated accumulator, valve and sensor technology.



### Boom suspension

Boom suspension for mobile excavators and telescopic handlers  
to reduce pitching vibrations and thus increase driving stability and  
performance.



### Cab suspension

Cab suspension systems with  
electronics to reduce  
driver exposure to oscillations  
and increase comfort.



### Chassis suspension

Intelligent axle suspension system with isolating function and adjustab-  
le driving characteristics to improve driving stability and thus increase  
performance.

► See brochure 10.116.4 - Hydropneumatic Suspension Systems for  
Lightweight Commercial Vehicles



HSE-10



HSE special version



HSE-16

### Hoist suspension

Our HSE series repre-  
sents a hoist suspen-  
sion for utilisation on a  
wheel loader or similar  
vehicles.

► See brochure 10.116.6 - Cab Suspension Element

► See brochure 10.116.8 - Hoist Stabilising Unit HSE-10  
See brochure 10.116.5 - Hoist Stabilising Unit HSE-16

# Filtration technology

## Filter ≤ 100 bar



## Filter > 100 bar



## Air filters, filter elements and accessories



Our broad filter range offers inline filters (LF, MDF, DF) with various pressure ratings and materials in addition to filler/breathers (ELF) for the hydraulic tanks. We also have a broad range of in-tank return line filters (RF) and return line & suction boost filters (RKM). Specially designed in-tank return elements (RMTR) offer good distribution of oil flow in the tank, highly effective air separation and thus a reduction in the size of the hydraulic tank.

The filters can also be used in explosion-hazard areas (ATEX).

### Advantages

High level of operating safety thanks to first class filtration

- Protection of system components
- Element is easy to change and filter housing is easy to install
- Low operating costs thanks to low pressure drops across the filter and filter element
- Improvement in operating safety through the use of filter clogging indicators
- Brand labelling to protect the spare parts business
- Tank-filter complete systems, optimised for component protection, system cleanliness and bleeding
- Ultra-modern laboratory and test rig technology



### Hydraulic Load Cycle Test (HCLT)

- Filter performance data measured in accordance with practical flow conditions (dynamic flow) rather than static multi-pass test to DIN 16889.
- The practical flow rate can, for example, be measured at the excavator and then simulated on a 1:1 basis on the test bench.

### Tank and filtration systems

A comprehensive range of hydraulic and breather filters, fitted with high-quality filter element material ensures high operational safety and extended maintenance intervals, e.g.:

### Return line / return line suction filtration

Using RFM and RKM filters (with optional thermal bypass valve built into head). Tank-mounted or tank-integrated filters

### Supply circuit filtration

using inline filters LPF

### Pressure oil filtration

using inline filters MFM, HFM, DF

### Gear oil filtration

Suction line filters for gear oil and hydraulic oil

### Removal of coarse contamination

using inline filter ILF

### Air filtration

using breather filters BF, ELF, ELFL, BDE.

Extensive standard product range, optionally with duo-valve for tank pressurising, anti-sloshing protection possible, version with air drying  
Air filter systems for motors

### Filter clogging indicators (VA)

to improve safety of operation and possibly display maintenance intervals

### Brand labelling to protect the spare parts business

Marking of the filter elements to improve product identification and to secure spare parts demand.

### Tank filter solutions from a single source

Ready-to-install complete systems, optimised for component protection, system cleanliness and bleeding

### Filtration solution for Ad-Blue and SCR cooling

- ▶ See catalogue 70.000 - Fluid Filters
- ▶ See brochure 10.777 - Filtration and Fluid Care



# Filter systems



FMM

ContaminationSensor CS1000 and AquaSensor AS1000 / AS 3000



SMU 1200



CTU 1000



CTM-SC



FCU 1310



OF 7 CM

## Fluid Condition Monitoring & Fluid Conditioning

For a system to be fully efficient and reliable, it needs a sophisticated filtration strategy and continuous online monitoring, combined with temperature-controlled cooling. Only if all factors are addressed can the condition of the fluids be improved in the long term and operating costs reduced (cost reductions of up to 30% are not uncommon). Accordingly, HYDAC provides the complete package of condition monitoring, filters, coolers and systems for detecting fluid stresses and rectifying them. You can plan service work in advance, avoid unnecessary costs for maintenance and repair and benefit from optimised costs for system maintenance. One product that prevents fluid stress is the Optimicron® element with Stat-Free® technology for the prevention of electrostatic discharge. If oils are subjected to electrostatic discharge, they age more quickly and in the long run systems become damaged. The VarnishMitigation Unit (VMU), which removes oil-ageing products from the fluid and the CM-Expert for online monitoring of production systems also increase the service life of the fluids used.

## Technical cleanliness

More efficient components and systems, increasing warranty claims and the reduction in start-up breakdowns are steadily driving up the demands for cleanliness management and cleanliness monitoring of production components. Tracing the source of damaging particles on surfaces which are in contact with the fluid, the removal and appropriate analysis of these particles are areas where HYDAC does extensive research within the framework of technical cleanliness.

The specially developed extraction units CTU (ContaminationTest Unit) and CTM (ContaminationTest Module) for analysing technical cleanliness have numerous applications in a wide variety of industries. Individually designed adaptations for carrying out cleanliness analyses provide solutions from a single source.

### ContaminationTest Unit CTU

The ContaminationTest Unit CTU 1000 series for inspecting the Technical Cleanliness of components and systems in accordance with VDA Guideline 19 (ISO 16232/ISO 18413).

### ContaminationTest Module CTM

The CTM ContaminationTest Modules are a modular system for inspecting the Technical Cleanliness of components. The CTM series consists of different modules:

#### Supply Module CTM-SC

(Supply and Control):

Module for fluid supply, control and data storage.

#### Extraction Module CTM-EB:

The modules vary according to the size/model and extraction process. They feature four types of extraction in different combinations.

#### Extraction Flushing CTM-EF:

By adapting to the geometry of the components being sampled, the module can be used for flushing components in contact with fluid.

#### Fluid Analyzer CTM-FA:

Module for determining the particle count according to ISO 16232 by conditioning the fluid and evaluating via visual particle counter.

## Service tools

Tools for documenting the oil cleanliness and water saturation, e.g. after service work

Bypass filter for optimising existing hydraulics and lubricating systems to remove oil time-deterioration products, particles and water

► See brochure 10.122 – Condition Monitoring

► See catalogue 79.000 - Filter Systems  
See catalogue 180.000 - Electronic

► See catalogue 79.000 - Filter Systems  
See catalogue 180.000 - Electronic

## Tank solutions

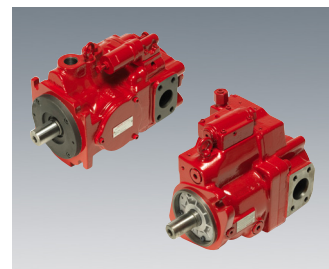
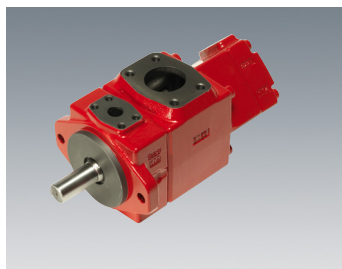
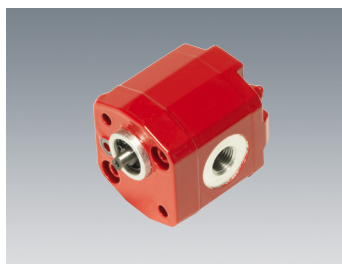


### Hydraulic tanks

Unlike welded steel tanks, customised plastic tanks – as a complete solution including breather and return line filters and fill-level and temperature indicators – are mainly used when installation space is extremely limited and very lightweight construction is required.

- *Improved component cleanliness*, since plastic tanks are very clean following production.
- *Air from oil*, special tank geometry allows quick and optimal air separation (RMTR)
- *Improved use of existing installation space* due to optimised design (complex, curved designs available)
- *Inexpensive* The costs depend on tank volume and not design complexity.
- *Clean tank surface*, due to integral baffle designed to prevent fluid spill from the breather filter onto the tank.
- *Element does not block*, due to dry air filter element and partial cleaning whenever air is expelled – dust is purged from the filter material.

## Drive technology



### Pumps

HYDAC offers a wide range of pumps for the working hydraulics of lift-lower systems in open hydraulic circuits. The pump range includes fixed and variable displacement pumps of various designs from 0.25 ccm/rev to 560 ccm/rev and pressure ranges of up to 400 bar.

**HYDAC fixed displacement pumps for auxiliary circuits and control oil supply:**

- **External gear pump PGE**

from 0.25 ccm/rev – 60 ccm/rev, nominal pressure up to 250 bar and maximum pressure up to 300 bar. Also available in multiple pump combinations.

- **Internal gear pump PGI**

from 3.8 ccm/rev – 250 ccm/rev, nominal pressure up to 330 bar and maximum pressure up to 400 bar. Also available in multiple pump combinations.

- **Vane pump PVF**

from 5.8 ccm/rev – 237 ccm/rev, nominal pressure up to 210 bar. Ideally suited to offline cooling and filtration circuits. Also available in multiple pump combinations.

**HYDAC variable displacement pumps for main functions:**

- **Axial piston pump PPV100S**

from 16 ccm/rev – 180 ccm/rev, nominal pressure = 315 bar and maximum pressure = 350 bar. High speed reserves, finely graduated flow levels, control range constantly being expanded. Design standard in accordance with DIN ISO 3019-2 and SAE. Also available in multiple pump combinations.

- **Axial piston pump PPV101**

from 45 ccm/rev – 200 ccm/rev, nominal pressure = 320 bar and peak pressure = 350 bar. High speed reserves, versatile controller program. Design standard in accordance with DIN ISO 3019-2 and SAE. Also available in multiple pump combinations.



# Hydraulic accumulators

## All designs for every application



### Accumulators

HYDAC provides accumulators and dampers for numerous hydraulic applications, from standard accumulators to customised solutions with integrated switching on/off of the hydraulic system accumulator. A matching accessories range with clamps, brackets and complete accumulator sets for fastening the accumulator to the machine securely is the perfect addition to the overall range.

#### Advantages:

Our accumulator specialists have decades of experience in the development and design of all types of accumulator construction at their disposal. This means that they are in a position to select the type of accumulator construction that suits the application out of the comprehensive product range and to lay it out in accordance with operating conditions. The correct accumulator is still the best support for an application and HYDAC accumulators can be used worldwide with country-specific acceptances.

#### Bladder accumulators

Nom. volume: up to 450 l  
Perm. operating pressure: up to 1,000 bar

#### Piston accumulators

Nom. volume: up to 3,500 l  
Perm. operating pressure: up to 1,000 bar  
Series SK 280  
Nom. volume up to 10 l  
Perm. operating pressure: 280 bar

#### Diaphragm accumulators

Weld-type and screw-type design  
Nom. volume: 0.075 to 4 l  
Perm. operating pressure: up to 750 bar

#### Hydraulic dampers

Pulsation dampers, shock absorbers, suction flow stabilisers, silencers  
Nom. volume: up to 450 l  
Perm. operating pressure: up to 1,000 bar

#### Spring accumulators

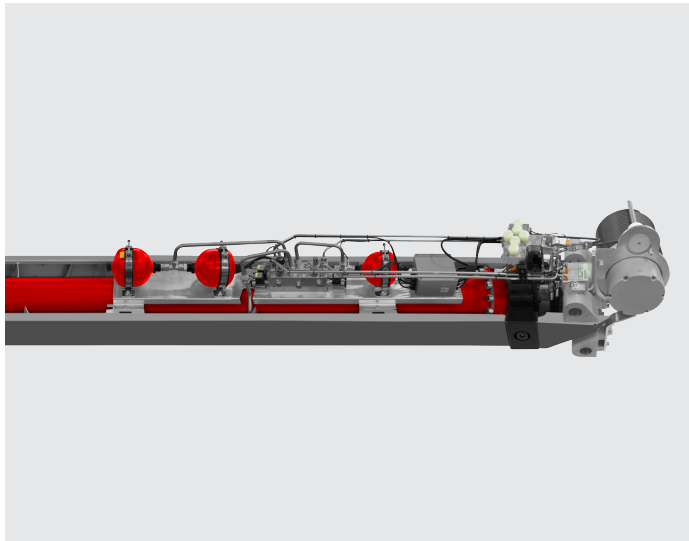
Application: energy storage, e.g. lubricating systems

#### Weight-optimised hydraulic accumulators

Bladder, piston and diaphragm accumulators as weight-optimised light-weight or ultra light-weight hydraulic accumulators

Application: e.g. energy recovery to increase energy efficiency

## Hydraulic cylinders



Telescoping cylinder (11 m) with semi-integrated hydraulic control

### Telescopic systems

- Single-cylinder telescopic systems
- Securing locking system
- Telescopic guide system
- Controllers

### Boom, outrigger and special cylinders

- Weight-optimised, space-saving design
- Integrated valve technology and sensors

### Mining and excavator cylinders

- For high dynamic loads
- Structurally durable design
- Integration of distance measuring systems

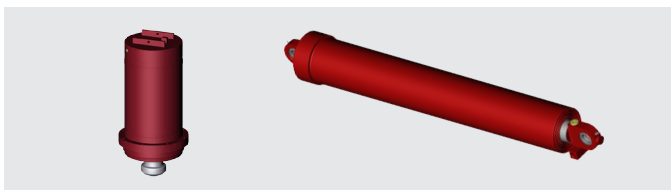
### Suspension and accumulator cylinders

- Cylinder-integrated accumulators
- Combined cylinder-accumulator solutions
- Self-supporting suspension struts

#### Advantages:

Our own Service Center offers you a comprehensive customer service.

We support you with the design, assembly, maintenance and commissioning of your system. We begin working closely with the customer right from the development stage. Because of our knowledge, we can achieve the best cylinder solution for your product, e.g. by using special surface coatings for the piston rod. FE simulations or fatigue strength calculations also come under our Engineering Standard.



Outrigger cylinder

► See brochure HS-D 10.102 -  
Cylinders and Cylinder Systems for Mobile Hydraulics

## Accessories



### For the completion of hydraulic systems

- Standard fittings and ball valves (high pressure)
- Mounting clamps for hydraulic hoses and pipes, cylinders, electrical cables and accumulators
- Tamper-proof inductive proximity switch (high pressure resistance)
- Fluid level sensors
- Temperature switch TSE
- Standard clamp 3015 Air/water reservoir clamping bands
- "Test point" connections
- Quick-release couplings
- Special clamps for particle filters
- Coaxial valves

#### Advantages:

HYDAC Accessories is your expert for modifications and special solutions at all times, and especially when custom jobs are required because standard parts are unsuitable. HYDAC's in-house engineering, coupled with our multidisciplinary approach and worldwide know-how, guarantees state-of-the-art technology and rapid development times.

HYDAC Accessories provide the final perfect touch to your machine with a broad range of standard and special components, also available in stainless steel.

► See catalogue 61.000 - Accessories



# Fuel supply



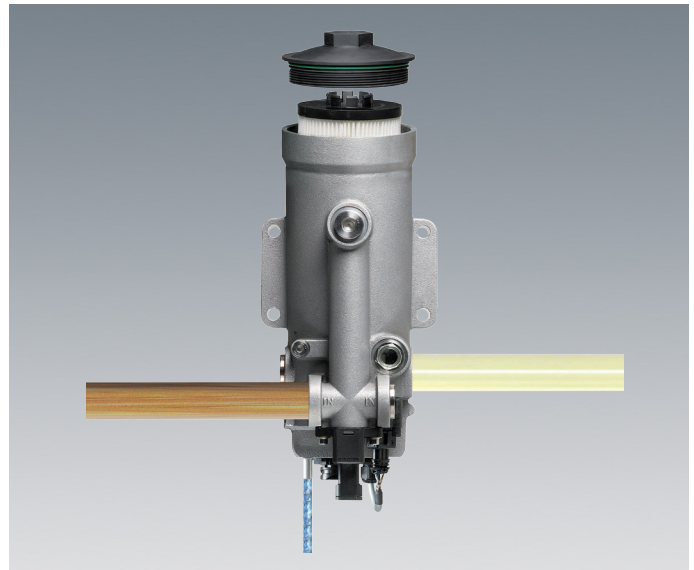
## Fuel pumps

HYDAC fuel pumps are compact units with direct current drive for quick and simple tank-to-tank transfer of diesel fuel or hydraulic oil.

- Fuel pump for diesel or hydraulic oil
- Flow rate
  - Diesel: up to 80 l/min
  - Mineral oil: up to 15 l/min
- Installation position optional

### Advantages

- Possible to fill the fuel tank on the vehicle, away from stationary fuel stations
- Self-priming up to 2.5 m in height  
no initial filling prior to commissioning required
- Compact design  
saves on both space and weight
- DC motor with protection rating IP65
- Good efficiency, low current consumption
- Suitable for dry running  
Safe also for short run periods without fluid
- Integrated temperature switch
- Non-return valve completely sealed, leak-tight



## Diesel filtration

Guarantees the fuel purity required of modern common rail diesel engines to meet the requirements of the exhaust emissions standards Euro6 and Tier4, and component protection of the fuel system through the use of the latest, fully synthetic filter media and continuously reliable water separation.

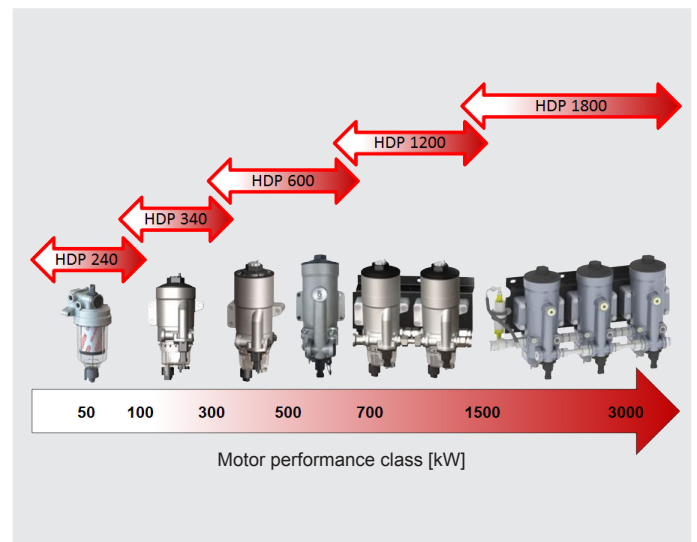
Reduction of the Life Cycle Cost (LCC) by extending the service life and service intervals.

- Suction-side pre-filter and water trap
- Manual or automatic water discharge
- Option: water sensor, fuel pre-heater, manual/electrical filling/booster pump
- Variants for diesel engines up to > 3000 kW

### Advantages

Protection of all of the components of the fuel system, e.g.: suction pump, common rail injection pump, diesel injectors, by:

- Excellent water removal
- Maximum contamination retention capacity
- Very long service life
- Very low pressure drop



► See brochure 7.125 - Diesel PreCare

# Cab-air filter for very fine and nano dust: CabinAirCare.

It is vital for self-propelled field sprayers to be fitted with a cab that has been certified to Category 4 (EN 15695-1), for health reasons and to protect the operating personnel and the environment.

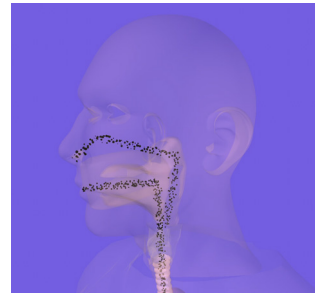
In effect, a certified driver cab replaces personal protective equipment (PPE) in the cabin when an appropriate Category 4 filtering system is installed.

For modular retrofitting on existing tractors and self-propelled sprayers, CabinAirCare provides optimal Category 4 passenger protection without having to substantially modify the existing air conditioning system or cab.

For a healthy environment that promotes performance, HYDAC Filter Technology already offers highly effective air filtration systems that can be equipped or retrofitted.

## Customer benefits:

- ⇒ Easy to install and expand (on existing air conditioning or filter systems)
- ⇒ Sufficient system reserve (fan power, media sizing) for common cabin sizes in construction and agriculture
- ⇒ Robust and simple construction
- ⇒ Filters airborne pollutants, including nano-particles and gases



Fine dust filter

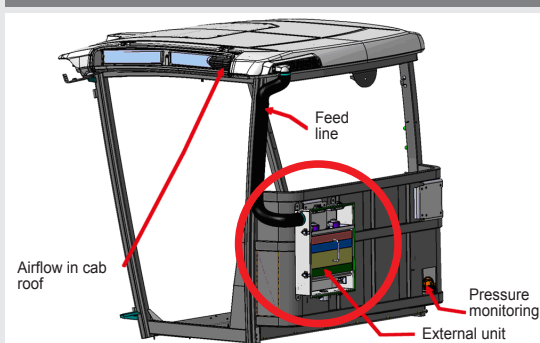


HEPA filter

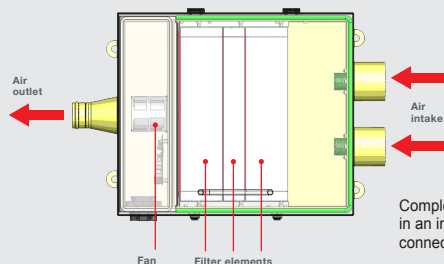


Active carbon filter

## CACR for retrofitting

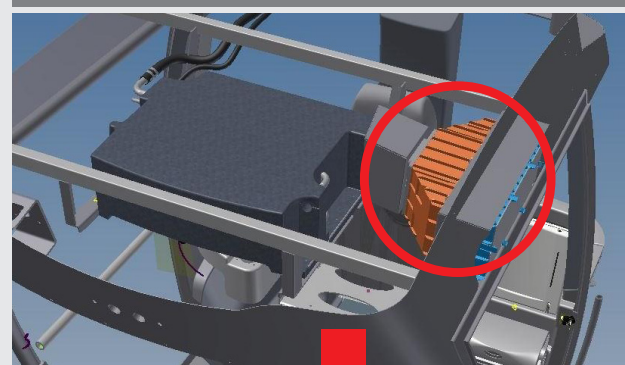


Example of retrofitting

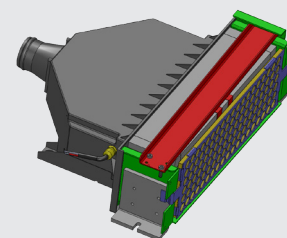


Complete system with fan and filter units in an impact-resistant housing for external connection to mobile vehicle cabs

## CACR for full integration



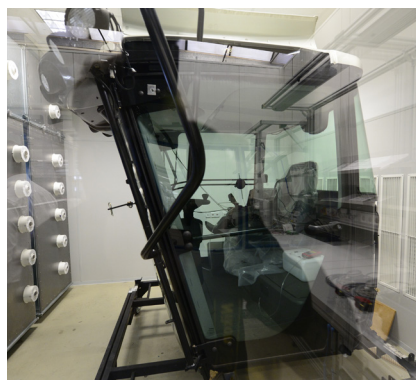
Example of installation



## Cabin air testing station

Cabin category & testing options under DIN EN 15695-1:

- Category 1:  
Cabin, no defined protection rating
- Category 2:  
Cabin that protects the driver from dust
- Category 3:  
Cabin that protects the driver from dust and aerosols
- Category 4:  
Cabin that protects the driver from dust, aerosols and vapours



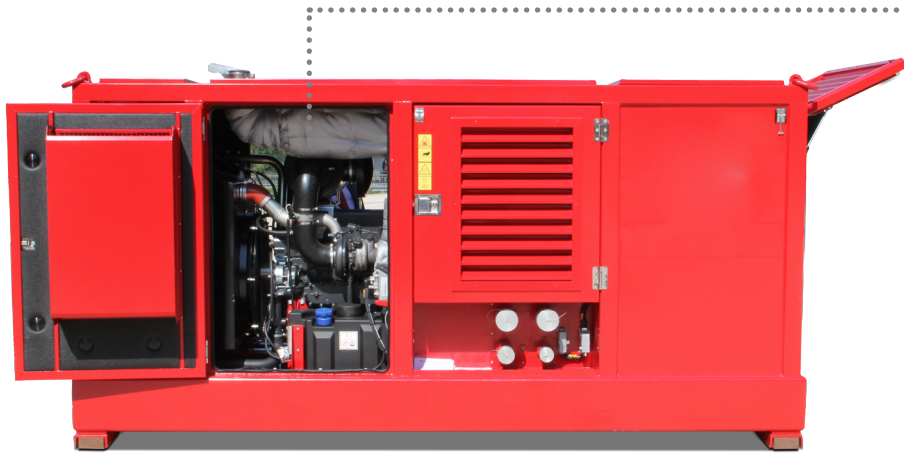
## Technical data:

- Air flow rate: 30 to 120 m³/h
- Possible overpressure in vehicle cab: 25 Pa to 300 Pa
- Central control unit with status indicator (optional)
- Power supply: 24 V DC or 12 V DC
- Weight: approx. 16 kg (with filter elements)
- Removable and sealed housing cover
- Service life of filter stages with regular use: approx. 100,000 km or 2,000 hrs or 3 months

► See brochure 7.016.1 - CACR CabinAirCare



# Hydraulic power units. Flexible drive power



Power units for HDD systems

HYDAC hydraulic power units provide a reliable drive unit for your machine. As auxiliary power units, they ensure great flexibility and can be operated with various different devices.

Our power unit system modules guarantee you superb quality, a high level of availability and short development times. We offer you a suitable and cost-effective solution for your application.

## Versatile applications for drives and auxiliary power units for drilling operations:

- 20-50 kW class: break-out tong, mixers, small flushing pumps, pipe handlers, loading crane, winches, emergency power units
- 100-300 kW class: power units for drill rigs or attachments, e.g. deep vibrators, milling drives, pile drivers and shakers, pumps
- 400-800 kW class: power units for HDD systems, deep level drilling rigs, solids pumps, triplex pumps

## Power unit versions:

- In lightweight or heavy-duty series, depending on customer requirement and area of application
- Various drive concepts: diesel, gas, petrol, electric motor, hybrid
- Fixed/variable displacement pump systems max. 420 bar with integrated control and valve technology
- Power unit solutions from the fully operational motor assembly unit to complete drive solutions
- Container power units in 8'/10'/20'/30'/40' transport containers, as mobile drive units

## Options or special requests for all power units:

- ATEX versions
- Approvals from various certification companies, such as Germanischer Lloyd and DNV
- Various temperature versions (arctic, desert)
- Offshore capability
- GPS monitoring
- Additional noise protection [ $< 60$  dB(A)]
- 3G modem remote service
- Drip tray, including monitoring and walkway grids
- Special paint jobs (RAL)
- With lifting and/or lashing points
- Underbody in skid design

## Advantages

- Robust and construction site-suitable technology
- High-performance and reliable transmission drives with proven HYDAC control technology
- Worldwide service on location
- Suitable solution from one source



Mobile small power units – heavy-duty series



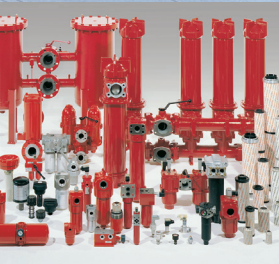
Piggyback power unit for crawler drill rig

► See brochure 10.153 - Components, systems and service for mobile power units





Accumulator Technology 30.000



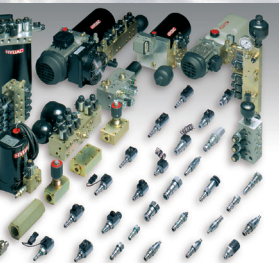
Filter Technology 70.000



Process Technology 77.000



Filter Systems 79.000



Compact Hydraulics 63.000



Accessories 61.000



Electronics 180.000



Cooling Systems 57.000

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- 📍 HYDAC Headquarters
- HYDAC Companies
- HYDAC Sales and Service Partners

## HYDAC INTERNATIONAL

Head Office  
HYDAC INTERNATIONAL  
GMBH

Industriegebiet  
66280 Sulzbach/Saar  
Germany

Tel.:  
+49 6897 509-01  
Fax:  
+49 6897 509-577

Internet: [www.hydac.com](http://www.hydac.com)  
E-mail: [info@hydac.com](mailto:info@hydac.com)

### 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.