Quality products for demanding applications

BRAKE SYSTEMS
In many mechanical drives, vehicles and machines, brakes are a crucial safety element. Their reliability and longevity are decisive for the security and quality of the complete system.

Brake systems ensure the controlled deceleration and secure standstill of a complete system respectively of its moving components. As security-relevant elements, they have to meet very high requirements. These depend on the particular range of applications. Brake systems thus have to be designed specifically for the intended service surroundings.

Hydraulically actuated brakes are particularly suited when high yet sensitively controlled braking forces have to be exerted within tight spatial limits. For applications with especially high safety requirements - e.g. for vehicles or cableways – brake systems with additional equipment such as redundant valves and switching position monitoring are deployed.

For wind generators, hydraulically actuated brake systems are used for the azimuth orientation and fixing. Especially in the case of high wind speeds, the system must feature the ability to be turned out of the wind and be brought to a standstill in a controlled way in order to avoid damage to the gearbox and the generator.

Also in the case of stationary machines such as in the manufacturing process of textiles, brake systems play a decisive role. In these applications, fast-turning drums have to be decelerated within milliseconds without the textile thread to become entangled or even to get ripped apart.

Typical application areas for hydraulic brake systems are, among others:
- Rail vehicles
- Mobile work machines
- Winches
- Wind generators
- Material lifts
- Textile machines
- Cableways
- Cranes
Brake systems have to ensure a fast, reliable and controlled braking action. In order to fulfil these requirements, the designer has to take into account a number of guidelines. A decisive prerequisite for a sensitive control is that the hydraulic action on the brake system itself is exerted as linearly as possible and with a small hysteresis.

Decisive features of brake systems:

**CONTROL**
In order to achieve a controllable braking action, a steadily changeable braking force is a crucial factor.

**SPEED**
The response time of the hydraulic valve used as an actuator has to be short for the brake effect to set in fast.

**SAFETY**
In order to secure an all-time reliable functioning of the system, its components have to meet stringent requirements.

**EFFICIENCY**
The amount of energy released has to be minimized in order to avoid high temperatures in the hydraulic system.

**LONGEVITY**
Hydraulic brake systems are made of modern high performance materials for high durability and low maintenance.

**COMPACTNESS**
Hydraulic brakes distinguish themselves by their high power density. This makes compact dimensions and space saving solutions possible.

Modern hydraulic brake systems are actuated using proportional valves. These are equipped with solenoids exactly controlling spool positions and thus hydraulic pressures, resulting in a linear increase of the braking force. Such systems are often fitted with proportional pressure valves. Increasingly, closed control circuits are used with proportional throttles and the corresponding electronics. In order to ensure good controllability of the system, these valves have small hysteresis, and their linearity can be precisely adjusted. Their frequent use in accumulator unloading systems makes small leakage and pilot oil volumes of hydraulic valves mandatory. In spring-loaded brake systems, a pressure relief down to nearly zero bar is of prime importance to prevent the brake from dragging.
HYDRAULIC BRAKE SYSTEMS

Brake systems are either active or passive. Operational brakes are often designed as active systems. Safety brakes are always passive systems whose braking action is activated by spring forces. For both types, there are a number of different hydraulic control methods. Controlled hydraulic solutions are realised using pressure relief or pressure reducing valves. In the case of closed hydraulic pressure controls either pressure relief valves or throttle valves are used. For both cases, electronics optimised for the valves is a crucial factor.

**WITH PRESSURE RELIEF**

By means of a proportional pressure relief valve, the pressure within the cylinder is adjusted to the required braking force. Additionally, the pressure in the brake system is monitored using a pressure sensor. Usually, these are direct operated controlled valves with compact dimensions and short response times. In the case of active systems, reverse hydraulic valves have usually to be selected. Inverse valves are spring loaded and adjusted to the maximum pressure value in a deenergised condition. This maximum value can be adjusted by means of an adjustment screw.

**WITH PRESSURE REDUCING VALVES**

By means of a proportional pressure reducing valve, the cylinder pressure is adjusted to the required braking force. The output pressure of the control valves is decoupled from the input pressure. Therefore higher input pressures do not play any role with respect to the brake pressure. Such systems are often selected for accumulator unloading operations in order to achieve as long standstill intervals of the motor pump unit as possible. In the case of proportional control valves, only low leakages must occur. For active systems, a reverse valve function usually are required.

**WITH ELECTRONIC PRESSURE CONTROL**

As an actuator, a proportional pressure relief valve is used. By means of a pressure sensor, the brake pressure is fed back into the electronics which compare the feedback value and the command value. As an alternative, the control can be realised using two proportional throttles, one positioned in the pressure line and the other one in the tank line. Proportional throttles distinguish themselves by their high speeds as well as by an enhanced flexibility with respect to the optimized adjustment of the controller.
Depending on the brake system, different sizes of proportional valves are required. For tight space conditions, small, compact, direct operated valves have been developed. For large systems, pilot operated valves are used. In order to meet the different requirements, more than 20 variants of valves are available for the selection of the most suitable valve. The available bandwidth ranges from valves with low maximum output pressure to models with a maximum output pressure of 450 bar. Likewise, the flows can vary between some 100 ml/min up to 40 l/min.

**PRESSURE REDUCING VALVES**

**MDPPM16**
The small, compact solution
- P max.: 40 bar
- Q max.: 6 l/min
- Size: M16 cavity

**MGPPM16**
The compact solution for higher brake pressures
- P max.: 100 bar
- Q max.: 6 l/min
- Size: M16 cavity

**MPPPU10**
The solution for larger brake cylinders
- P max.: up to 350 bar
- Q max.: 20 l/min
- Size: UNF 7/8-14 cavity

**MQPPM22**
For fast movements of large brake cylinders
- P max.: up to 350 bar
- Q max.: 40 l/min
- Size: M22 cavity

**PRESSURE RELIEF VALVES**

**BDPPM18**
The small, compact solution
- P max.: 315 bar
- Q max.: 8 l/min
- Size: M18 cavity

**BDPPM22**
The solution for large brake cylinders
- P max.: up to 350 bar
- Q max.: 25 l/min
- Size: M22 cavity

**BSPPM22**
For high brake pressures, seat tight execution
- P max.: up to 450 bar
- Q max.: 2 l/min
- Size: M22 cavity

**THROTTLE VALVES**

**DNPPM18 / DOPPM18**
The small, compact solution
- P max.: 250 bar
- Q max.: 12 l/min
- Size: M18 cavity

**DNPPM22 / DOPPM22**
For fast movements of large brake cylinders
- P max.: 350 bar
- Q max.: 25 l/min
- Size: M22 cavity

**Control system** | **Pressure relief** | **Pressure reducing** | **Electronic control**
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Pressure accuracy | | | |
Space conditions | | | |
Costs | | | |
Tightness | | | |
Response times and hysteresis | | | |
The control of proportional valves is made using electronic control devices. These control the solenoid current in the valve. Through pulse width modulation with a superimposed dither signal, a very sensitive control of the valve with a small hysteresis is ensured. Our control devices are equipped with microprocessors. This enhances their functionality as well as their flexibility for use in different control systems. The various electronic devices feature amplifying and control functionalities with an optional fieldbus interface for easy connection to superordinate controls.

Decisive prerequisites for an optimum electronic control of the pressure are high-end signal processing and control of the solenoids. Three different electronic control variants are available. A user-friendly parameterising and diagnosis software facilitates adjusting the parameters of the valve and the PID controller.

**SNAP-ON MODULE SD7**
Digital electronic controller for the control of maximum 2 solenoids for installation in control cabinets.

The inputs and outputs can be freely assigned. This allows an optimised utilisation of existing hardware and enables a flexible adaptation to the application even without programming knowledge.

Parameter adjustments are stored in a non-volatile memory and are thus immediately available after switching on the control system.

Instead of an analogue interface, for all types a fieldbus interface can be used (Profinet, CANopen, J1939 or HART). Apart from the 24 VDC execution, also a 12 VDC version is available.

**ON-BOARD ELECTRONICS DSV**
This digital controller module for the control of maximum 2 solenoids is mounted directly onto the solenoid. The “Digital Smart Valve” features digital electronics in an extremely small space, making it the most compact design currently available on the market. These solutions have been designed especially for demanding applications in block constructions for stationary as well as mobile systems. The plug-and-play valves distinguish themselves by simple commissioning. The easy replacement facilitates fast repairs and thus short downtimes. Control can be made either by analogue signals or via a CAN fieldbus.

**MOBILE ELECTRONICS MD2**
The digital amplifier and controller module MD2 for maximum 8 solenoids was especially developed for the control of hydraulic valves under extreme ambient conditions. This device is suitable for use in conditions where moisture, vibrations, higher temperatures or fluctuating voltage supplies might occur. Thanks to its large voltage supply tolerance range (8…32VDC), the MD2 can be flexibly integrated into various systems.

The module features digital inputs and outputs as well as high-powered PWM outputs for the control of solenoid valves. Its digital inputs can easily process FM or PWM signals. Instead of an analogous interface, the MD2 is also available with a CAN fieldbus interface.

The MD2 is the ideal solution when several brake systems have to be controlled by a single electronic circuit board.
INDIVIDUAL SOLUTIONS

Wandfluh is offering its customers a large number of individual solutions based on existing components. Together with the customer, the specific requirements are defined prior to the design of a product exactly matching these prerequisites. Thanks to the profound experience of our engineers and the flexibility of our manufacturing organisation, we achieve optimised solutions for your specific needs.

EXPLOSION PROTECTION
For equipment used in ambient conditions where explosive liquids or gases are present, special technologies are mandatory. This particularly applies to sectors such as the extraction or processing of oil and gas, but also in mines with dangerous dusts or gases explosion protection valve technology is required.

CORROSION PROTECTION
For valves operating in continuous contact with salt water, a salty atmosphere or extreme weather conditions, an enhanced corrosion protection is required to enhance their service life. For such applications, valves with a zinc-nickel coating (> 800 h salt spray test) or in stainless steel execution (AISI 316L) are available.

LOW TEMPERATURE APPLICATIONS
For application in cold conditions, valves in two low temperature executions are available

**Z604 (-40 °C):**
Suited sealings, partly adapted fitting tolerances

**Z591 (-60 °C):**
Special materials, special sealings, increased fitting tolerances