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# Integrated Hydraulic Control Blocks Bring Concentrated Benefits

**Bespoke control blocks offer many advantages over conventional pipework solutions across a wide spectrum of hydraulic installations, including leak-free operation, robustness and compact size.**

Gerhard Ruppel, founder and managing director of Gerhard Ruppel Hydraulik in Bad Münden explains the key elements of this design discipline.

Hydraulic circuits work by using valves that open and close to direct the fluid to the required part of the system. Traditionally the valves are positioned around the circuit at points where the fluid flow needs to be controlled.

An alternative approach that is increasingly being favoured is to group all (or at least most) of the valves together in one place on a single block. The pipework that makes up the circuit has to be routed through the block, which may seem complicated, but this is more than compensated by the many other benefits that accrue.

While the control block approach is not suitable for all hydraulic installations, it is for a wide range of applications from presses, through construction machinery to deep-sea drilling rigs.

The block concept enjoys clear advantages over the more conventional method where each hydraulic

control element is piped individually. A block has a small footprint, and the risk of leaks is low. The screw-in valve technology is easy to maintain, and both standard valves and tailored valve solutions can be used. Energy and flow optimised systems can be incorporated during the block development stage and, last but not least, a block with screw-in valves simply looks better than a traditional hydraulic control with its multitude of pipes and connectors.

In this demanding domain of hydraulic and electrohydraulic engineering, experience counts for a great deal. When designers develop a control block of this type, their work revolves around the specific requirements profile of the application in question. And once a project is completed the details of each design are carefully filed away, because while the design is bespoke to a particular application, it contains elements that may be useful in later jobs. As the library of past jobs grows, so does its value to the design team, who may be able to produce a new solution tailored to a new requirement very quickly by re-using pre-existing partial solutions.

## Applications

The field of mobile hydraulics has already adopted the concept of control blocks with enthusiasm. This is due in part to the fact that mobile applications often impose special requirements in terms of space restraints, ensuring power density and long service life under unfavourable environmental conditions (vibrations, fluctuations in temperature, corrosive media, etc.). Another significant advantage is that the installation time for the hydraulics is dramatically reduced.

A typical project for mobile plant may involve the



Figure 2: When it comes to selecting its screw-in valves, Ruppel Hydraulik has an unusually wide range at its disposal, so that special requirements can also be implemented in practical applications.

design of a control block with more than 50 valves for the control console of an item of construction machinery (Figure 1). Pipework design for a control console of this size would be considerable and its installation would require around two person-weeks for completion. In contrast, a block solution would produce a compact control desk - considerably less than a metre long - which could be connected up by one fitter within a single day. The manufacturer is thus able to reduce the lead time for assembly of the machine as well as save on costs.

## Cement mill innovation

When developing a new type of cement mill, the designers were faced with the task of implementing a hydraulic safety system. If a very large piece of rock has to be processed, the gap in the crushing

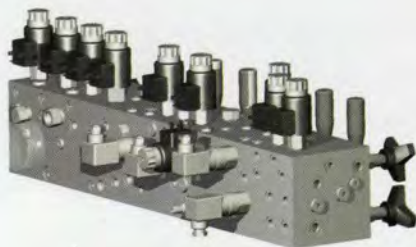
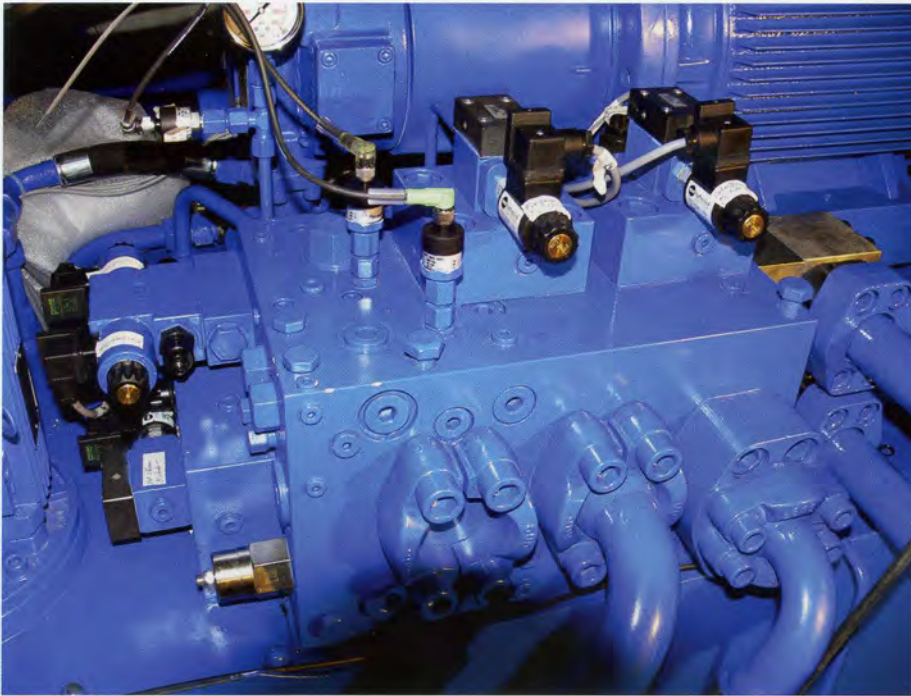


Figure 1: A block design can significantly reduce installation times for hydraulic control systems - in this case from two weeks to a single day.



gear has to be enlarged in a very small space of time. This is the only way to prevent the rock material damaging the crushing rollers and/or their drive.

Using conventional pressure limiting valves as shock valves does not work, as they will not react quickly enough. Instead a control block was developed incorporating a pressure limiting valve from the Sun Hydraulics range which has a particularly fast reaction time (Figure 2). Thanks to this valve, the adjustment drive is able to react very quickly. Within 300 msec, the system flow increases from 100 l/min to 1000 l/min without any pressure spikes.

All the functions required by the machine manufacturer have been incorporated in a compact, application-specific block which is also reliable under the harsh environmental conditions prevailing in the production of cement (Figure 3). The hydraulics are therefore instrumental in achieving practical implementation of an innovative, highly energy-saving concept in the production of building materials.

#### Integration press hydraulics

A Russian press manufacturer originally used a hydraulic controller of piped design to provide synchronous control of the two big cylinders on a series of hydraulic presses. In a redesign project, a block was developed incorporating three NG25

Figure 3: Even under challenging conditions, e.g. in cement production, control blocks work reliably, requiring a minimum of maintenance.

directional control valves and four NG10 valves, as well as other components. The block uses both proportional and on/off control valves, as appropriate for each task.

With the new hydraulic system pressure build-up to initiate press movement is very rapid, despite the massive volumes of hydraulic oil moving round the system. The block also manages pre-charging and



Figure 4: Subsea hydraulics: this block controls the drilling unit of a research ship which takes samples at depths of 2,500 metres.

pressure sequencing. The new block is a lot more compact than the solution it replaces, there are no leaks, and the system is reliable with very little need for maintenance.

#### Going deep

Particularly high requirements were presented by a project where a German research ship had been equipped with a hydraulic drilling unit designed for drilling the seabed at a depth of 2,500 metres. The first challenge was to ensure compensation of the external pressure of around 250 bar and reliable separation of the hydraulic circuit from other media such as drilling fluid and sea water.

The electrical signals generated at the control desk on the ship are converted by the hydraulic block (Figure 4) into movement at a depth of 2.5 km. Here too, both on/off and proportional valves are employed, and pressure regulation is used to adapt the hydraulic circuit to the requirements in question.

#### Summary

As well as extensive knowledge of and experience in control technology and applications engineering, flexible production options are needed if customer-specific control blocks of this type are to be developed and manufactured economically. In-house manufacture of the blocks is important in ensuring short lead times, both in larger production runs and on single batches.

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