



## DFplus<sup>®</sup> in hexapods

aerospace  
climate control  
electromechanical  
filtration  
fluid & gas handling  
**hydraulics**  
pneumatics  
process control  
sealing & shielding



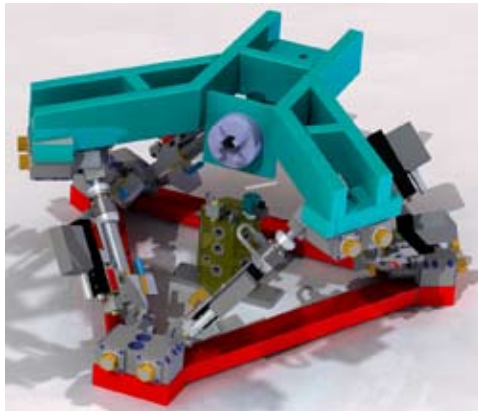
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# The visionary approach continues

## OHE: dynamic DFplus® control valves meet the challenging needs of hexapods

*The hexapods created by Swiss company Oelhydraulik Hagenbuch AG are characterised by demanding and highly dynamic control technology. Shakers and testing equipment with six degrees of freedom require high positioning and repeating accuracy – which is delivered by the DFplus control valve from Parker Hannifin. This means the Hagenbuch machines are already equipped for visionary applications.*

A neutron beam that can see inside aircraft components. In the Airbus assembly hanger, the landing gear being fitted to the body of the aeroplane. An automotive supplier testing car seats for vibration resistance. Simulators giving visitors the time of their life in interactive entertainment. All these applications are all very different, but they have one thing in common: they use hexapods – parallel kinematic devices with six legs of different lengths. Called “Hexamove“, these shakers and testing machines are the flagship of Oelhydraulik Hagenbuch AG (OHE), based in Ebikon near Lucerne.



Hexamove: Drive concept for parallel kinematics

Hexapods are characterised by high dynamics and low moving mass, with the consequent high accelerations and top speeds. Other benefits include positioning accuracy and enormous agility thanks to the six degrees of freedom. *“We need extremely dynamic valve technology with high repeating accuracy for these high-tech machines but also for other applications with high-precision actuators, such as our pressure intensifiers. Parker Hannifin’s DFplus delivers perfect results,”* explains Dipl.-Ing. Heiner Hagenbuch, owner and managing director of OHE.

### Best performance and high dynamics

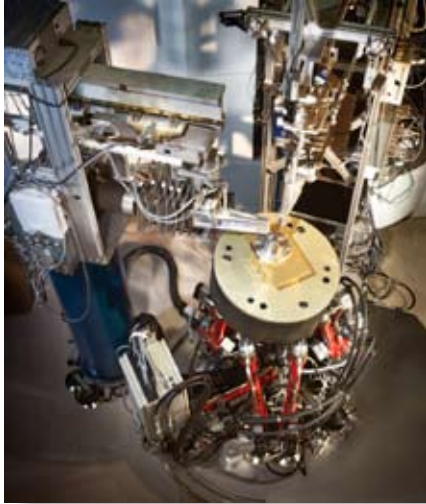
In 2003, when the Swiss company was looking for a solution to an application with problematic harmonics, the DFplus control valve was just coming onto the market. Looking back, Hagenbuch says: *“we tested a lot of valves from different manufacturers internally. The DFplus quickly became the favourite because it brought excellent performance to the system as a central component. It offers the best dynamics with low harmonics.”* This marked the start of closer collaboration between OHE and Parker Hannifin, who had already supplied pumps and valve to OHE’s unit assembly department.

To illustrate the serious challenges faced by the valves in particular, here are some facts and figures about Hexamove: depending on the application, the machines work in frequency ranges of 30 to 200 Hertz. They have an accuracy of up to 0.01 mm, generating accelerations up to 4 g under sustained load – with peak values of 25 g. To put this into context, a person can only withstand up to 10 g before losing consciousness. Machines like this, with very strictly controlled movement, are used by automotive suppliers for vibration-testing vehicle components.

### High-tech solution for research

One of the most interesting yet challenging tasks is creating a hexapod for research institutes, where components are illuminated, like in an X-ray, by a neutron beam to find out more about the properties of the material. The Hexamove’s job is to move to a very specific position and stay there. Hagenbuch explains the problem: *“alongside the positioning and repeating accuracy, the dynamics of the valve is crucially important.”*

*When the weight of the component – sometimes several tonnes – causes the Hexamove to oscillate, the control technology must quickly counteract the movement, keeping the component absolutely still while it is being radiographed. The DFplus makes child's play of this. There is even spare capacity for better performance."*



Neutron test facility (courtesy of Institute Laue-Langevin, Artechnique photo, France)

What makes the DFplus so special is its unique construction. Based on the patented VCD® drive (Voice Coil Drive) – a refinement of the voice coil principle, which works like a loudspeaker coil – the valve reaches up to 350 Hertz. The low moving mass also contributes to the high dynamics. The step response of valves with a nominal size of 6 is very short at less than 3.5 milliseconds, and the force development is very high.

### **Short step response, clean signals**

Hagenbuch has used these values successfully in the Hexamove machines: *"the short step response times are particularly important for our applications. The clean signal is vital for fine control. In terms of system frequencies, we're currently at 200 Hertz, but demands are increasing here too, and we're already getting enquiries about 400 Hertz."*

The range of applications also includes shakers with controlled acceleration and special test facilities with sweep functions. These are used to test the resonant frequency of components to destruction.

The enormous forces required in applications like these mean that there is a risk that the forces will act on the components of the test machines, potentially damaging them. That is why Hagenbuch adds: *"this is another reason why working with Parker Hannifin is good for us. Things are made much easier for us, with fast support if there are problems, short delivery times and a designated contact. This partnership and the established technology of the DFplus control valve form a sound basis for future projects – our visionary approach well beyond merely simulating reality."*

### **OHE: traditional think-tank for the ideas of the future**

Oelhydraulik Hagenbuch AG (OHE), based on Ebikon near Lucerne, was established in 1955. The family company is now run by the third generation. OHE combines established hydraulics with cutting-edge electronics and software. Most of the 50 employees work on engineering activities, making the Swiss company a powerhouse of innovation. The proof is the customer base, consisting of car manufacturers and automotive suppliers, aircraft manufacturers, research institutes and theme parks. For example, OHE created the hydraulic system for the famous "Back to the Future" simulator at Universal Studios in Orlando, Florida. OHE is a centre of expertise in components and complex drive systems, developing, supplying and commissioning bespoke solutions for customers.



Technical cooperation over many years: H. Hagenbuch jun. (right) with Parker engineers M. Wolf (left) and K. Mangold (middle)



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