PRESS INFORMATION

Simply electric: actuators for green hydrogen and carbon capture and storage applications

Manuela Kessler | 22.04.2024 | Lohr am Main / Germany | PI 006/24

Electrification reduces capital and operating costs of offshore systems above and below water

eSEA subsea electric actuators with functional safety for controlling all types of valves in water depths of up to 4,000 meters. (Image source: Bosch Rexroth AG)

To limit global warming to 1.5 °C above pre-industrial levels, the Intergovernmental Panel on Climate Change (IPPC) recommends in its Special Report on Global Warming, among other things, the use of hydrogen and, in a number of cases, the capture, use and storage of CO2 (CCUS). For the offshore plants needed to produce green hydrogen or for CCUS to be operated economically, the technology applied must become significantly more cost-effective to purchase and operate than it has been up to date. To achieve this, Bosch Rexroth is expanding its portfolio of subsea actuators with additional variants and motion options to electrify and digitalize all safety-relevant movements at depths of up to 4,000 meters.

In the offshore storage of CO2 as well as in the intermediate storage of green hydrogen, valves regulate the controlled flow of process gases and fluids. Up to now, these valves have mostly been operated by hydraulically driven actuators. This requires central hydraulic power units above water with kilometers of pipelines to the individual actuators on the seabed. Newly developed eSEA actuators supplied with 24 V low-voltage (DC) are an economical alternative to these capital- and energy-intensive conventional hydraulic systems. Their lower power consumption reduces operating costs. In addition, digital twins increase process reliability with condition monitoring.

Bosch Rexroth is now adding the eSEA Push actuator for linear movements and the eSEA Drive for applications with very high torques in excess of 35 kNm to its actuator for rotary movements (eSEA Torque), which has won several international technology awards. This means that all movements required for a safe and reliable valve control under water can be now controlled and executed purely electrically, with a standardized interface.

Safe without electric energy and with self-monitoring

All variants use the fail-safe principle, in which spring elements are actively clamped to keep the valve either open or closed. If the power supply fails, the clamping is released, and the valve automatically moves to the safe position in accordance with IEC 61508 and IEC 61511 without the need for expensive safety-relevant subsea batteries. Bosch Rexroth supplies the eSEA actuators with interface to external sensors and process valves as well as with digital twins of these assemblies. The control hardware is based on electronics from the automobile industry. The solution also comprises software, including machine learning applied for the embedded condition monitoring. On the basis of internal and external sensors and measured values, the condition of the overall system and impending wear can be detected before a failure occurs. If a sensor fails, the digital twin can take over and ensure continued operation.

Small energy requirement for low and high loads

The eSEA actuators significantly reduce the energy requirements of subsea systems. They also connect increasingly distant step-outs. In some cases, these are valves located more than one hundred kilometers from the coast, which also have to be controlled via actuators. eSEA Push modularly covers the performance range for valves up to five inches in diameter up to 745 kN. The eSEA Drive is designed for larger diameters and torque requirements of more than 35 kNm. This unit generates the high forces via a decentralized drive module suitable for deep-sea use with a closed hydraulic circuit and special protective measures to prevent hydraulic fluid contamination.

All eSEA actuators from Bosch Rexroth are designed for a safe and reliable operation over 25 years permanent subsea. Replacement is possible with subsea robots without impairing the function of the valves. The digital twins reduce the engineering and commissioning costs of the actuators for new systems. They can also be retrofitted in existing installations.

On April 24 at 10:35 a.m., Bosch Rexroth together with NOV I APL Norway AS will present an innovative solution for the offshore industry at the Energy 4.0 Conference Stage of the Hannover Messe trade fair under the title “Lean Electrification to scale up Carbon Capture and Storage Subsea”.

Basic Information Bosch Rexroth

As one of the world’s leading suppliers of drive and control technologies, Bosch Rexroth ensures efficient, powerful and safe movement in machines and systems of any size. The company bundles global application experience in the market segments of Mobile and Industrial Applications as well as Factory Automation. With its intelligent components, customized system solutions, engineering and services, Bosch Rexroth is creating the necessary environment for fully connected applications. Bosch Rexroth offers its customers hydraulics, electric drive and control technology, gear technology and linear motion and assembly technology, including software and interfaces to the Internet of Things. With locations in over 80 countries, around 33,800 associates generated sales revenue of 7.6 billion euros in 2023.

Basic Information Bosch

The Bosch Group is a leading global supplier of technology and services. It employs roughly 429,000 associates worldwide (as of December 31, 2023). The company generated sales of 91.6

billion euros in 2023. Its operations are divided into four business sectors: Mobility, Industrial Technology, Consumer Goods, and Energy and Building Technology. With its business activities, the company aims to use technology to help shape universal trends such as automation, electrification, digitalization, connectivity, and an orientation to sustainability. In this context, Bosch's broad diversification across regions and industries strengthens its innovativeness and robustness. Bosch uses its proven expertise in sensor technology, software, and services to offer customers cross-domain solutions from a single source. It also applies its expertise in connectivity and artificial intelligence in order to develop and manufacture user-friendly, sustainable products. With technology that is "Invented for life," Bosch wants to help improve quality of life and conserve natural resources. The Bosch Group comprises Robert Bosch GmbH and its roughly 470 subsidiary and regional companies in over 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. Bosch's innovative strength is key to the company's further development. At 136 locations across the globe, Bosch employs some 90,000 associates in research and development, of which nearly 48,000 are software engineers.

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