

Technical Report

Cast in concrete – Innovative vibration damping on truck-mounted concrete pumps with strain sensors.

The trend on truck-mounted concrete pumps is for greater reach with less weight. Technical advances at Schwing are currently making it one of the market leaders in this field. In order to raise operator comfort levels on truck-mounted concrete pumps with large booms, the company has launched an innovative vibration damping system. Schwing, in partnership with Baumer Electric AG, has developed a new strain sensor with an IP 69K protection rating and an exceptionally broad measuring range to provide precise signaling of deflections as they occur in the boom.

Since its formation in the 1930s, the German group of companies has been designing, constructing and selling pumps, machines and plant equipment for the production, transport and reprocessing of concrete: batching plants, truck-mixers, stationary and truck-mounted concrete pumps as well as recycling plants. Whether concreting a swimming

pool in the front garden of a family home or realizing prestigious public projects such as the One World Trade Center in New York, USA, or the third Bosphorus bridge in Turkey, the machines and plant are deployed wherever concrete is used to provide permanent stability. With six manufacturing sites and subsidiaries or representatives in more



The Baumer corrosion resistant strain sensor DST55R with an IP 69K protection rating provides cost-effective external force measurement under tough conditions.



Schwing truck-mounted concrete pump in use on a large construction site

than 100 countries, the company provides efficient, reliable and long-term solutions throughout the world. Extensive in-house production capacity for core components guarantees strict inspection processes and high product quality. Truck-mounted concrete pumps of various sizes and types are manufactured at sites in Herne (Germany), Chennai (India) and Sao Paulo (Brazil). The models with the longest placing booms are manufactured at the SCHWING Group's German headquarters. With a new boom drive concept, high-strength steel, less weight, and more operator comfort, they are Schwing's answer to the market's increasing demands in terms of economics, ecology and ergonomics.

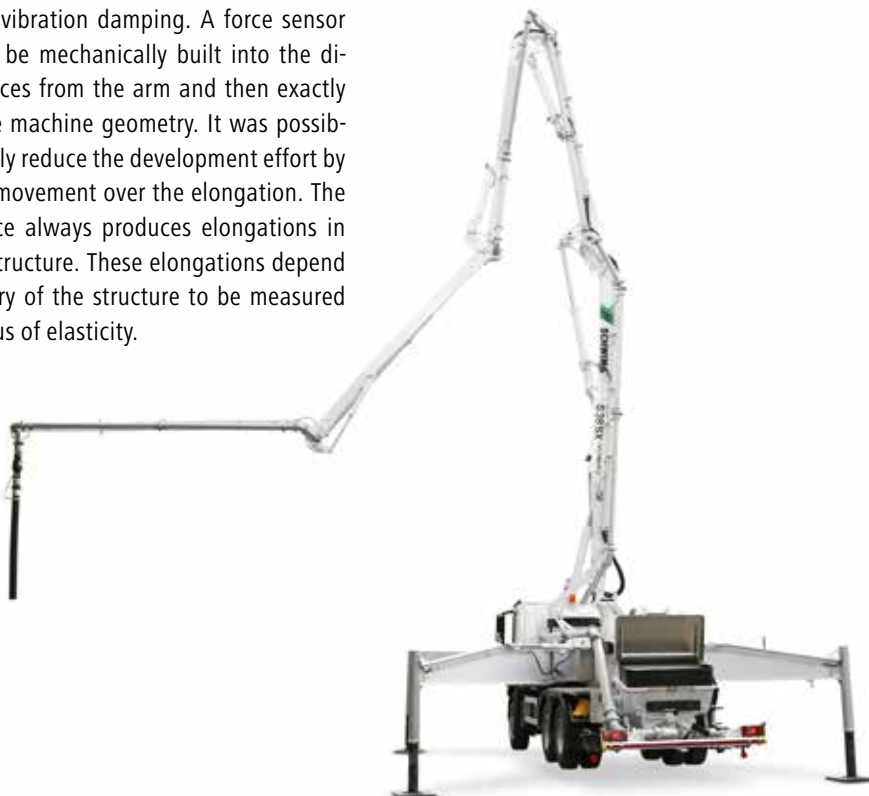
Tough construction site conditions

Modern placing booms have a reach of almost 65 meters. With highly efficient twin cylinder piston pumps and a pressure of up to 85 bar, they pump concrete at up to 164 m³ per hour. This obviously causes vibrations in the boom. In order to be able to offer end users improved operator comfort at the end hose, Schwing has developed an innovative vibration damping concept which has included a complete revision of the hydraulic elements. A precision transducer was required which could pick up the elongations from the signal boom caused by movement of the whole placing boom, and which would then transmit the command variables for the vibration damping. A force sensor would have to be mechanically built into the direct flow of forces from the arm and then exactly matched to the machine geometry. It was possible to significantly reduce the development effort by absorbing the movement over the elongation. The effect of a force always produces elongations in a mechanical structure. These elongations depend on the geometry of the structure to be measured and the modulus of elasticity.

Customer-specific solution

"We developed a customer-specific, innovative strain sensor in close collaboration with Baumer Electric AG which comfortably overcomes all the challenges," explains Reiner Vierkotten, Senior Engineer Control Systems at SCHWING GmbH. "The new high-strength steels we have used allow the mechanical stresses and elongations to take place in higher areas than in previously used materials. Conventional strain sensors cannot operate in these areas."

A completely new set of sensor mechanics was developed using FEM simulations with a measuring range of $\pm 2000 \mu\text{m/m}$. The easy-to-mount sensor with long-term seal functions perfectly in multi-shift operation in spite of the tough conditions on building sites. It is calibrated at the factory which speeds up installation and any possible replacement work. The new sensor, with its on-board electronics, supplies a high-resolution digital CANopen[®] signal directly to the truck-mounted concrete pump's control system.



The trend towards lightweight construction using high-strength steel combined with longer booms has demanded innovative solutions to increase operator comfort.

Compared to force sensors, which have to be precisely adjusted to the machine geometry, the strain sensor can be easily mounted at the optimum position with just two bolts. This does not affect the structure of the machine, save times in development and makes mounting easy. The robust design of the sensor makes it impervious to shocks, impacts, and other mechanical influences and is therefore ideal for use in the construction environment. At the same time, it is very gentle, reacts quickly, and can accurately detect even the slightest elongation or compression. It is resistant to wind and weather due to its corrosion-resistant housing. With a certificated protection class of IP 69K, its seal is absolutely guaranteed and can be cleaned with high-pressure or steam cleaning systems.

“We are very pleased with our collaboration,” confirms Vierkotten. “The innovative damping system is also available for the latest S 65 SXF truck-mounted concrete pump from SCHWING which was launched at the beginning of 2018 at the World of Concrete trade fair in Las Vegas. Following comprehensive prototype testing and optimization during the development phases, the new DST55R strain sensor was successfully put into volume production by Baumer. We can imagine using Baumer sensors for future projects on our truck-mounted concrete pumps.”

Further information:

www.baumer.com

www.schwing.de



A strain sensor bolted to the lower part of the main boom records the movement of the placing boom and sends the signal for the vibration damping to the control unit.



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