Custom-built eccentric valve a dam fine choice

Viking Johnson not only supplied the eccentric plug type valve used in the maintenance of Grizedale Reservoir's dam tunnel, it also co-ordinated the various specialist companies that participated in what was regarded as a complex project.

A TEAM OF specialist divers working in a cramped, water-filled tunnel 20m beneath the surface of a reservoir has just completed installing an eccentric plug valve to control water flow.

The valve and associated equipment have been supplied to United Utilities by Crane Building Services & Utilities subsidiary Viking Johnson – a leading supplier of pipe joints as well as repair and flow control products.

The valve has been installed at the end of a tunnel that runs beneath the dam holding back 332,000m3 of water in the Grizedale Reservoir, near Scorton in Lancashire.

The reservoir was built in 1866 by forming a 22m high, 120m long earth embankment across the valley of Grizedale Brook to act as the dam wall.

A tunnel – 1.8m wide and 1.7m high – beneath the dam takes water from the reservoir to a pump house from where it is pumped up to the nearby Barnacre North Reservoir before it flows under gravity to the treatment works at Franklaw.

The diving pontoon in position on the lake

Flow control

A gate valve sited near the outlet has, for many years, controlled water flow through the tunnel. However, recent inspections showed that the valve was no longer adequate.

In order to improve operational control of the water flow without reducing the water level in the reservoir or potentially polluting the downstream watercourse, it was decided to install a secondary valve.

Viking Johnson was selected to supply this replacement valve which, rather than being of a gate design, is of the eccentric plug type. This will provide United Utilities with the ability to not only isolate but also control the flow when transferring water to Barnacre.

The eccentric plug valve requires only a one-quarter turn of the shaft between its fully open and fully closed positions, therefore making it relatively easy to automate its operation for submerged duty.

In addition to the valve, Viking Johnson has provided a total solution, including the bespoke actuation system, a specially designed hydraulic power pack and an emergency hand pump facility for the hydraulic system that permits the valve to be operated in the event of electrical supply failure.

The system includes almost 400m of high-specification stainless steel braided hydraulic hose lines running between the valve and pump house.

A team of ten divers winched the valve and actuator, weighing almost three quarters of a tonne, along the tunnel on a specially designed trolley.

Viking Johnson provided the diving company with a dummy valve ahead of the installation so that the divers could practice manoeuvring it in controlled conditions within a training facility.

On site at Grizedale, the divers used a decompression chamber housed on a floating pontoon above the submerged tunnel entrance, 20m beneath the surface, allowing them to work for up to 70 minutes at a time.

The 450mm bore Viking Johnson eccentric plug valve is designed to give reliable service for many years in this almost inaccessible location.

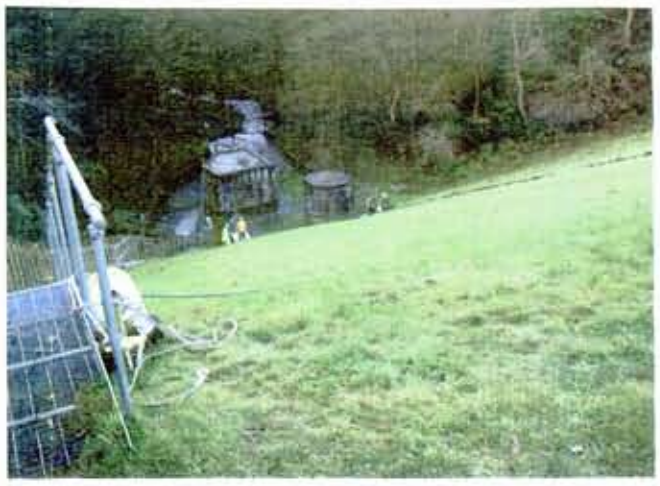
Manufactured in cast iron using high-pressure moulding techniques, the valve incorporates a nickel-welded seat for corrosion resistance, specially profiled for low torque and extended valve life.

The valve is trunnion-supported and fully encapsulated in elastomeric polymer, with a valve body fully internally and externally lined with epoxy.

Challenging project

The eccentric plug design ensures that the ductile iron plug – fitted on permanently lubricated austenitic stainless steel bearings – rotates away from the seat as soon as movement begins, avoiding scuffing and therefore extending the operational life of the valve.

James Tresnan, United Utilities project manager, comments: "Grizedale was a particularly challenging project. Installing a 450mm diameter valve 50m along a 1.7m high brick arch tunnel should never be classed as straightforward. But when the tunnel is submerged 20m below water and the silt in it results in zero visibility for the divers, the degree of difficulty is amplified tenfold.



The pump house where the valve controls are situated

"This was the situation at Grizedale. Consequently, it was key that we worked with our contractors and suppliers from an early stage in the development to ensure we simplified the construction activities whilst at the same time achieving the required functionality. Viking Johnson was part of the strong team that was developed on this project and worked with us to assist in the successful delivery of the scheme."

Graham Biggs, business development manager at Viking Johnson, says: "This unique, complex project has required close co-ordination with a number of specialist companies and personnel, including Eric Wright Civil Engineering, Shakespeare Engineering Supplies, Rotork Fluid Systems, Consortium Underwater Engineers Ltd, Red 7 Marine diving contractors and MWH project consultants working alongside United Utilities capital maintenance, site operations and project management teams.

"The custom-built design and the engineering quality of the new eccentric plug valve and its automation and power system means it will be many years before such an operation is required again to replace it," says Biggs.

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The Viking Johnson valve and trolley is lowered into the lake