

Rise of the machines

IWP&DC takes a look at some of the latest news and developments concerning machinery in the hydropower and dams industry



Above: **Loch Lomond Electric Facility**

Below, left to right (images courtesy Glenfield Valves): **12 inch face and seat rings before Piston assembly**

12 inch valve in the closed position showing the Seat and Face engagement

48 inch Piston assembly

Sloy Dam Dispersal Valve Leaking before refurbishment



GLENFIELD VALVES WAS RECENTLY awarded a contract by Dales Engineering Services for overall client Scottish and Southern Energy (SSE) to refurbish two Needle Discharge Valves – one 48” and one 12” – on the Sloy Hydroelectric Power Station.

In May 1945 construction began on the Sloy Hydroelectric Power Station on the banks of Loch Lomond in Scotland. The power station was completed five years later and was opened on 18 October 1950 by the late Queen Mother – It is still the largest conventional hydroelectric power plant in the UK.

The Loch Sloy Dam, built as part of the project, is 56m high and 357m long and raised the surface level of the loch by approximately 47m. The resulting Sloy Reservoir has a 17km² direct catchment area, although various pipes and intakes have provided a further 63km² of the indirect catchment area. The total volume of water held in the reservoir by the dam is approaching 36million m³, and a 3km long tunnel takes water from Loch Sloy to a valve house positioned approximately 197m above the tank. From the valve house, four DN2000 steel pipes carry the water down into the powerhouse that is situated on the west coast of Loch Lomond.

Jim McAllister, Glenfield Valves Project Manager for the project, explained about the valves and the company’s involvement. “The Needle Discharge valves are the original ones fitted in the 1960s by Glenfield Valves, and it is the first major refurbishment they have had. We still have the original drawings in our extensive drawings library that enabled us to understand what was needed for the refurbishment.”

The valves were originally removed by Dales Engineering Services Ltd and were delivered to the workshop.

From there the Glenfield Valves engineering team were able to remove and replace the bronze seat and face rings on both valves. The most challenging aspect of replacing the seat and face rings is ensuring that the ‘bedding’ or ‘lapping’ between the seat and face rings was accurate. This is done by hand and is

a highly skilled process; one which is fundamental to successful and cost-effective valve refurbishment.

McAllister explained: “During the assembly, we have to rebuild all the gearing within the valve and replace the bronze piping for the grease lubricating pipe. We then have to undertake the ‘lapping’ element to match the seat faces – this is also carried out by hand. It entails introducing a marking dye on one surface and then closing the valve until the two surfaces are engaged. This indicates the high points on the surface that have not been dyed. It is then that the most intricate and skilled aspect of the works takes place. The engineer fitter has to file or grind the surfaces by hand until they are completely engaged and ‘drop tight’ – no leakage whatsoever.

“The valves are then fully assembled, painted and hydrostatically tested.

“We received a visit from the Dales Engineering Services Limited and SSE Engineers who witnessed the successful testing of the valves post refurbishment. The SSE engineer commented that he looked forward to another 50 years of successful operation.”

For further details on the Sloy Hydroelectric Power Station scheme, please contact:

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Single source solutions

Gilkes Hydro offers single source solutions for a range of hydropower turbines. The company’s range of Pelton, Francis and Turgo Turbines cover low, medium and high head projects capable of generating up to 30MW per unit. Having manufactured over 6800 turbines, Gilkes offers complete water to wire solutions for small hydroelectric developments.

Drawing on this vast experience gained from over 160 years of designing, manufacturing and commissioning hydro schemes, Gilkes says it excels when it comes to servicing and plant modernisation – from single part replacement to fully rehabilitating whole installations back to their optimum working efficiencies.



With thousands of installations around the world, Gilkes says it has the ability to be sensitive to regional differences and requirements, and design, manufacture and install bespoke engineered solutions for their customers.

A strong customer base and key relationships in the Asian, African and North American markets continues Gilkes exporting legacy, with the following projects currently being installed and commissioned:

- Iskale, Turkey (2 x 5.4MW, 6 Jet, Vertical Pelton)
- Sadiola, Mali (154kW, Compact Turgo)
- Tsanga B, Zimbabwe (2.8MW, Twin Jet Turgo)
- Ghuilbinn, Scotland (4 x 703kW, Francis Turbines)
- Calligan & Hancock, USA (2 x 6.4MW Twin Jet Pelton)
- Shoshone, USA (3MW Francis Turbine)
- South Rivers, St Vincent (Plant Modernisation of 3 Turgo’s installed 1952)

Furthermore, Gilkes engineers have recently completed commissioning of a 13.5” Twin Jet Turgo for the Kaptega scheme at Mount Elgon Orchards in Kenya. Mount Elgon Orchards Ltd is a remote farm based on the Kenya/Uganda border, exporting 80 million top quality roses around the world under the brand “The Elgon Collection”. It also grows 80 hectares of avocados currently. It is a family run farm and the largest employer in Trans Nzoia (Western Kenya) employing 1400 permanent employees. Its corporate social responsibility is impressive, with three schools (2000 children), a hospital treating 40,000 patients annually, a children’s home, a special needs home, a physiotherapy centre and an orthopaedic workshop. The recently commissioned hydro plant produces 249kW and is saving the farm over 1100 litres of diesel per day, previously in its diesel generators.

This was an ideal scheme for the firm’s Turgo machine, which has proved very popular in Africa since it was invented by Gilkes in 1919. The company has delivered around 1000 Turgo’s into the world market in that time. The Turgo is a simple Impulse type machine designed to operate at a higher speed than the Pelton turbine. With a higher efficiency across a broad flow range, the Turgo is operational on silt laden water over long periods with minimum wear. The simplicity of the Turgo translates to minimal service and maintenance requirements, making it particularly suited to remote, rural electrification schemes.

For further projects and a selection of case studies see www.gilkes.com/Hydropower

Manufacturing

Canyon Hydro manufactures hydro turbines, supplies hydroelectric systems and offers hydroelectric

equipment refurbishment services for utilities and independent power producers. For more than 40 years the company has built upon the fundamentals of delivering maximum attainable efficiency, long term reliability, and customer support, it says.

Canyon Hydro’s engineers leverage the latest technology to build more efficient turbines. Designs for runners, spiral cases, nozzles, wicket gates and other wetted surfaces are continually refined. This fine tuning involves the use of advanced, three-dimensional CAD modelling and simulation tools. Such precision is carried through to the manufacturing process where computer-controlled mills produce exact replicas of the digital 3D models. When the CNC milling process is complete, the finishing team meticulously polishes the runners to further maximise efficiency.

Manufactured within company owned facilities in the US, Canyon Hydro says its turbines are built to deliver utility-grade power for many decades. This long-term durability receives a great deal of emphasis during design and manufacture. Canyon says its turbines exhibit attention to detail, reflected in everything from leak-free connections to smooth seams and finishes.

A hydropower project is a team effort and Canyon recognises the importance of this. During the design and construction phase the Canyon project team communicates regularly with onsite project engineers and other suppliers to ensure all components and installation teams will work well together.

www.canyonhydro.com

Technology-orientated

Oiles America Corporation is a technology-oriented manufacturing company that continues to focus on responding to customer’s design, testing and manufacturing needs for self-lubricated bearings. The company’s maintenance free bearing products offer cost effective alternatives to automatic lubrication systems, while freeing machine operators from day to day lubrication requirements, it says.

For over 50 years, Oiles has been providing custom designed, self-lubricated bearings to the hydro electric industry. Oiles products are self-lubricating, maintenance free and reliable. Worldwide Oiles says it has over 1400 installations with zero failures. The company offers bushings for hydro (wicket gates, thrust pads, Kaplan hubs); dams (Tainter gates, roller gates, radial gates); offshore (fairlead moorings, sheaves); locks (pintle, spherical); and bridge (cable hanger and thrust plates).

Applications include hydroelectric turbine applications, pintle bearings for navigational lock f



Top left: **13.5 inch Twin Jet Turgo. Images above courtesy of Gilkes Hydro**

Top right: **Gilkes Turbine during installation**

Middle: **Mt. Elgon Farm**

Bottom: **Powerhouse during construction**

Machinery |



Top left: The La Esperanza project in Honduras uses twin Canyon Pelton turbines to produce 12MW from 370m (1214ft) net head



Top middle: Canyon owner Richard New inspects the runner mounting bolts during installation of a 5 MW Pelton system



Top right: A 1 MW Francis turbine in final stages of assembly before being delivered to site. All components are test fit at Canyon's facilities to ensure on-site installation goes smoothly



Above: Inspecting a one-piece, 7 MW Pelton runner on Canyon's 7-axis CNC mill. The runner has a diameter of 3.4m (11.25ft) and weighs 21,000 pounds. The computerized milling process creates an exact match of the digital 3D model created during design.



Above right: Canyon technicians work below a generator stator to prepare line boring for wicket gates. Canyon Hydro provides extensive onsite services such as disassembly & assembly, inspection, machining, and welding.

Below: Inner sphere. Images below courtesy of Oiles

Bottom left: 500 bushing

Bottom middle: Inlet valve

Bottom right: Water turbine



j gate projects and spherical bearings for hydroelectric dam gates along with fixed and flowing swing bridge applications.

Oiles custom designed bearings are manufactured using Oiles 500SP SL4. Its material is a high strength bronze alloy impregnated with PTFE solid lubricant. The solid lubricant material is distributed in a specific pattern depending on the motion. The design can meet the most demanding applications which include small oscillations +/- 1 degree says the company. Oiles bearings are designed for high load, long service life and maintenance free operation.

Oiles 500AB SL4 is nickel aluminum bronze for sea water and other corrosive environments. Oiles products are designed to run in the most demanding environments that include but are not limited to Kaplan inner runner blades found with pumped storage units, wicket gates, wear pads specialty linkage mechanisms and inlet valves.

Oiles' new composite self-lubricating bearing, Fiberflon GH, consists of lubricant (PTFE) containing unsaturated polyester and special woven fabric. It offers:

- Low swelling rate and higher dimensional stability than other thermosetting resin bearings.
- Superior sliding performance under low temperature or in muddy water.
- Environmentally friendly due to the absence of grease.
- Superior low coefficient of friction and wear resistance.

Oiles produces self-lubricating, maintenance free & reliable bushings which are offered in flanged & straight plain bearings, washers, plates, die components and sintered vents. ●

www.oiles.com

