

Hobas for Penstocks



The lightweight Hobas fiberglass pipe sections were carried to the point of installation and assembled using a single excavator.

Hobas Field Service assisted the contractor during installation.



MEANDERING THROUGH THE WHITE MOUNTAINS, a large wooden penstock served as the main water supply for a local hydro facility. Jackman Station, as the facility is referred to, is fed by the Franklin Pierce Reservoir, which was created by the hydro's dam and surrounding earthen dikes. The water elevation in the reservoir is managed according to spring run-off.

Public Service of New Hampshire (PSNH), the Granite State's largest electric utility, serves more than 475,000 homes and businesses. PSNH's power generation facilities consist of nine hydroelectric plants, including the Jackman Hydro station, which was built in 1926. This facility, located in Hillsborough, has been serving the area for years, but the penstock was approaching the end of its service life.

Reliable CCFRPM

Prior to the recent improvements, 5,000 feet of wood stave penstock extended from the Franklin Pierce reservoir to a surge tank upstream of the powerhouse. This 7.5-foot diameter penstock was made up of vintage wood stave sections, circa 1926. Repairs were undertaken in 1954 and in the 1970's, yet the downstream sections of the wood penstock still leaked badly. This leakage caused icing problems during winter months and required constant maintenance. In 2003, the penstock had a significant rupture that impacted abutting properties. To prevent future failures and ensure reliable operations of the hydro facility, repairs to the existing penstock were necessary. In a series of contracts, PSNH decided to replace the remaining wood stave penstock with a new pipeline.

Kleinschmidt, headquartered in Pittsfield, Maine, that specializes in energy and water resource projects, was retained to develop a feasibility study and engineer a replacement pipeline.

Kleinschmidt initially evaluated five pipe material options for the penstock replacement: wood stave, concrete, HDPE plastic, steel and fiber reinforced polymer (FRP). Factors that led to the final determination included the structural reliability, corrosion resistance, hydraulic capacity, ease of installation (pipe weight) and performance history of the pipe material. Kleinschmidt provided their evaluation and recommendations to PSNH, which chose the fiberglass pipe option and purchased CCFRPM pipe manufactured by Hobas PIPE USA of Houston, Texas.

(continued on reverse)

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Year of construction	2007
Total length of pipe	1,020 feet
Diameter	84-inch
Stiffness class	46 psi
Installation method	Aboveground
Application	Hydro power
Client	Public Service of New Hampshire
Installer	CCB, Inc./JML Trucking and Excavating
Advantages	High-strength, long-life



Design Considerations

"The corrosion resistance and relative stiffness of FRP pipe meant it could be supported on the existing grade and half buried, rather than placed on saddles or completely covered in a buried trench. This design flexibility, combined with a longer projected service life lead to a competitive total construction cost for the FRP alternative," stated Keith Martin, a project engineer and civil/structural engineer with Kleinschmidt's Pittsfield, Maine, office.

"The lower frictional resistance of Hobas compared to other materials allowed the replacement pipe to be reduced to a 7-foot diameter without additional head loss," stated Martin.

The pipe was half buried in the shallow trench of the existing penstock, requiring minimal excavation costs and low environmental disturbance. Approximately 300 feet of the new penstock were supported above ground on steel saddles to accommodate the topography as well as

minimizing the impact to the wetlands that the penstock crossed.

"Hobas CCFRPM is manufactured by a unique computer controlled centrifugal casting process. To achieve the higher axial strength necessary for the aboveground installation, additional reinforcement is placed in the longitudinal direction during the manufacturing process," explained Rene Garcia, Sr. engineering associate with Hobas Pipe's Houston manufacturing facility. The design flexibility is just one of the benefits provided by this product.

"PSNH bought the Hobas pipe directly and CCB, Inc. of Westbrook, Maine (CCB) was contracted to install it," stated Mr. Newell Porter, project manager with CCB.

"Prior to this project, I had heard of Hobas pipe, but had never installed it."

The job site posed some challenges as the pipe was installed in a remote area. "The pipe arrived as scheduled and unloaded near the roadside. This phase of the job was 1,020 feet of 84-inch diameter Hobas pipe. The individual joints were then carried to the point of installation with an excavator. We had no truck access to the installation point. A Hobas field rep was onsite pretty much from day one. The first part of the installation was through a curve where 10-foot joint sections were connected and then deflected to make up the curve," stated Porter.

The Hobas FWC coupling joint utilized on this project is a pressure joint. It is commonly used in direct bury application and also for above ground installations such as penstocks. It is a structural filament wound sleeve over wrapped and mechanically locked to an internal fullfaced elastomeric membrane. The sealing design includes both lip and compression elements so the joint is suitable for both non-pressure and pressure service up to 250 psi. "In our case, we air tested each joint after assembly with a 10 psi air test. None of the joints leaked. Once the line was in operation, we were required to visually inspect each and every joint for a sign of leakage and there was none," stated Porter.

Tight Sealing Joints

JML Trucking and Excavating of Errol, N.H., was the installation sub-contractor for CCB. Mr. Butch Lane echoed the general contractor's sentiments, "It really is a good pipe. The joints are really tight. I know that we've had people come by and look at the project, and they are all happy. We were able to put PSNH online two weeks ahead of schedule and that makes them happy."

"At the end of the project, it was found to be approximately seven times cheaper per foot to utilize the fiberglass pipe option partially backfilling the penstock than to support it above ground," summarized Martin. Hydraulic advantages and longevity of the line will also provide life-long savings.