

Application note



How Panametrics clamp-on flow meter technology delivered accurate measurements of high velocity water flow in a penstock pipeline

Summary

700-meter-long penstocks at a hydroelectric power plant in China had no flow measurement to assess the water turbine efficiency and to better control the power plant performance. To address this gap, the operator evaluated three flow measurement technologies: vortex; differential pressure; and ultrasonic transit time. Before making any decision, they required a technical evaluation and a potential field test.

Application

Medium:	Water
Pipe size and thickness:	DN700 (32")
Pipe material:	Stainless steel
Pressure:	0.2 MPa (29 psig)
Flow rate:	4–7 m ³ /s (63,401–110,952 GPM)
Temperature:	~ 25°C (77°F)
Requested accuracy:	± 1 to 2% of reading

Benefits:

- Easy to install with no process shutdown
- Very low maintenance
- No pressure drop
- Unrivalled large turndown ratio from low flow to high flow
- Long term stability and drift characteristics



Fig. 1: C-RS 0.5MHz installed on DN700 pipe

Challenge

The customer's objective was to install flowmeters on these lines with the understanding that flow velocities could exceed 15 m/s (49 ft/s). At the same time, minimizing pressure drop was critical due to the limited available head (pressure).

Conventional technologies such as differential pressure devices and vortex meters were not suitable, as both introduce pressure losses and are unable to handle low-flow conditions due to inherent cut-off limitations.

Ultrasonic flowmeters were ultimately pre-selected, given their ability to overcome these challenges.

Of course, the customer requested a field validation test, which was initially carried out using the Aquatrans AT600 ultrasonic clamp-on flowmeter. During testing, the high flow velocities caused the flowmeter to reach its upper operating limit, constrained by default factory settings that could not be overridden. As a result, an alternative solution needed to be investigated and evaluated.

Solution

The Panametrics PanaFlow LC clamp-on ultrasonic flowmeter was selected, configured as a single path XMTXP R05 in a 2-traverse set up. This configuration supports liquid flow velocities from 0.03 to 20 m/s (0.1 to 65.6 ft/s) making it well suited to the application.

Installed at the same pipe location, the flowmeter immediately provided accurate measurements, confirming a flow velocity of 16.52 m/s (Figure 2).

The customer was very satisfied with PanaFlow LC's performance, as it matched their expectations in full. It was able to better monitor the water turbine efficiency and make the needed improvement for increased efficiency. As a result, Panametrics is now established as the sole qualified flow measurement supplier on the penstock lines, with multiple PanaFlow LC flowmeters installed.



Fig. 2: XMT1000LC transmitter