CASE STUDY REF: 015

ECONOMIC SURGE CONTROL SOLUTION FOR SAUNI YOJANA PROJECT, GUJARAT, (INDIA)

Project Details	
Project	Saurastra Narmada Avtaran Irrigation Yojana (SAUNI) Link 2 package 1 & 2
Owner	Narmada Water Resources Water Supply & Kalpsar Department
Engineering Contractor	M/s. Pratibha Industries Limited, Mumbai
Consultant	M/s Shah Technical Consultant

Pipeline Detail	
Pipeline Size	Dia. 3000 mm twin pipeline
Pipe thickness	17.5 mm
Flow	107800 m³/hr.
Flow velocity	2.12 m/sec
Surge protection system	Zero Velocity valve & Air Cushion Valve
Quantity	3 nos. & 5 nos. respectively
Manufacturer	JASH Engineering Ltd.
MOC	Mild Steel
Client name	M/s. Pratibha Industries Limited, Mumbai

Figure 1 Zero Velocity Valve dia 3000

Figure 2 Air Cushion Valve

Location:

SAUNI Yojana Link2 Limdi Bhogavo II Dam on Limdi river in Surendranagar district of Gujarat, India to Raidy dam of Amreli district of Gujarat.

Purpose of SAUNI Yojana project:

Saurashtra-Narmada Avataran Irrigation Yojana (SAUNI Yojana) of Government of Gujarat, India, is introduced to divert 130.676 cumec of overflowing flood water of Narmada river to 115 reservoirs of Saurashtra region (11 districts), through 1126 km pipelines, benefitting irrigation of 10,22,589 acres of land. All 115 reservoirs are filled by 4 major pipeline networks of twin pipelines of 3000 mm diameter each, named as Link 1 to link 4.

Challenge of Protecting the pipeline from Surges:

In the first phase of SAUNI project, 12 twin rising mains of diameter 3000 mm, (one of the largest in India), convey 130.676 m³/ sec. water. The highest flow velocity through the pipe in this project is 2.46 m/sec.

To strike a balance of providing economic solution that gives effective and reliable surge control is a challenge for such long and large diameter pipeline of low wall thickness.

Some of the commonly used methods for pressure surge control in such large diameter pipelines were evaluated and cost of each solution was compared to arrive at the best solution.

Surge protection by various methods:

Out of various surge protection methods, the most suitable ones for such rising mains of large diameter and high flow velocity, were studied and compared for surge control and cost –

Air Vessel: *It is a pressure vessel partly filled with water and partly with pressurized air. The air pressure is maintained through a compressor. The water level in the vessel and air pressure are controlled and monitored regularly.*

A battery of Air Vessels of a total volume of 3600 m³ is required to mitigate the surges of this rising main.

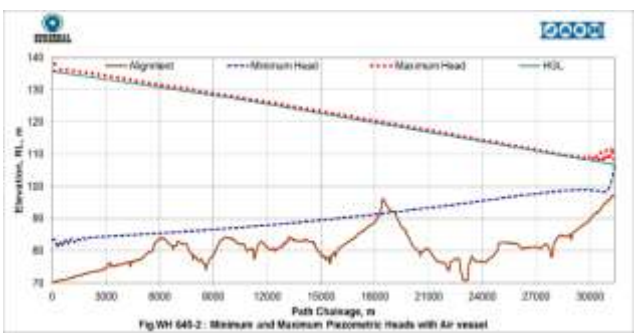

Figure 3 Surge Control with Air Vessels

One Way Surge Tank: *An overhead reservoir delivers water into the rising main during the surge event. It is filled when the pumps restart. The water level in the reservoir is controlled by a float valve.*

For this method, two One-Way Surge Tank of Dia. 41 m and Dia. 16 m both of 10 m staging height and 4 m water depth are required. First 6 Km observe some down surges, for rest of the rising main, it is a good control.

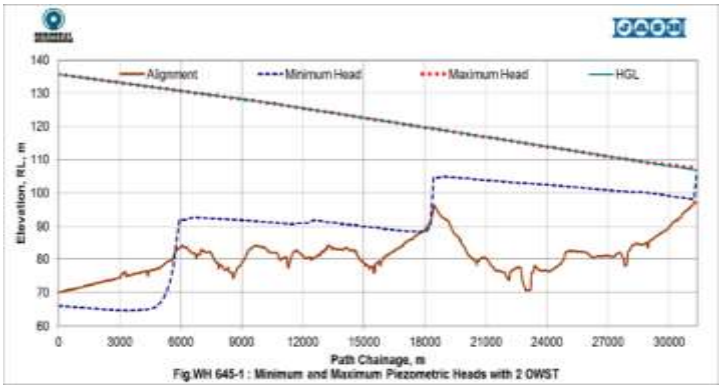

Figure 4 Surge Control by 2 One Way Surge Tanks

SURESEAL ***ZVV and ACV combination:*** *Due to its closing characteristics, Zero Velocity Valve breaks the water column into smaller ones. The Air Cushion Valve instantaneously breaks vacuum and also provide air intake in large volume. Its controlled release of air gives cushion to reversing water column.*

For this rising main project three Zero Velocity valves are modeled for upsurge control and Air cushion valves modeled for down surge control

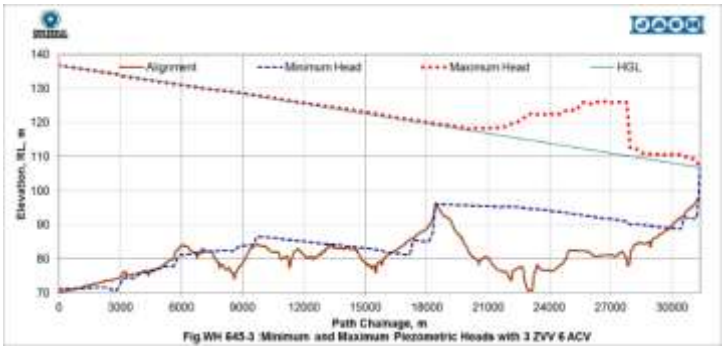

Figure 5 Surge Control with Zero Velocity Valves and Air Cushion Valves

Solution and Conclusion:

All the 3 options control the surges well within the desired limits. Looking into the extent of surge control, equipment cost and operation cost, 3 Nos. Zero Velocity Valves of dia 3000 mm and 6 Nos. Air Cushion Valves of dia 400 mm were provided for this project. Both these valves being self-actuating and responding to the flow and velocity of water offer least operational cost besides the lowest equipment cost (Figure 6).

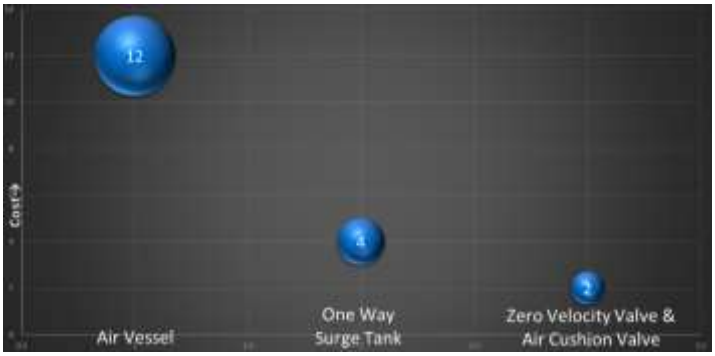

Figure 6 Comparison of Equipment cost of the three surge protection methods

Role of Jash (SURESEAL) Zero Velocity valve and Air Cushion Valve in surge control of cross-country rising mains:

Jash's **SURESEAL** *Zero Velocity valve is a soft closing self-actuating surge protection valve. It very effectively prevents the reversal and oscillation of water column, which is the prime cause of pressure surge in the pipeline due to tripping of pumps. This water column reversal and its oscillation cause high-pressure surge and even bursting of pipes. The Zero Velocity Valve is characterized by its closing just before water column starts reversing, i.e. when the velocity reaches close to zero just before reversing. This Valve is used in combination with* **SURESEAL** *Air Cushion valve. This self-actuating valve has instantaneous vacuum breaking and a high air intake capacity. Separate ports for air intake and release enable quick vacuum breaking. The controlled release of air through its outlet port reduces the secondary surges by giving cushion of air to the returning water and prevents its collision.*

These valves for the case discussed here were supplied in the year 2016 and are amongst over 70 such Zero Velocity Valves and more than 90 such Air Cushion Valves supplied for SAUNI Yojana and various other projects across the country.

For more details about SAUNI Yojana project:
https://www.youtube.com/watch?v=005gsi2ZDPQ; https://www.youtube.com/watch?v=JZ_TeAirXyw;
https://www.youtube.com/watch?v=11cgw2ns-og

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