HYDROPOWER

TURBINE INLET VALVE **BYPASS**

Background: Plant setup can vary depending on plant design, geography, and size. A plant set up with a reaction turbine and penstock will usually feature two components: a Turbine Inlet Valve (TIV), also known as a guard or shutoff valve, and a Turbine Inlet Valve Bypass on the downstream end of the penstock before the turbine. The TIV prevents or allows water from entering the turbine. During startup, before the TIV can be opened, the TIV Bypass opens to equalize the pressure upstream and downstream of the TIV. Although the TIV Bypass spends most of its time in the closed position as a low-duty cycle application, it still plays an important role as part of the startup sequence with the TIV. The TIV Bypass employs different valve and actuator technologies and is integrated in the TIV body itself in some configurations. Actuator types can differ between electro-mechanical, hydraulic, and even manual operation for smaller plants.

Key to success: Is responsive and stable opening/closing of the TIV Bypass to equalize pressure upstream and downstream of the TIV before spinning the turbine in the startup sequence. Positioning is either fully opened or closed. Most of the duration of TIV Bypass stays in the closed position.

For reversible pump turbines, besides balancing pressure, the TIV Bypass is also part of the pumping sequence. The TIV Bypass is only opened to a small position between the open/close range, allowing the turbine to spin. Enough force builds inside the spiral case to overcome the penstock pressure before opening the TIV to return water back upstream.

Problem: If pressure is not balanced between both sides of the TIV, havoc

ELECTRAULIC™ ACTUATION

can be wreaked on any unit. A turbine can experience turbulence, cavitation, and mechanical shock and fatigue that reduces the life of the equipment or disables it all together. The greater the pressure delta, the greater the risk. This makes the TIV Bypass a critical part of the startup sequence to equalize pressure.

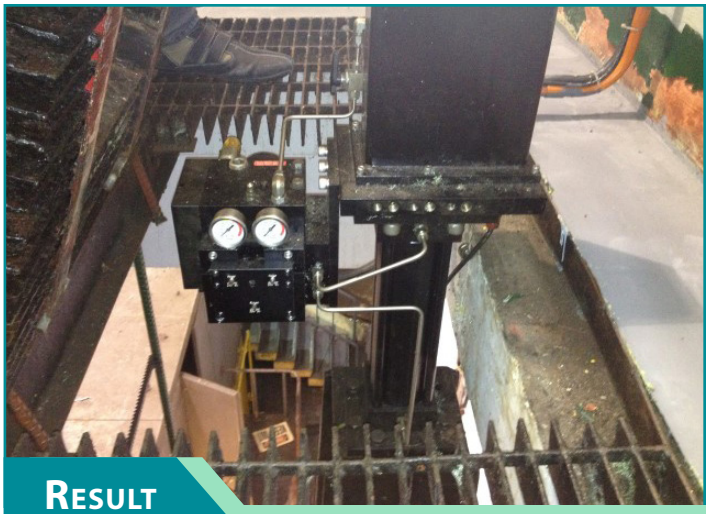
Problems can originate from issues with the actuator that operates the TIV Bypass. Electro-mechanical actuators can cause sticking, where the valve either intermittently gets stuck or is jammed in place. Gearing within the actuator can cause gradual wear, leading to slop and possible valve "floating." This can cause poor positioning and, if close to the valve seat, wear down the valve trim from wire draw.

An electro-hydraulic actuator can encounter similar problems. Hydraulic fluid contamination can be a root cause for performance issues and failures. Forms of contamination can come from entrained air, particulates, acid build up, oxidation, and water. Applying numerous filters and increasing oil volumes by a significant amount are common preventive measures to reduce the affects of contamination, which brings other problems with it.

In effect, the use of an electro-mechanical or electro-hydraulic actuator can encounter similar problems, despite having different root causes, when actuating a TIV Bypass. Since the TIV Bypass is mostly used during a startup sequence, operating reliably and preventing these problems are even more critical.

Solution: What if common headaches could be avoided altogether? What could be gained from eliminated oil maintenance, reduced oil volumes, and having stable hydraulic and precise control?

REXA's true closed loop hydraulic circuit, with Electraulic™ Technology, originally developed for rigorous modulating process controls, is well suited for actuating the TIV Bypass. Whether it's a once through or a reversible pump turbine, the REXA Actuator ensures reliable control for open/closed applications with readily available precise positioning and stroke timing. Designed for control and reliability REXA brings worry-free actuation for the TIV Bypass ensuring that every startup sequence is safe and continues to extend the life of critical components in your hydroelectric plant.



Result

Always designed for "tough" modulating applications, REXA's Electraulic™ Technology adapts to critical low duty cycle control for the TIV Bypass. The Electraulic™ true closed loop hydraulic system is the difference to eliminate stubborn control issues, gain back reliability during startup, and assure reliable ongoing operations.

- Data Loggers
- Compact Design
- 100% and low duty cycle control
- Zero oil maintenance
- Low oil volumes for reduced environmental risk

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