WATER

FILTRATION
FILTER EFFLUENT CONTROL

BACKGROUND: Most drinking water plants combine a conventional gravity-fed filtration system with a means for disinfection as part of the water treatment process. As the last stage of particle removal prior to disinfection, filtration plays a critical role in assuring safe water quality, given that many pathogens can escape common methods of disinfection under the cover of particle-filled water. Filter performance is evaluated based on turbidity, which effectively uses the clarity of liquid to indicate the amount of particulate present in the water. Higher performing filters have greater capture rates of particulate, producing lower turbidity readings and cleaner water. The method of flow control through the filter media is a major factor that directly affects the ability of a filter to clean water. The most commonly used valve & actuator combinations selected for filter effluent control expose performance limitations of these control elements, leaving a lot more to be desired for process efficiency and optimal water quality.

KEY TO SUCCESS: Gravity fed filters often use a modulating butterfly valve for filter effluent flow control. Maintaining a steady flow of water through the filter media is critical to ensuring maximum capture rate of particulates. If flows are stirred or jostled as they pass through the media, hydraulic surges can occur, potentially forcing suspended particles through the filter media and subsequently raising turbidity readings. Due to the cyclical nature of the process, the filter effluent valve must control accurately across the wide range of flows.

When a clean filter is brought online, it takes some time for the filter to ripen to optimal efficiency at full flow capacity. The water that runs through the media at this stage is not sufficiently filtered, commonly resulting in turbidity spikes during this initial filtration period. For filtration operations that do not have filter-to-wasting, it is desirable to reduce the ripening period by any available means.

Ripened filters will operate until their effectiveness starts to degrade as the media becomes clogged with captured particulate. As the filter media clogs with run time and head loss increases, the filter effluent valve will open further to maintain effluent flow. Eventually, the filter will be brought offline for a wash, before the cycle begins again. Throughout this cycle, the filter effluent valve must position accurately to small flow changes with incremental movements of the butterfly disc. Poor control of the butterfly disc can result in pulsing of the flows upstream from the valve, potentially causing hydraulic surges of the filter flow.

The reliability of all filter effluent valves to control accurately is critical to ensure that all filters are operating efficiently, so that the poor performance of one filter is not masked by other properly performing filters. This places further emphasis for the need of a reliable solution to control filter effluent flows.

THE PROBLEM: Electric quarter-turn actuators are most commonly selected to modulate butterfly valves for filter effluent control, typically due solely to low capital cost.

Butterfly valves are designed such that most the flow control is handled in a smaller percentage of the travel at the closed end of the valve stroke. Control at this portion of the valve travel requires tight position accuracy of the butterfly disc, a task most actuators are not capable of performing. This has led to a reputation that butterfly valves are difficult to control close to the seat.

Electric quarter-turn actuators are all gear-based products that are susceptible to gear wear over time, leading to gear slop that can reduce positioning accuracy. Moreover, electric actuators are not suited for modulating control to begin with, as all are typically capable of position control resolutions of ~ 2%, at best. As gears wear, this accuracy can degrade further over time.

The combination of poor position control accuracy offered by electric actuators and difficult modulating control ranges for a butterfly valve will often result in hunting for set-point by the actuator. Essentially, the actuator does not have the resolution to achieve target set-point, so it will hunt around that position over time. This occurrence affects the flows through the filter media, potentially causing surges that pass particulate through the filter media, spiking turbidity readings.

RESULT

REXA offers modulating control with valve position accuracy as tight as 0.05% resolution, turning butterfly valves into an accurate flow control devices. In some cases, the tighter flow control realized by REXA retrofits of existing actuators controlling filter effluent butterfly valves have…

- Reduced turbidity spikes during filter start-ups (example reduction of 0.3 NTU to 0.1 NTU for average spikes).
- Reduced average turbidity readings on the order of 33%.
- Reduced filter ripening time from 4 hours down to 1 hour.
- Saved money on chemicals in plants that dose based on flows, due to tighter effluent flow control in cases where chemical feed is based off flows.
- Reduced O&M costs to at or near zero over 10 to 20 year periods, due to long maintenance-free cycles.
- Provided reliable operation that ensures 100% filter availability by eliminating down-time due to actuator failures.

No other actuator can provide the peace of mind offered by REXA to consulting engineers or drinking water operations for ensuring your filter effluent valves maintain proper flow control, promoting efficient filter capture rates. Join other drinking water agencies who have learned from experience that the sure way to help properly and reliably minimize your turbidity readings is to Rely on REXA.

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