Passive Intake Screen Systems – Cylinder Designs

Through Slot Velocity vs Approach Velocity

The Issue: The design of passive intake screen systems has become complicated as regulations continue to impact the withdrawal of surface water. The basic requirements of getting the maximum flow of water with the least amount of plugging has now expanded to include protecting a myriad of aquatic lifeforms under the guidelines of a variety of local, state and federal agencies. The basic issue stemming from these guidelines revolves around the movement of water as it passes into the pumping system through the intake screen. And the key design criteria affecting all of this is the concept of "through-slot velocity" verses "approach velocity."

Approach velocity: This design concept is based upon a measurement of the velocity at a prescribed distance from the screen surface, commonly established around 3" or so. However, this is based upon *flat screen panel configurations*, not cylinders. When used for cylinders, it becomes an erratic and inconsistent measurement, and varies greatly depending upon screen open area and flow modifiers within the screen assembly. Numerous tests have shown this to be true (Iowa Laboratories, Alden Research Labs). The reason is screen manufacturers will make assumptions in their calculations to create what is known as "effective" approach velocity. This method assumes a 100% porosity of the entire screen surface area, which in practice is impossible with cylinders. Then they extrapolate the additional 3 inches by mathematically adding it to the screen diameter, thus creating a phantom cylinder for calculation purposes. In reality, these erratic data produce undersized screen designs, thereby *increasing velocities* beyond the .5 fps commonly specified by regulators. This has proven to be especially fatal to not only fish but their larvae and eggs that suffer from impingement and entrainment.

Through-slot velocity: This design concept was developed specifically for cylinders. It is based upon measurements taken right at the screen surface for a number that is extremely accurate and dependable. The key to maximizing the flow of the water and minimizing its velocity is to use as much of the screen surface area as possible, and distribute the flow evenly across that surface. This is accomplished by using a flow modifier within the screen assembly. The capacity of the screen system in terms of this flow is determined by multiplying the open area by the average through slot velocity. The latest industry design, patented by Johnson Screens, has an average velocity that is 90% of the maximum .5 fps allowed This translates into an extremely efficient design, thereby allowing greater flows while maintaining uniform velocities that minimize entrainment and impingement.