Chlorine Residual Control Explained

Chlorine residual control systems, are an often misunderstood and improperly implemented, and as such, usually get abandoned for simpler manual or flow-paced chlorination systems. This trend is starting to change due to state and federally mandated chlorine control requirements. Successfully installing and running chlorine residual control system requires a solid understanding of the system as a whole, and the role of the individual components that makeup the system. To get a better understanding of a chlorine control system, we first need to know what the necessary components are.

Required Equipment

A good chlorine residual control system should include the following equipment: a properly placed chlorine residual sample point, a chlorine residual analyzer, a flow meter, a single or compound loop controller, a chlorine gas control valve or variable chlorine liquid metering pump, a properly placed injection point, a chart recorder to track and troubleshoot the results, and a portable digital chlorine residual test kit or lab Titrator for system calibration and verification. The flow meter is not needed in installations where the process being treated is of a fixed or constant flow rate.

Cruise Control

Let’s start by comparing a typical system to something everyone is already familiar with... a car’s cruise control. In a typical car cruise control system, there are many components that make up the entire system as a whole, but we will only focus on those that compare to a typical chlorine control system. Let’s start with the car itself, moving along at a given speed. The speed is what we are interested in controlling automatically. This is our process. In our chlorine system, this would be the chlorine residual in the water being treated. To control the speed of the car, we first need to know how fast it is going, at any given second. We use the speedometer reading as a signal input to the cruise control computer. You may not be aware that there is one in your car, but there is. We select the desired speed in this computer with a pushbutton on or near the steering wheel. The output signal from the cruise control computer connects to a servo motor (or a vacuum positioner), which controls the accelerator, and thus the speed of the engine and transmission, and finally the speed of the car. This brings us back to what we were interested in controlling in the first place, the speed of the car. This is known as the “closed-loop” or “feedback” method of process control. There are “open-loop” or “feed forward” methods used in other types of process control, but we will confine our discussion to the “closed–loop” method.

Chlorine Residual Control

In our chlorine residual control system, much of the same functionality of the car cruise control system is implemented, using different equipment, specific to our process. We already know that the process we are interested in controlling is the chlorine residual level in the water. We read the chlorine residual level, or the “speed” of our process, with a chlorine analyzer. The signal from the analyzer is connected to a single or compound-loop controller, where we select our desired chlorine residual level. This would compare to the cruise control computer and speed selector pushbutton in the car. The output signal from the controller connects to a chlorine gas pacing valve (or liquid metering pump), which varies the amount of chlorine going to the water being treated, and thus the chlorine residual. The chlorine residual is then picked up again by the chlorine residual analyzer, which closes the control loop. This would be the servo motor and accelerator in the car, which varies the amount of gasoline going to the engine, and eventually the speed of the car. An

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important thing to note here, is that the analyzer must be installed downstream of the chlorine injection point, to form the closed loop necessary for the system to work properly. If the chlorination process must follow varying flow rates, a compound-loop control system has an additional signal input from a flow meter, which allows instantaneous changes in the chlorine feed rate, when the flow rate changes. This would compare to the transmission in the car changing gears on a hill, but still maintaining the selected "cruise-controlled" speed of the car. Some of the other components in our chlorine control system do not directly relate to the car cruise control example, but they are either already inherent, or not needed in the car. With the basic understanding of the chlorine control system, the importance of the additional items will be more apparent.