# Understanding Herrtronic®
# Electrode Steam Generator Operation

*by Steve Schneider, Product Manager*

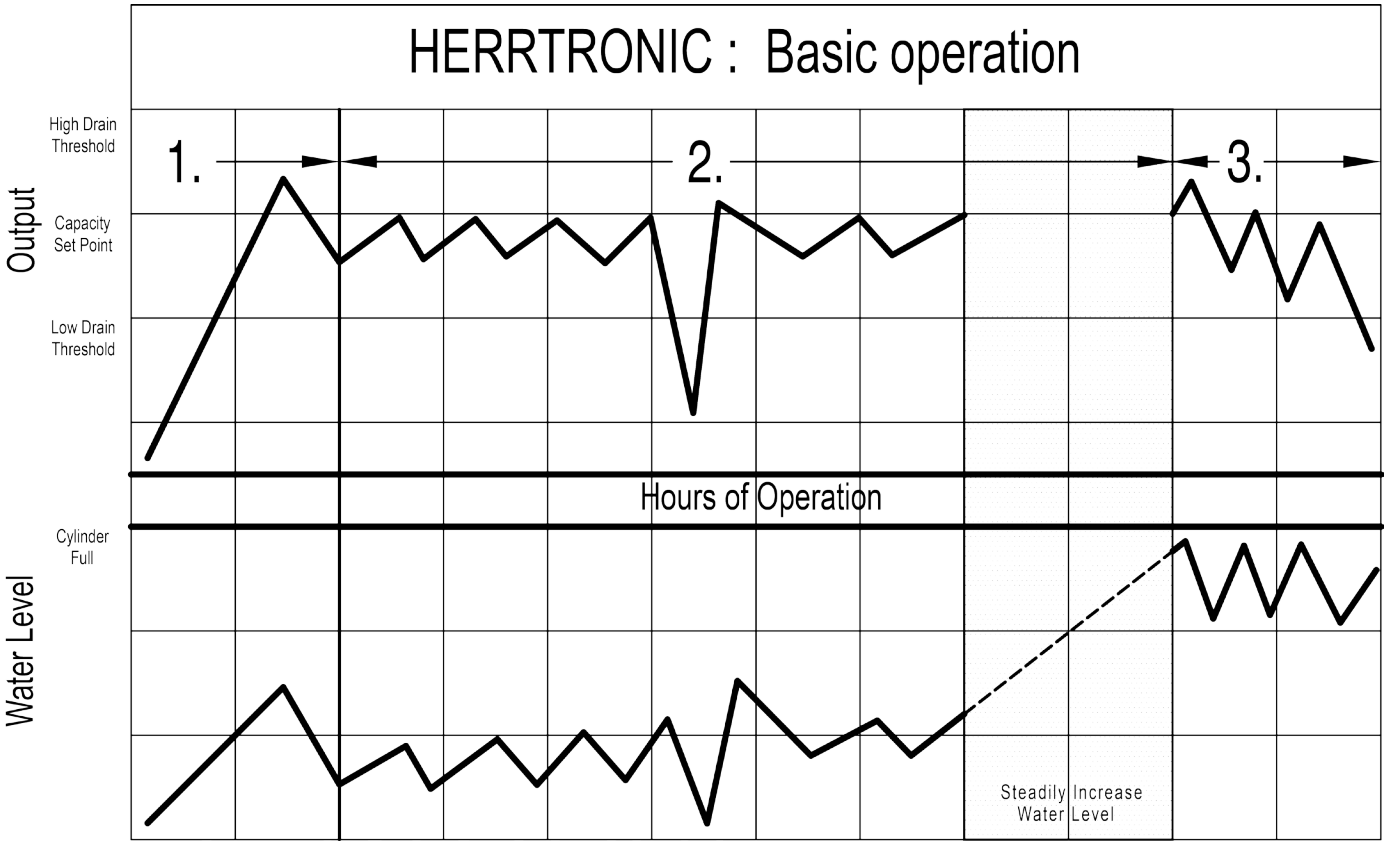
Unlike steam generators that use an immersed electric heating element, an electrode steam generator utilizes simple electrodes immersed in water to pass electrical current. This current heats the water to a boiling temperature, which creates steam. For this technology to work reliably, it's important that the water have a level of conductivity between 100 and 2000 micro-Siemens per centimeter. If the water conductivity is too low, the water will heat slowly and the unit will have difficulty achieving the desired steam output. If the conductivity is too high, the unit becomes difficult to control and will result in wasted water during operation. Most tap water falls within this operable range and will work fine with electrode steam generator units.

While it is the minerals in the water that allow for conductivity, after many hours of operation, they build up on the electrodes, which reduces the effectiveness. To resolve this, it is necessary to replace the steam cylinder. This procedure is simple and takes only minutes to perform, and once complete, the steam generator will operate like-new again. This is similar to replacing the engine in a car. With a new engine the car runs strong again; however the other parts of the car remain the same.

The Herrtronic® series of electrode steam generators use the principle of electrode technology to generate steam. Specially designed controls are necessary to control the operation of the steam cylinder so that efficiency can be maximized, output can be maintained, and waste water can be minimized.

## Herrtronic Series: Basic Operation

Controlled humidification requires a very precise control system. The Herrtronic® MD utilizes a microprocessor to monitor performance and maintain humidity. Further, the Herrtronic® evaluates the operation and will alert the operator of problem conditions to prevent undesirable operation.



**1. Start-Up:** On initial start-up, the fill valve opens to allow water to enter the cylinder. When the water level rises to the electrodes, current will flow and the water will begin heating. As the water temperature increases, its conductivity also increases, which accelerates the rate of temperature increase. When the output reaches the "capacity setpoint," the fill valve closes. The output capacity may continue to rise slightly beyond the "capacity setpoint." As the water boils, the water level falls with resulting output reduction.

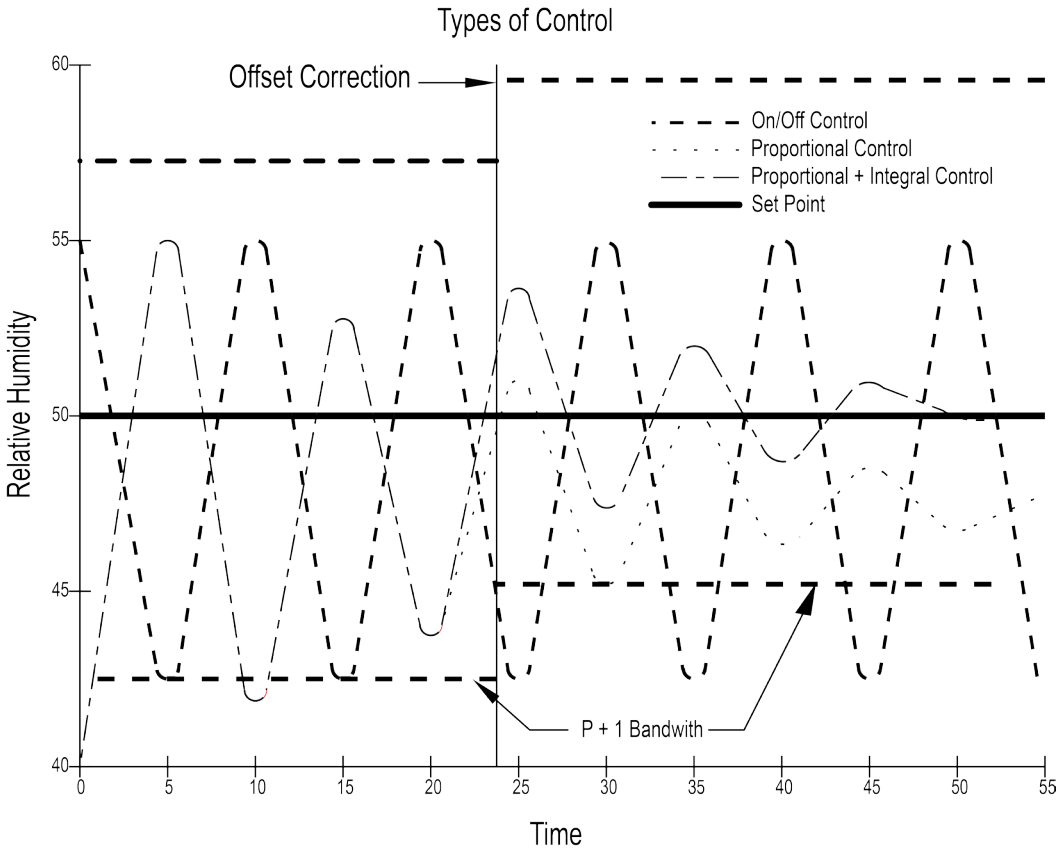
**NOTE: Two conditions may occur on start-up that will alter the normal start sequence:**

**A. Low Conductivity Water: Under this condition, the output capacity may not initially achieve the "capacity setpoint." The water level continues to rise until it reaches the cylinder-full electrode, which will close the fill valve. The unit will then cycle between cylinder-full and fill mode until a combination of temperature and increases in mineral concentration leads to the "capacity setpoint" being achieved.**

**B. High Drain Threshold: If the rate of output capacity increase is exceptionally fast, the output may achieve the high-drain threshold before normal boiling reduces the output. At this point, the drain valve will open to reduce the water level until the output reaches the "capacity setpoint."**

**2. Normal Operation:** Upon achieving "capacity setpoint," the system begins operation in a steady-state mode. Output capacity slowly decreases until the elapsed "cycle time" opens the fill valve to replenish the water level until the "capacity setpoint" output is again achieved. As the mineral concentration in the water increases, the water conductivity also increases. Accordingly, the rate of boiling increases. Eventually, the rate of boiling reduces the output capacity below the "low drain threshold" before the cycle-time initiates the fill cycle. When this happens, the drain valve opens and discards the mineral laden water, replacing with fresh water, which lowers the mineral concentration and allows a steady-state operation to resume. This steady-state operating mode continues with small increases in water level to maintain output capacity (exposing new electrode surface).

**3. End-of-Cylinder Life:** A steady-state operation continues with "fill and boil" and periodic drain cycles with ever increasing water levels. Eventually, the water level reaches the cylinder-full electrode, which represents the maximum allowable water level. The system output will begin to decrease since there is no new electrode surface to expose. If the system operates for six hours continuously without achieving "capacity setpoint," an "end-of-cylinder life" fault will be displayed. Cylinder replacement should occur to maintain satisfactory humidity levels.



## Herrtronic Series: Control Configurations

The Herrtronic® MD system is available with three types of control: (1) ON/OFF, (2) Proportional, and (3) Proportional + Integral. These provide “good,” “better,” “best” control. Below, we describe each control configuration; see the diagram (above) for an illustration.

**1. ON/OFF:** Humidity is sensed by a humidistat that provides digital (ON/OFF) input to the humidifier. Humidity varies above and below the setpoint based on tolerance and accuracy of the humidistat. When the humidistat is open, the humidifier does not generate steam and will remain in a standby state. When the humidistat is closed, the humidifier will operate and attempt to generate the maximum capacity that is programmed into the microprocessor control system.

**2. Proportional:** An analog demand signal is provided to the unit from a stand-alone humidity controller or a building management system. For example, a 100 pound per hour Herrtronic® steam generator that is supplied with a 40% demand signal will operate and deliver 40 pounds per hour of steam. If the demand signal is increased, the Herrtronic® will increase the capacity by increasing the water level in the cylinder until the demand signal is satisfied. With a decrease in demand signal, the Herrtronic® will reduce the output by draining some water from the cylinder until the lower demand signal is satisfied. The variation between the control input signal and the humidity setpoint results in adjustments to the unit output. Variations will be smaller than with the “ON/OFF” control and will be within the control band.

**3. Proportional + Integral:** The controlled humidity level is delivered to the unit by an analog humidity transmitter. The control setpoint is programmed into the Herrtronic® microprocessor control and the P + I control simply evaluates the actual humidity vs. desired humidity over a period of time or integration period. The humidity difference, known as an offset, is corrected by an “offset-correction”. This correction shifts the bandwidth up or down to attempt to eliminate the offset condition. The Herrtronic® will operate at a capacity level up to the maximum for the unit. The output will be modulated according to the offset.

## Conclusion

This describes the basic operation of Herrtronic® electrode steam generators. For a more advanced feature description, such as “fault annunciation” and “modulating high limit operation” please refer to the Herrtronic® Engineering Guide and the Herrtronic® Installation, Operation, & Maintenance (IOM) manual.