Demineralization of Deionizer System

Background

The ion exchange process removes unwanted ions from raw water by transferring them to a solid material, called an Ion Exchanger, which accepts them while giving back an equivalent number of desirable species stored on the Ion Exchanger skeleton. The Ion Exchanger has a limited capacity, called its exchange capacity, for storage of ions on its skeleton. Because of this, the Ion Exchanger eventually becomes saturated with unwanted ions. It is then washed with a strong regenerating solution containing the desirable species of ions. These ions flush out the accumulated undesirable ions, returning the exchange material to a usable condition. This operation is a cyclic chemical process, and the complete cycle usually includes backwash, regeneration, rinsing, and service.

Process

Ion exchange is used for the production of ultra pure water, for removal of "hardness" (Ca^{2+} and Mg^{2+}) from water supplies, and for the removal of iron and manganese from ground water supplies. As mentioned above, the raw water is passed through a cation exchanger, which converts the mineral salt (such as sodium, magnesium, potassium, and calcium in the form of assorted chlorides, sulfides, phosphates, etc.) to mineral acids. The water leaving the cation exchanger unit will now contain hydrochloric acid, sulfuric acid, phosphoric acid, etc. Since the conductivity of these acids is considerably higher than the salt that were present originally, measuring conductivity is a very convenient measurement to monitor the life cycle of the cation exchanger. A drop in conductivity, therefore, signals the end of this cation bed's efficiency and the need to regenerate.

The cation effluent at this point will typically pass to a basic anion exchanger. Hydroxyl ion is substituted for the chloride, sulfate, phosphate, etc., ions previously mentioned. This leaves us with HOH, which is pure water. Since the conductivity of pure water is very low, it is again convenient to monitor the life cycle of the anion exchanger using conductivity. An increase in conductivity will signal the end of this bed's efficiency and the need to regenerate.

Instrumentation

Figure 1 describes a demineralization process and the recommended placement for conductivity measurements. There are at least four conductivity measurements per cation/anion train. The two most important measurements are made at the discharge of the ion exchangers. The recommended conductivity analyzer, after the cation exchanger, is the Rosemount Analytical 1056 Dual Input Conductivity Analyzer with the Rosemount Analytical 400 Endurance™ sensor. The discharge from the Anion Exchanger should also be measured by the 1056 analyzer and the 400 sensor.

The recommended conductivity analyzer/sensor for concentration measurements of acid regenerant and caustic regenerant is the Rosemount Analytical 1056 Analyzer with the 228 Sensor.

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1056 Analyzer

- Multi-parameter dual input instrument
- Temperature correction for high purity water, cation conductivity, linear temperature coefficient
- Two (2) 4–20 mA outputs
- Four (4) fully-programmable alarms
- Choice of enclosures for pipe, surface, & panel mounting
- Measure your choice of conductivity, percent (%) concentration, or resistivity
- Percent concentration curves for 0–12 % NaOH, 0–15 % HCl, and 0–25 % or 96–100 % H_2SO_4
- Clear, easy-to-read two-line back-lit display
- Multi-language (English, French, German, Italian, Spanish, Chinese or Portuguese)
- NEMA 4X (IP65) enclosure

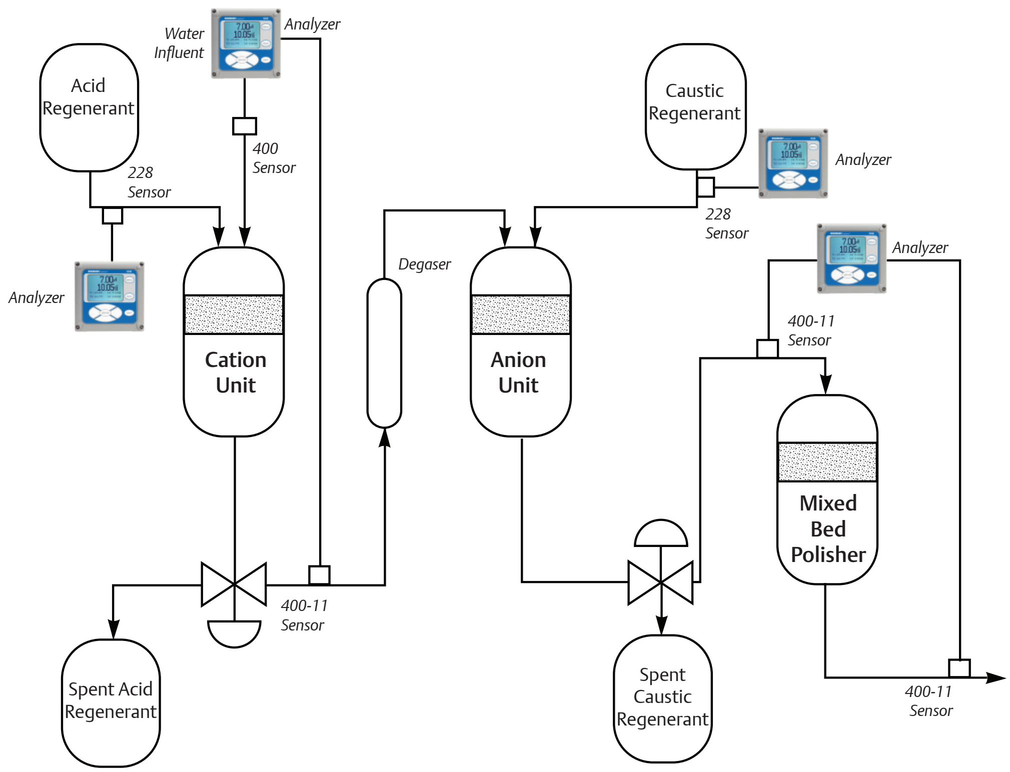
400 Endurance Conductivity Sensors

- Pressure/temperature ratings up to 250 psig (1825 kPa) at 200 °C (392 °F).
- Versatile design to allow the sensor to be used in numerous loop configurations with many different Rosemount Analytical instruments.

228 Toroidal Conductivity Sensor

- Toroidal measurement principle greatly reduces sensor fouling problems.
- High temperature PEEK sensor operates at temperatures up to 200 °C (392 °F).
- Installation options include insertion in a tee, submersion on a standpipe, and a high pressure mechanical retraction assembly.

Figure 1 - Demineralization or Deionizer Systems



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