The Measurement of pH in Superpure Condensate and Feedwater of Power Units

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Abstract—The change-over to the European standards for the quality of water coolant in power units of thermal and nuclear power stations makes the requirements for the feedwater quality stricter and brings about problems in the measurement of pH. The conventional calibration of a pH-meter against buffer solutions does not yield the measurement accuracy during measurements in infinitely diluted water solutions with electrical conductivity below 0.3 μS/cm. Reliability and validity of pH measurements can be improved by using the readings of automatic conductivity meters and calibration of analyzer in a superpure medium. The first method is implemented in foreign-made instruments, such as FAM Deltacon pH and AMI Deltacon Power. The second method has not yet been developed and is waiting for its implementation in practice. The investigation of the possibility for implementation of these methods using domestic equipment was carried out in the laboratory at the ion-exchange membrane test facility with metering ammonia or carbonic acid solution into deeply demineralized water and was verified under actual operating conditions at the Petrozavodsk Cogeneration Power Station (TETs) and the Kostroma District Power Station (GRES). This investigation resulted in the design of a prototype of a Lider-APK industrial analyzer intended for measurement of pH and concentration of impurities (such as ammonia, sodium, or chlorides) in condensate type waters in the range of pH = 6.0–10.0, and the development of a calibration procedure of industrial bench test pH-meters using ammonia or carbonic acid solutions. The Lider-APK analyzer outperforms its import equivalents and can be used in the automatic chemical monitoring at thermal power stations (TPS). A procedure for calibration of pH-meters in ultradiluted solutions has been first developed and should be verified at industrial facilities. The results of investigation suggest that both methods can improve the reliability of pH measurements in a superpure water coolant using automatic analyzers.

Keywords: electrical conductivity, pH, ammonia concentration, power unit feedwater, calibration of automatic analyzers