EFFECTS OF VARYING HYDRAULICS ON THE CALIBRATION OF EIGHT PATH CHORDAL ULTRASONIC METERS

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Eight path transit time ultrasonic meters are being used in the US, Europe and Japan to support measurement uncertainty power uprates of nuclear power plants. Power uprates rely on the demonstration of improved power accuracy to justify a reduction in the traditional 2% margin between operating power and the power at which loss of coolant accidents and other transients have been analyzed. The flow, density and enthalpy of the feedwater are key elements in the power calculation, and the eight path ultrasonic meters measure the flow and temperature from which these elements are derived.

A key element in the uncertainty analysis for these meters is an allowance for the uncertainties that the feedwater flow profiles introduce in the meters' flow calibrations. To minimize and bound this uncertainty calibration tests are performed on each eight path element to be used in an uprate application.

This paper describes extensive testing of a prototype eight path meter, results of which have been used to define the sensitivity of 8 path meters to broad variations in flow profiles, both axial and transverse and to establish a methodology whereby the impact of these changes on the uncertainty of the meters can be minimized. This testing confirms the general insensitivity of 8 path chordal systems to axial and transverse fluid velocity profiles.

An 8 path chordal system provides a quantitative measurement of the flatness of the axial profile, which allows a quantitative assessment of the differences in hydraulic profile seen by a meter in a plant versus the hydraulic profile seen by that same meter in the calibration lab. Since the sensitivity of the meter's calibration can be established as a function of profile flatness in the lab through parametric testing, the profile flatness in the plant can be used to confirm or to adapt as necessary the calibration coefficient measured in the lab for use in the plant.