

1998 **Title:** **Ultrasonic Flow Monitoring for Boiler Circulation Analyses**
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ABSTRACT:

Based on our experience with Ultrasonic Flow Monitoring (UFM) for making field measurements on several boilers, we have determined this to be very useful in boiler circulation analyses. The technique offers advantages over Pitot tubes for some applications including:

- Clamped onto the outside of a tube rather than drilling and welding Pitots to the tube.
- Moved to different test locations.
- Mounted while the boiler is on-the-line without waiting until the next boiler outage.
- Used to make a line-scan measurement across the pipe rather than at a single point.
- Calibrated mid-way during testing if measurements are in question.
- Used to measure flows as low as 0.1 ft/s

We have used the technique for making flow measurements on tubes and pipe with diameters from 2 ½" to 22" and velocities from less than 0.1 ft/s to over 14 ft/s at temperatures up to 600°F.

Some of the problems that we have encountered in making the flow measurements include:

- Deterioration of transducers at high temperatures after several days.
- Achieving adequate coupling of transducers on rough pipe surfaces.
- Adjusting for changes in boiler operation, such as operating pressure, which change the water temperature, speed of sound in the water, and required transducer spacing.
- Electronic problems at high ambient temperatures.



None of the problems has been insurmountable. The UFM appears to be best suited for short-term measurement programs. If there is the need for monitoring flows over months or years, Pitot tubes would remain the best option. The UFM offers a good opportunity for checking the Pitot tubes once they have been installed.

As for checking and calibration of the UFM, we have a simple flow loop at our facilities in which we can run a bucket test to check the meters.

In the field, we often make a measurement on the economizer feedwater piping, which often has a comparable flow rate and diameter as a downcomer. This offers an opportunity to test the equipment at a higher temperature. When measuring flows in smaller tubes, we have used the smelt spout cooling water piping to check the instrumentation.

While checks of circulation have been the main use, we have considered applying the UFM system for making flow measurements on the sweet water supply system in boilers where intrusive measurement cannot be applied. As of yet, we have not had the need to make this measurement.