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OPTIMIZATION OF A MULTI-JET WATER FLOW METER

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ABSTRACT

Multi-unit residential buildings (MURBs) pose numerous challenges for the accurate measurement of utilities usage. Water flow meters often must be installed against vendor recommendations as space can be quite limited. Meters are forced to be installed adjacent to 90° pipe bends, expansions, or contractions which create unsteady flow profiles. Meters operate best under fully developed conditions so this can result in increased inaccuracies in meter readings, and consequently, improper consumer billing. This research project focusses specifically on the optimization of the multi-jet style meter. Multi-jet meters are mechanical devices which contain an impeller enclosed by a concentric ring of guide vanes, which cause the water to form multiple jets that impact the impeller from multiple angles. These meters can provide a high accuracy for their low price point but can be heavier, bulkier, and less accurate than some other meter designs. Currently, no quantitative research has been performed on the effects of pipe bends on multi-jet meter performance. There is also a lack of information available in the literature discussing the performance of these meters when the size or design of their internals is altered. Thus, the goal of this project is to reduce the overall size of the meter to allow it to fit easier in these tight installation conditions and mitigate or potentially eliminate the impact to accuracy caused by awkward installation conditions. To determine the effectiveness of the improved design the accuracy of current models must first be established. The testing apparatus used is a closed-loop pipe network consisting of a water reservoir, pump, venturi meter, and the multi-jet flow meter. The venturi meter with high resolution pressure transducers will allow for comparison between registered flowrates of the tested meter versus the actual flowrate. This pipe network will also be modified to simulate the special restrictions of MURBs to establish a baseline for meter performance under these circumstances. The main parameters that are to be examined are: the overall size of the meter body, number of jets/guide vanes, as well as the size and design of the inlet diffuser which is meant to improve the flow profile to make it more suitable for measurement prior to entering the meter. Some general testing has already been completed but due to the pandemic, delays in equipment deliveries have slowed progress on the testing of the multi-jet meters specifically.