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Drinking Water Engineering and Science Discussions

Interactive comment on "Leakages and pressure relations: an experimental research" *by* F. De Paola and M. Giugni

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The authors would like to thank the referee for the interesting remarks. In response to the general comment on the experimental approach to the leakage simulation, the setup aims to reproduce the layout of private connections in water distribution networks, where water losses are particularly frequent. Replies to specific comments, which will be taken into account for the revised version of the manuscript, are listed below: 1. The current paper gives a global summary of all the experimental tests conducted so far at Hydraulic Laboratory of University of Naples. In particular, dynamic tests on ductile iron are presented, with the aim of contributing to the scientific literature in the field of hydraulic modeling through the description of the experimental evidences. 2. The objective of the research is the experimental investigation of the parameters affecting

the leakage/pressure relationship with reference to different pipe materials: in particular, this paper focuses on metal pipes, while nowadays are in progress further tests on plastic pipes. 3. In static tests conducted on steel pipe the driving pressure P varied in the range 2 – 7 bar, while the discharge Q between 0 and 30 lps. 4. In the first phase of experimental tests (steel pipe) the discharge was detected by a volumetric tank of small volume (see Fig. 1). Therefore the duration of dynamic tests was limited to minutes. 5. As mentioned above, the research about pressure/leakage relationship is still in progress at the Hydraulic Laboratory of University of Naples. Steel and ductile iron pipes, which are the most common materials used in Italian water distribution networks, have been studied first but further experiments will be conducted on HDPE and GRP pipes. Moreover, in the author's opinion the influence of pressure on the leak size is not very meaningful for metal pipes. Tests on both the investigated materials highlighted very slight differences in the results, highlighting a substantial independence of exponent b of equation (1) from test characteristics and showing an increasing trend of coefficient a with the size of the outflow orifice. 6. Figure 6 just shows the comparison between measured discharge values and those obtained by model after calibration with GA. The time series of pressure is reported in figure 5. 7. The GA was run varying at each iteration the values of a and b coefficients in order to minimize the sum of the square differences between measured discharge at time t and that obtained by model Q=aPb at the same time. 8. As reported in the manuscript (page 409, lines 4-9), the significant difference in values of b with respect to the theoretical value of 0.5, observed by some authors but not detected in this work, may be ascribed to the conservation level of the experimental pipes (steel pipes affected by corrosion) which may result in reduced consistence of material around the holes. In other cases, the difference may be explained by the shape of the hole (longitudinal cracks instead of regular holes) or by a remarkable pipe elasticity (e.g. plastic pipes). Nevertheless, in the author's opinion this topic requires more investigation to discern if it depends on the physics of the problem or maybe it is a distortion induced by the analysis of experimental data.

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