# Transient Flow Caused by Air Expulsion through an Orifice

Giuseppe De Martino[1]; Nicola Fontana[2]; and Maurizio Giugni[3]

**Abstract:** A pressurized water system may be subjected to high pressure surges because of the expulsion of a trapped air pocket through an orifice at the downstream end of the pipe. Results are presented of laboratory experiments, in which pressure histories were recorded for different upstream heads, air pocket volumes, and orifice sizes. The resulting pressure oscillation pattern was divided into two distinct stages: a first phase of low-frequency pressure oscillation during the air release, followed by a sudden pressure increase with water hammer characteristics when the water column reaches the orifice. The experimental results show that the duration of the first phase decreases substantially with increasing upstream head and orifice size, and increases with air pocket volume. A simple relationship was deduced, which agrees well with experimental data. The maximum pressure peaks, always observed in the water hammer phase, increased with upstream head and orifice size, whereas the volume of the air pocket appeared to be a less significant factor in the range investigated. A simple predictive equation was deduced based on Allievi–Joukowski results.

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