Flow Resistance of Metallic Screens in Liquid, Gaseous and Cryogenic Flow

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Fluid flow applications usually are connected with filtration issues. For chemical processes, engine fuel supply or in several other technical applications it is necessary to assure the pureness of the used fluid. In case of aggressive media, very high or very low temperatures, metallic woven screens are used. An important application for such screens is the filtration of propellant in space craft tanks and feed lines. In cryogenic propulsion systems the additional feature of the screens, to retain gas in a liquid flow, is used to ensure a bubble and gaseous free supply of propellant to the engine.

In space craft systems commonly fine-mesh screens are used, in which the occurring pressure drop across the screen is relevant concerning the design of propulsion system, in particular when more than one screen is in the flow path. High flow velocities induce significant pressure losses.

There are several investigations related to pressure loss on metallic screens, but most of them focus on weave types with wider meshes (e.g. plain square or plain dutch [Park et. al 2002; Pedersen 1969, Lu et.al. 1996]). Only few data are available for twilled dutch or similar woven screens and general correlations are not consistent [e.g. Amour & Cannon 1968]. Some authors present a correlation between pressure loss and fluid flow for single screens, using screen properties determined by experiment, however they cover only a few screen types [e.g. Blatt et al. 1970].

Within this study comprehensive experiments with different metallic screens were performed. Various fluids (water, gaseous and liquid nitrogen) were used to measure the pressure loss in a wide range of Reynolds number. Correlations were determined for each screen, in dependence on the individual screen properties. The results will be presented and compared with data from the literature.