Scaling of two-phase friction pressure drop from R12 to water

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Research and development in the field of two-phase (gas-liquid) flow is still carried out on prototypes under the later conditions of operation. This accounts for expensive prototypes and experimental works. Relatively more economically and easier would be experiments with models and/or model fluids, if similarity laws allow a reliable scaling of the results in two-phase flow. For the derivation of scaling laws for the two-phase friction pressure drop systematical measurements were carried out with R12 in unheated vertical circular, rectangular and annulus geometries and modeling criteria for the two-phase friction pressure drop have been developed through dimensional analysis for scaling from R12 to water. The investigations revealed that only an approximate similarity is possible, as the number of degrees of freedom available for the model. A comparison of the experimental results with the two-phase friction pressure drop of water available from literature shows that scaling of the two-phase friction pressure drop between water and R12 in similar flow configurations is possible with sufficiently accuracy for technical purposes, if three dimensionless numbers are met in prototype and model: a number for the thermodynamic state of the fluids, a number for the enthalpy of the flow and a number for the relation between mass flow rate and hydraulic diameter of prototype and model.