Compressed and Saturated Liquid Densities for 18 Halogenated Organic Compounds

D.R. Defibaugh and M.R. Moldover
Physical and Chemical Properties Division
National Institute of Standards and Technology
Gaithersburg, MD 20899 USA

The pressure-density-temperature $P(\rho,T)$ behavior of 18 liquids that are potential working fluids in thermal machinery has been measured using a vibrating tube densimeter. For each liquid, the data were taken on isotherms spaced at intervals of 5 K to 10 K spanning the temperature range 245 K to 370 K. The pressures ranged from just above the vapor pressure (or the critical pressure) to 6500 kPa. The results of measurements at more than 12,000 thermodynamic points are summarized by correlating functions. Comparison with data from other laboratories indicates that the relative expanded uncertainty in the measured densities is less than 0.05%, except in the critical region. The repeatability of the measured densities is on the order of 0.005%. For each liquid, the $P(\rho,T)$ data were extrapolated to the vapor pressure to obtain the density of the liquid at the vapor pressure. The fluids studied (and their designations by the refrigeration industry) were: trichlorofluoromethane (R11); chlorodifluoromethane (R22); 1,1-dichloro-2,2,2-trifluoroethane (R123); 1,2-dichloro-1,2,2-trifluoroethane (R123a); 1-chloro-1,2,2,2-tetrafluoroethane (R124); 1,1,2,2-tetrafluoroethane (R134); 1,1,1,2-tetrafluoroethane (R134a); 1,1-dichloro-1-fluoroethane (R141b); 1,1,1-trifluoroethane (R143); 1,1,2-trifluoroethane (R143a); pentafluorodimethylether (E125); 1,1-difluoroethane (R152a); octafluoropropane (R218); 1,1,1,2,3,3,3-heptafluoropropane (R227ea); 2-(difluoromethoxy)-1,1,1-trifluoroethane (E245); 1,1,1,2,2-pentafluoropropane (R245cb); 1,1,1,3,3-pentafluoropropane (R245fa); and propane (R290).