

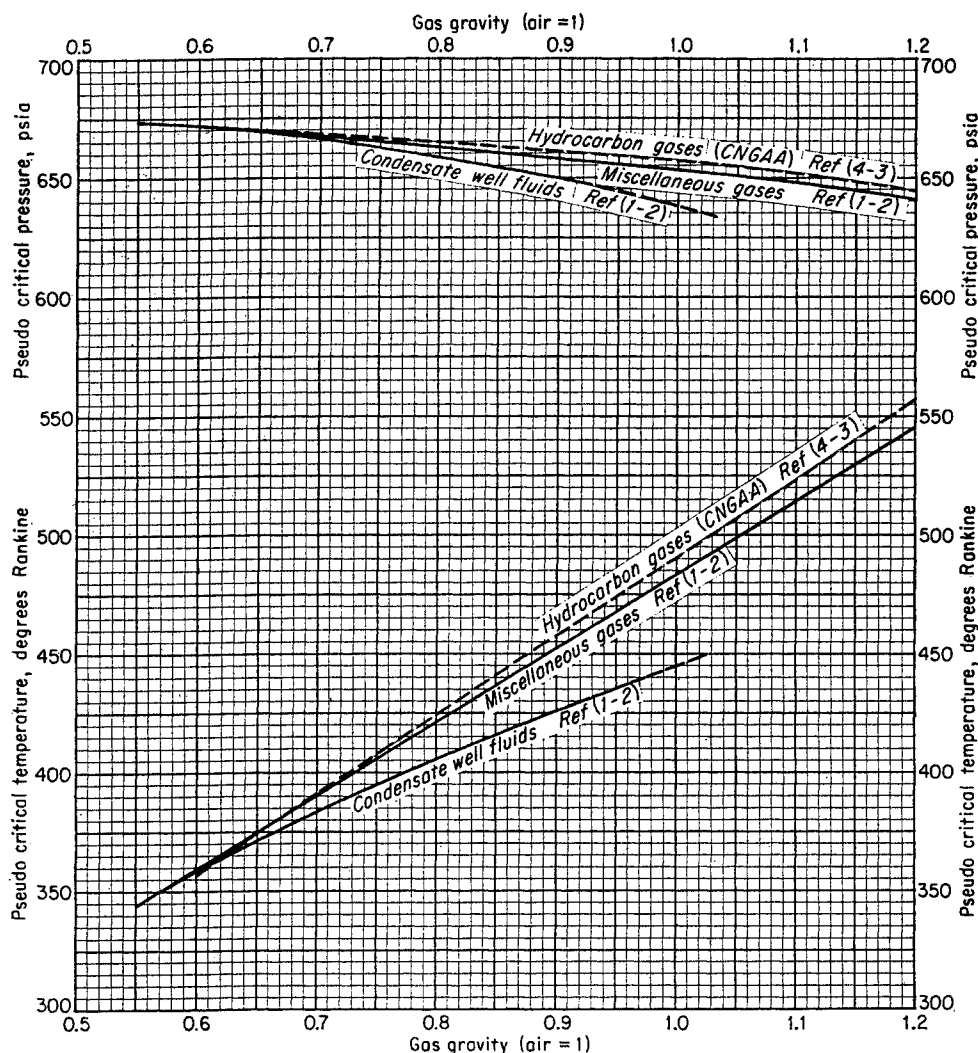


Fig. 4-22. Pseudocritical properties of natural gases. (Brown, Katz, Oberfell, and Alden, 1-2.)

the 0.7 and 0.8 gravity gases corresponding to the condensate well fluids.

Effect of Liquid Phase

It was found that certain natural gases entered the two-phase region during P - V - T studies and that the compressibility factor for the entire mixture was similar to that for a single phase. To study the use of the compressibility factor for density calculations in the high-pressure two-phase region, data on a natural gas-natural gasoline mixture were used. The phase diagram for the mixture is given by Fig. 4-24 and includes the regions likely to be encountered in high-pressure gases. The effect of a small amount of liquefaction on the over-all density is of especial interest in meter calculations.

Table 4-14 gives the comparison between experimental and calculated densities for the natural gas-natural gasoline mixture. The calculations were made assuming that the system density could be com-

puted from Eq. (4-2), including the compressibility factor. The observed volume percentages of liquid were taken from the phase diagram (Fig. 4-24). Table 4-14 demonstrates that the compressibility-factor method can be used to compute the density of a mixture in the single-phase region above the bubble-point curve, a short way into the two-phase region below the bubble-point curve, and completely through the two-phase region at high temperatures where a small volume percentage of liquid is present. The region in which these calculations may be made is limited to T_R of 1.05 or higher.

A study of the methane-butane system also indicated that the over-all density of a system existing as a small proportion of liquid and the remainder gas can be computed at high pressure by assuming that the system is a single phase. The explanation of this remarkable behavior lies in the relatively small change in partial molal volume between the vapor and liquid phases at these conditions. Hence, it matters little