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NASA TECH BRIEF

Water-Glycol System Volume Calculation

The problem:

To calculate accurately the volume of a water-glycol thermodynamic system, including consideration of various second-order effects such as the compressibility of fluid, solubility of entrapped gas, and mechanical expansion of the system.

An accurate volume prediction assuming zero loss is useful, together with a measurement of actual volume, in measuring the amount of system fluid lost through leakage.

The solution:

Two methods are presented for calculating the volume: an integral method and a differential method. Detailed error analyses are also included.

How it's done:

The integral method uses an iterative solution to determine system volume as a function of temperature and pressure, based on two assumed constants: the total mass of liquid and the total mass of gas, both free and dissolved.

The differential method approximates the system volume by its initial value plus first-order differential changes in volume as functions of temperature and pressure. The error analysis indicates that the integral method is more accurate. The differential method remains useful in predicting uncertainty due to errors in external parameter measurement.

Notes:

1. Two FORTRAN program listings are included for computer processing of the integral and differential methods.
2. This report should be of interest to industries engaged in thermodynamics applications and leak detection.
3. Documentation is available from:
   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP69-10563

Patent status:

No patent action is contemplated by NASA.

Source: Gerald C. Schaedle and Bobby Liley of
Space Division
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