

89018

Issued August 1989

Orthobaric densities and molar volumes of liquids

Introduction to Data Items issued after July 1989

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THE PREPARATION OF THIS DATA ITEM

The work on this particular Data Item was monitored and guided by the Physical Data and Reaction Kinetics Committee, which first met in 1966 and now has the following membership:

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Dr D.T.Jamieson	— National Engineering Laboratory
Mr S.R.Knight	— Stone & Webster Engineering Ltd
Dr M.Schoenberg*	— Hoechst AG, Frankfurt, West Germany.

The technical work involved in the construction and subsequent development of the Data Item was undertaken (under contract to ESDU) by

Mr J.Walton	— Independent.
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in consultation with Dr D.Ambrose.

The person with overall responsibility for the work in this subject area is Mr G.H.Walter, Head of Heat Transfer, Internal Flow and Physical Data.

KEEPING UP TO DATE

We are constantly striving to develop new work and review data already issued. Any comments arising out of your use of our data, or any suggestions for new topics or information that might lead to improvements, will help us to provide a better service.

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(Continued on inside back cover)

*Corresponding Member

†Emeritus Member

ORTHOBARIC DENSITIES AND MOLAR VOLUMES OF LIQUIDS
INTRODUCTION TO DATA ITEMS ISSUED AFTER JULY 1989

1. INTRODUCTION

This Item provides explanatory notes and additional information to supplement that given in each Data Item on the orthobaric densities and molar volumes of liquids issued from August 1989 onward. The text in each Item provides adequate information for its use.

2. SOURCES OF DATA

Experimental orthobaric liquid density or volumetric measurements have been made from the triple point to the critical point for a number of low molecular weight liquids, for example methane, which have normal boiling points and sometimes critical temperatures below ambient temperatures. For these liquids the density or molar volume of the saturated vapour has also been measured in the same investigation and the critical density calculated using the 'law of rectilinear diameters'.

For a large number of liquids with normal boiling points higher than about 30 °C, densities have been determined at only a few temperatures between 10 and 30 °C at atmospheric pressure. However, for some of these liquids, densities over wider ranges of temperature terminating below the normal boiling point have also been determined, again at atmospheric pressure. Those orthobaric densities that have been measured have usually been restricted to the range above the normal boiling point. In these cases the saturated vapour density or molar volume has usually also been measured and the critical density calculated as described above.

Experimental data at temperatures around ambient for liquids boiling above this temperature can be of very high accuracy, possibly with an uncertainty in density as low as 0.01 per cent. For most liquids densities at other temperatures are less accurate and in the critical region errors may be a few per cent.

Except in the critical range the compressibility of liquids is very low. Consequently, below the normal boiling point, the difference between the densities at one atmosphere and at saturation pressure, for a particular liquid at a given temperature, is usually less than the uncertainty in the measured values. Hence in the Data Items, for each liquid, densities at atmospheric pressure have been combined with orthobaric densities and fitted by a single equation.

To indicate the extent of the experimental data on which the tabulated values for each compound are based, each source used to derive the constants of the liquid density/molar volume equation is followed by one of the letters 'L', 'M', 'H' or 'C' which denote the temperature range of the data of each source. These letters correspond respectively to the arbitrary temperature ranges defined as:-

L: low temperature, below the temperature at which the vapour pressure is 1 kPa,

M: medium temperature, from the temperature at which the vapour pressure is 1 kPa to the normal boiling point,

H: high temperature, from the normal boiling point to the critical point,

C: the critical point.