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Hydraulic fluid power – Petroleum fluids – Prediction of bulk moduli

(Revision and redesignation of ANSI/B93.63-1984)

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Foreword

This Foreword is not part of *Hydraulic fluid power — Petroleum flluids — Prediction of bulk moduli,* (NFPA)/T2.13.7 R1-1997, (Revision and redesignation of ANSI/B93.63M-1984)

At the 9 February 1995 T2.13 meeting, Chairman Paul Schacht recommended that ANSI/B93.63M be revised. At the 25 May 1995 T2.13 meeting, Chairman Schacht agreed to serve as Project Chairman for this document and began revising the document.

The Technical Board approved the TSP at the 17 August 1995 meeting. At the 21 September 1995 T2.13 meeting, additional changes to the document were discussed. At the 13 February 1996 T2.13 meeting Draft No. 1 was reviewed and approved for General Review.

The document was sent out for General Review on 10 April 1996. The General Review closed with comments from two companies. At the 19 August 1996 Technical Board meeting this document was granted approval to be sent out for Ballot. The document was updated at Headquarters on 20 August 1996 and sent to Project Chairman Schacht to complete. The revised draft was received at Headquarters on 26 August 1996.

The document was sent out for Ballot on 27 August 1996. Balloting closed with no negative votes. This document was granted final approval at the 5 December 1996 Technical Board Meeting.

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Hydraulic fluid power — Petroleum fluids — Prediction of bulk moduli

0 Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure in an enclosed circuit. Bulk modulus measures the fluid's resistance to volume reduction by pressure.

1 Scope

1.1 This standard specifies a procedure for predicting the bulk moduli of petroleum or hydrocarbon oils used as fluids (in the absence of air bubbles) in hydraulic fluid power systems and for other purposes.

1.2 This standard provides graphical techniques to obtain moduli of these fluids without extended calculations and with such accuracy as would be required for the practical calculation of hydraulic system parameters.

1.3 The useful temperature range is from 0 °C to 270 °C, with a pressure range from atmospheric to 700,000 kPa (7,000 bar).[1)]

1.4 Select the appropriate bulk modulus according to the problem and conditions of operation (see definitions).

1.5 Refer to annex A for range of measurement.

1.6 Refer to annex B for sample calculations.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All documents are subject to revision, and parties to agreements based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below. NFPA maintains registers of currently valid NFPA standards.

ISO 91/1:1992, *Petroleum measurement tables — Part 1:Tables based on reference temperature of 15 degrees C and 60 degrees F.*

ISO 3675:1993, *Crude petroleum and liquid petroleum products — Laboratory determination of density or relative density — Hydrometer method.*

ISO 3838:1883, *Crude petroleum and liquid or solid petroleum products — Determination of density or relative density — Capillary-stopped pyknometer and graduated bicapillary pyknometer methods.*

ANSI/B93.2-1986, *Fluid power systems and products — Glossary.*

3 Definitions

For definitions of terms not listed below, see ANSI/B93.2.

3.1 bulk modulus: The measure of resistance to compressibility of a fluid. It is the reciprocal of the compressibility.

3.2 isothermal bulk modulus: Modulus data based on equilibrium conditions and constant temperature.

3.3 isothermal secant bulk modulus (B_T): The bulk modulus, resulting from pressure change from atmospheric to the pressure of interest.

$$B_T = -V_o\,[(p-p_o)/(V_o-V)]_T$$

1) 1 Pa = 1 N/m^2; 1 bar = 100 kPa ≈ 14.5 lbf/in^2