INTERNATIONAL

RECOMMENDATION

OIML R 63

Edition 1994 (E)

Petroleum measurement tables

(with reference to the ISO International Standard 91-1:1982 & 91-2:1991)

Tables de mesure du pétrole

(en référence à la Norme Internationale ISO 91-1:1982 & 91-2:1991)

OIML R 63 Edition 1994 (E)

ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION
OF LEGAL METROLOGY

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Foreword

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States.

The two main categories of OIML publications are:

- **International Recommendations (OIML R)**, which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity; the OIML Member States shall implement these Recommendations to the greatest possible extent;
- **International Documents (OIML D)**, which are informative in nature and intended to improve the work of the metrological services.

OIML Draft Recommendations and Documents are developed by technical committees or subcommittees which are formed by the Member States. Certain international and regional institutions also participate on a consultation basis.

Cooperative agreements are established between OIML and certain institutions, such as ISO and IEC, with the objective of avoiding contradictory requirements; consequently, manufacturers and users of measuring instruments, test laboratories, etc. may apply simultaneously OIML publications and those of other institutions.

International Recommendations and International Documents are published in French (F) and English (E) and are subject to periodic revision.

This publication – reference OIML R 63, edition 1994 (E) – was developped by the OIML technical committee TC 8 *Measurement of quantities of fluids*. It was approved for final publication by the International Committee of Legal Metrology in 1993 and will be submitted to the International Conference of Legal Metrology in 1996 for formal sanction. It supersedes the previous edition dated 1985.

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INTRODUCTION

In 1982 and in 1991 respectively, the International Organization for Standardization (ISO) published the two parts of its revised Standard 91 “Petroleum measurement tables”, Part 1: “Tables based on reference temperatures of 15 °C and 60 °F ” and Part 2: “Tables based on a reference temperature of 20 °C”. This Standard, developed by ISO/TC 28, replaces the tables referred to in the previous edition of ISO R 91, developed during the late 1940’s and based on data for crude petroleum and petroleum fractions published in 1916. Some later data on natural gasolines reported in 1942 were also used.

The tables referred to in ISO 91-1 were developed jointly by the American Petroleum Institute (USA), the American Society for Testing and Materials (USA) and the Institute of Petroleum (United Kingdom). The tables were prepared by the American Petroleum Institute following the development of a new data base by the National Institute of Standards and Technology (USA). The tables referred to in ISO 91-2 are obtainable through computer implementation procedures prepared by the Institute of Petroleum.

The measurement tables 1 to 58 referenced in Annex A.1 have been published by the American Petroleum Institute and the American Society for Testing and Materials and consist of 12 volumes. The computer implementation procedures designated by tables 59 and 60 referenced in Annex A.2 have been published by the Institute of Petroleum.

PETROLEUM MEASUREMENT TABLES

1 Scope

This Recommendation covers petroleum measurement tables used by Administrative Services such as Customs for official determination of quantities of petroleum and its products, under reference conditions, starting from measurements of volume or mass, temperature, density, etc.

2 Reference temperature

The reference temperature at which volumes are expressed is 15 °C. However, other reference temperatures (for example, 20 °C or 60 °F) may be used if required by national regulations.

3 Recommended petroleum tables

OIML Member States are requested to use the petroleum measurement tables:

- Nos. 1 to 58 referred to in the ISO Standard 91-1:1982, and
- Nos. 59 and 60 referred to in ISO Standard 91-2:1991,

the list of which is given in Annex A and mainly tables Nos. 53A, 53B, 54A, 54B, 54C, which are based on the reference temperature of 15 °C.

4 Information concerning availability of tables

All volumes referenced in Annex A.1 (tables Nos. 1 to 58) may be purchased from the publishers, the American Petroleum Institute, c/o Publication and Distribution Section, 2101 L Street, NW, Washington, DC 20037, USA, or from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103, USA. Other suppliers include American Technical Publishers Ltd., 68a Wilbury Way, Hitchin, Herts SG4 OTP, England. The tables are also available on microfiche and the computer sub-routine as magnetic tape or as FORTRAN card decks from the American Petroleum Institute. The “Petroleum measurement paper No.3: Computer implementation procedures for correcting densities and volumes to 20 °C ” referenced in Annex A.2 may be purchased from the publishers, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, United Kingdom.

ANNEX A

A.1 Titles of tables contained in the API-ASTM-IP petroleum measurement tables (Extract from ISO 91-1:1982)

Table No.	Title	Volumes in which table appears	
		Non-metric units	Metric units
1	Interrelation of units of measurement	XI	XII
2	Temperature conversions	XI	XII
3	API gravity at 60 °F to relative density 60/60 °F and to density at 15 °C	XI	XII
4	Gallons (US) at 60 °F to litres at 15 °C and barrels (US) at 60 °F to cubic metres at 15 °C against API gravity at 60 °F	XI	
5A	Generalized crude oils - Correction of observed API gravity to API gravity at 60 °F	I	
5B	Generalized products - Corrections of observed API gravity to API gravity at 60 °F	II	
6A	Generalized crude oils - Correction of volume to 60 °F against API gravity at 60 °F	I	
6B	Generalized products - Correction of volume to 60 °F against API gravity at 60 °F	II	
6C	VCF (*) for individual and special applications - Volume correction to 60 °F against thermal expansion coefficients at 60 °F	III	
8	Pounds per gallon (US) at 60 °F and gallons (US) at 60 °F per pound against API gravity at 60 °F	XI	
9	Short tons per 1 000 gal (US) at 60 °F and per barrel (US) at 60 °F against API gravity at 60 °F	XI	
10	Gallons (US) at 60 °F and barrels (US) at 60 °F per short ton against API gravity at 60 °F	XI	
11	Long tons (**) per 1 000 gal (US) at 60 °F and per barrel (US) at 60 °F against API gravity at 60 °F	XI	
12	Gallons (US) at 60 °F and barrels (US) at 60 °F per long ton against API gravity at 60 °F	XI	
13	Metric tons (tonnes) per 1 000 gal (US) at 60 °F and per barrel (US) at 60 °F against API gravity at 60 °F	XI	
14	Cubic metres at 15 °C per short ton and per long ton against API gravity at 60 °F	XI	
21	Relative density 60/60 °F to API gravity at 60 °F and to density at 15 °C	XI	XII
22	Gallons (US) at 60 °F to litres at 15 °C and barrels (US) at 60 °F to cubic metres at 15 °C against relative density 60/60 °F	XI	
23A	Generalized crude oils - Correction of observed relative density to relative density 60/60 °F	IV	
23B	Generalized products - Correction of observed relative density to relative density 60/60 °F	V	

(*) VCF: Volume correction factor

(**) The preferred term in ISO 31/3 is "ton" and is equal to 2 240 lb

Table No.	Title	Volumes in which table appears	
		Non-metric units	Metric units
24A	Generalized crude oils - Correction of volume to 60 °F against relative density 60/60 °F	IV	
24B	Generalized products - Correction of volume to 60 °F against relative density 60/60 °F	V	
24C	VCF for individual and special applications - Volume correction to 60 °F against thermal expansion coefficients at 60 °F	VI	
26	Pounds per gallon (US) at 60 °F and gallons (US) at 60 °F per pound against relative density 60/60 °F	XI	
27	Short tons per 1 000 gal (US) at 60 °F and per barrel (US) at 60 °F against relative density 60/60 °F	XI	
28	Gallons (US) at 60 °F and barrels (US) at 60 °F per short tons against relative density 60/60 °F	XI	
29	Long tons per 1 000 gal (US) at 60 °F and per barrel (US) at 60 °F against relative density 60/60 °F	XI	
30	Gallons (US) at 60 °F and barrels (US) at 60 °F per long ton (US) against relative density 60/60 °F	XI	
31	Cubic metres at 15 °C per short ton and per long ton against relative density 60/60 °F	XI	
33	Specific gravity reduction to 60 °F for liquefied petroleum gases and natural gasoline	(*)	
34	Reduction of volume to 60 °F against specific gravity 60/60 °F for liquefied petroleum gases	(*)	
51	Density at 15 °C to API gravity at 60 °F and to relative density 60/60 °F		XII
52	Barrels (US) at 60 °F to cubic metres at 15 °C and cubic metres at 15 °C to barrels (US) at 60 °F against density at 15 °C		XII
53A	Generalized crude oils - Correction of observed density to density at 15 °C		VII
53B	Generalized products - Correction of observed density to density at 15 °C		VIII
54A	Generalized crude oils - Correction of volume to 15 °C against density at 15 °C		VII
54B	Generalized products - Correction of volume to 15 °C against density at 15 °C		VIII
54C	VCF for individual and special applications - Volume correction to 15 °C against thermal expansion coefficients at 15 °C		IX
56	Kilograms per cubic metre at 15 °C and cubic metres at 15 °C per metric ton (tonnes) against density at 15 °C		XII
57	Short tons and long tons per cubic metre at 15 °C against density at 15 °C		XII
58	Gallons (US) at 60 °F and barrels (US) at 60 °F per metric ton (tonne) against density at 15 °C		XII

(*) Available only as ASTM publications

A.2 Computer implementation procedures contained in the IP measurementpaper No.3 (Extract from ISO 91-2:1991)

Table No.	Title
59A	Implementation procedure for sub-routine TAB59A - Generalized crude oils - Correction of observed density to density at 20 °C
59B	Implementation procedure for sub-routine TAB59B - Generalized products - Correction of observed density to density at 20 °C
59D	Implementation procedure for sub-routine TAB59D - Generalized lubricant oils - Correction of observed density to density at 20 °C
60A	Implementation procedure for sub-routine TAB60A - Generalized crude oils - Correction of volume to 20 °C against density at 20 °C
60B	Implementation procedure for sub-routine TAB60B - Generalized products - Correction of volume to 20 °C against density at 20 °C
60D	Implementation procedure for sub-routine TAB60D - Generalized lubricant oils - Correction of volume to 20 °C against density at 20 °C