THE INSTITUTE OF PETROLEUM

PETROLEUM MEASUREMENT MANUAL

PART II
Tank Calibration

SECTION 1
STRAPPING, INTERNAL DIAMETER AND INTERNAL OFFSET METHODS FOR THE CALIBRATION OF VERTICAL CYLINDRICAL TANKS
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CYLINDRICAL TANKS

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Measurement accuracy is essential for the sale, purchase and handling of petroleum products. It reduces the likelihood of disputes between buyer and seller and facilitates control of losses. Accurate measurement demands the use of standard equipment and procedures.

The Petroleum Measurement Committee of the Institute of Petroleum is responsible for the production and maintenance of standards and guides covering the various aspects of static and dynamic measurement of petroleum. These are issued as separate Parts and Sections of the Institute’s Petroleum Measurement Manual, which was first published in 1952.

Membership of the IP working panels is made up of experts from the oil industry, equipment manufacturers, cargo inspectors and government authorities. Liaison is maintained with parallel working groups of the Committee on Petroleum Measurement of the American Petroleum Institute, and is extended as necessary to embrace other organizations concerned with quantitative measurement in other countries and in other industries.

Users are invited to send comments, suggestions, or details of experience with this issue to:

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The Petroleum Measurement Manual is widely used by the petroleum industry and has received recognition in many countries by consumers and the authorities. In order to promote their wide adoption internationally, it is the policy to submit selected standards through the British Standards Institute to Technical Committee TC 28 - Petroleum Products and Lubricants - of the International Organization for Standardization (ISO/TC 28) as potential International Standards.

A full list of the Parts and Sections of the Petroleum Measurement Manual (PMM) is available on request from the Institute of Petroleum.

Note:

The IP Petroleum Measurement Manual is recommended for general adoption but should be read and interpreted in conjunction with weights and measures, safety and other regulations in force in a particular country in which it is to be applied. Such regulatory requirements should have precedence over the corresponding clauses in the Manual except where the requirements of the Manual are more rigorous, when its use is recommended. The Institute disclaims responsibility for any personal injury, or loss or damage to property, howsoever caused, arising from the use or abuse of any Part or Section of the Manual.
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The Institute is grateful for permission to use some of the data and concepts contained in the article ‘Guidelines set for recalibration of storage tanks’ by Messrs S Sivaraman and B J Hampson, published in the Oil and Gas Journal, 12 June 1989.
INTRODUCTION AND SCOPE

The static measurement of bulk quantities of oil stored in tanks is dependent on the calibration of the tanks. Any errors made in the calibration will act consistently in one direction. Such systematic errors in tank calibration tables may result in very large cumulative losses or gains throughout the long period of time in which the tables remain in force.

The calibration methods given in this Part of the Manual have been drawn up with the foregoing constantly in mind and provide an accuracy consistent with the most stringent requirements. The procedures and equipment described in this document represent the minimum requirements to achieve an acceptable level of measurement uncertainty. Any deviation from the procedures and/or equipment described may change the level of measurement uncertainty. Personnel responsible for the calibration of tanks should have the necessary skill and experience to implement the recommendations given in the methods. Scrupulous attention should be given to detail at all times.

The three methods that are described are: calibration by strapping, which is the measurement of external circumference using a strapping tape, calibration by direct measurement of the internal diameter of the tank using a tape, and calibration by measurement of internal diameter using an offset measurement method. The methods are for tanks having cylindrical courses that are substantially vertical. It is assumed that any deformation of the tank is within limits set by recognised National or International Construction Standards.

The strapping procedure described in Chapter 6 is known as the IP Strapping Method, IP Tank Calibration Method 1. Tanks calibrated by the strapping method may be measured whilst containing liquid. However, the presence of liquid may increase the uncertainty of the method by introducing systematic errors if it prevents measurement of such items as the position of the dipping datum-point or the calibration of the tank bottom and deadwood.

The internal diameter procedure described in Chapter 7 may be used as an alternative to strapping and is known as the IP Internal Diameter Method, IP Tank Calibration Method 2-1. It is recommended that the internal measurement procedure be limited to tanks having diameters not exceeding approximately 10 metres in order to maintain the necessary accuracy required in tank calibration.

If no alternative method of calibration is available or practicable, tanks of greater diameter may be calibrated using the offset measurement method described in Annex D. This procedure is referred to as the IP Internal Offset Method, IP Tank Calibration Method 2-2.

The section dealing with floating roof calibration and tank bottom calibration allows either survey/measurement or liquid metering techniques to be used. The technique employed should be determined having regard to the availability of the equipment and facilities at the tank site.

SI units of measurement are used throughout this Manual. This does not preclude the use of other systems but the precision of SI units should be maintained.

The calculation procedures give equations based on
the assumption that tables will be calculated using computerised techniques.

It is recommended that tank calibration be verified either by continuous correlation with other measurement systems or by recalibration. While the recalibration of any tank originally calibrated by the methods laid down in the former edition of this Manual, or by any other approved method, should not be required as a result of this publication, reference should be made to the recommendations concerning the recalibration of tanks given in Annex C. Tanks should be recalibrated when any major renewal of steelwork has been undertaken.

On completion of a calibration or recalibration, information and data obtained during the operation should be recorded in a Tank Calibration Record. Details of the data and information to be recorded are given in Annex G.