
**Petroleum and liquid petroleum products —
Calibration of vertical cylindrical tanks —**

Part 6:

Recommendations for monitoring, checking and
verification of tank calibration and capacity table

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*Pétrole et produits pétroliers liquides — Jaugeage des réservoirs cylindriques
verticaux —*

*Partie 6: Recommandations relatives à la surveillance, au contrôle et à la
vérification du jaugeage des réservoirs et des tables de jaugeage*

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Contents

	Page
1 Scope.....	1
2 Normative reference	1
3 Definitions	1
4 Recalibration and recalculation.....	1
5 Criteria for deciding significance of change	2
6 Recalibration of the tank	2
7 Recalculation of the tank capacity tables due to operational changes	3

Annexes

A Tank shell temperature determination.....	9
B Bibliography	10

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

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- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
 - type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
 - type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard (“state of the art”, for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 7507-6, which is a Technical Report of type 2, was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 3, *Static petroleum measurement*.

It was decided to publish this document in the form of a Technical Report (type 2) in order to gain wider experience with the use of the recommendations. It is envisaged that, when ISO 7507-1 is reviewed, that these recommendations will be included in it and this Technical Report withdrawn.

ISO 7507 consists of the following parts, under the general title *Petroleum and liquid petroleum products — Calibration of vertical cylindrical tanks*:

- Part 1: *Strapping method*
- Part 2: *Optical-reference-line method*
- Part 3: *Optical-triangulation method*
- Part 4: *Internal electro-optical distance-ranging method*

- *Part 5: External electro-optical distance-ranging method*
- *Part 6: Recommendations for monitoring, checking and verification of tank calibration and capacity table*

Annex A forms an integral part of this part of ISO 7507. Annex B is for information only.

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Introduction

Vertical cylindrical tanks are a type of tank in general use throughout the world for the storage of petroleum and petroleum products. Measurement of liquid levels and the use of the tank's capacity table permit the assessment of volume of the liquid held in store or transferred. Vertical cylindrical tanks, in common with other measurement devices, are subject to alterations in their calibration. Previously, such alterations were considered insignificant and their magnitude had never been seriously assessed. This part of ISO 7507 is based on the results of an investigation carried out in the United States of America ([1] in annex B).

Data currently available indicates that tanks are subject to a primary settlement which generally occurs during the first 5 years to 10 years of service. Secondary settlement can also occur but appears to spread over the next 10 years to 20 years of the tank's life. Tanks can undergo gradual changes in diameter, tank plate thickness and tilt throughout their service life. These factors affect the calibration of the tank and consequently the accuracy of any quantity assessments made using the tank capacity tables.

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Petroleum and liquid petroleum products — Calibration of vertical cylindrical tanks —

Part 6:

Recommendations for monitoring, checking and verification of tank calibration and capacity table

1 Scope

This part of ISO 7507 gives guidance on monitoring the accuracy of the calibration and the tank capacity table of a vertical cylindrical tank.

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2 Normative reference

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The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 7507. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 7507 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7507-1: 1993, Petroleum and liquid petroleum products - Calibration of vertical cylindrical tanks - Part 1: Strapping method.

3 Definitions

For the purposes of this part of ISO 7507, the terms and definitions given in ISO 7507-1 apply.

4 Recalibration and recalculation

The assessment of the nature and extent of various factors which can influence changes in the capacity of the tank determine whether a tank should be recalibrated or its tank capacity table recalculated. It is not practicable to indicate definitively all those factors which would require either recalibration or recalculation.

Recalibration is the process of measuring the tank when it has been established that the original measurements no longer define the tank dimensions accurately. In these circumstances, the tank should be remeasured completely and a revised tank capacity table calculated from the new measurements.

Recalculation of the tank capacity table is required when operating variables, such as product density, average storage temperature, or reference height, are altered; or modification of the deadwood occurs. In these circumstances, the recalculation of the tank capacity table is based on previously measured tank dimensions.

5 Criteria for deciding significance of change

In order to establish acceptance limits for change in the measurement and the operating variables which affect a tank's capacity, it is necessary to decide the overall variation in tank volume that is significant.

As a general rule, a variation in tank volume of 0,01 % or greater should be considered significant.

A range of 0,01 % to 0,05 % change in the tank capacity is given in tables 1 to 5. Tables 1, 2 and 3 provide criteria for recalibration, whilst tables 4 and 5 provide criteria for recalculation.

In the case of tilt, the recommended criterion is a change of 10 mm/m of tank height.

NOTE 1 - Although this will affect the apparent tank capacity to only a relatively minor extent, the change in tilt is considered more important than the capacity effect. A significant degree can be an indication of serious structural problems in the tank's foundations and should be investigated.

6 Recalibration of the tank

6.1 Factors influencing the need for recalibration

Recalibration of a tank may be required if any of the dimensions or characteristics of the following alter:

- a) tank diameter;
- b) tank plate thickness;
- c) tank tilt;
- d) deadwood;
- e) tank reference height; or
- f) repairs undertaken to the tank structure which significantly alter its capacity.

6.2 Recommendations for assessment of need for recalibration

The following recommendations are a basis for deciding whether recalibration is required:

- a) Verification of the bottom course diameter, plate thickness and tank tilt should be carried out every 5 years. If the changes in measured dimensions exceed the minimum level of significance (see clause 5), the recalibration should be undertaken.
- b) A total recalibration should be undertaken every 15 years as a matter of routine, even if the 5 yearly verification checks do not show any variation within the limits given in clause 5.

6.3 Structural alterations to tanks

Recalibration may be required if structural alterations are made to the tank. Examples of such alterations are:

- a) extensive changes to the deadwood of the tank;
- b) alterations to the reference height by alterations to the height of the dipping datum-point;
- c) repair work to the bottom plating.

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7 Recalculation of the tank capacity tables due to operational changes

7.1 Factors which generate a need for recalibration

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There are several factors which, when altered, generate a need for recalculation of the tank capacity tables. The first 2 are operational factors, the others mechanical changes:

- a) Changes in the average operating temperature of the tank shell.
- b) Changes in the density of the product stored in the tank.
- c) Alterations to the vertical position of the dipping datum-point.

NOTE 2 - This may require recalculation of the tank capacity tables (see 7.5).

- d) Alterations to the apparent mass in air of the floating roof.
- e) Simple changes to tank deadwood.

7.2 Tank shell temperature

Tank capacity tables are calculated at a standard temperature which is indicated on the printed tables.

Unless the tank capacity tables are included in a computerised oil volume calculation procedure which includes a routine to calculate the effect of temperature on the capacity of the tank, alterations in the average operating temperature of the tank shell may require that the tank capacity tables be recalculated. Such recalculations should be carried out in accordance with annex A or ISO 7507-1:1993.