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**Petroleum measurement systems —  
Calibration — Temperature corrections for  
use when calibrating volumetric proving  
tanks**

*Systèmes de mesure du pétrole — Étalonnage — Corrections de  
température à utiliser lors de l'étalonnage des jauges étalons*



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8222 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 3, *Static petroleum measurement*.

This second edition cancels and replaces the first edition (ISO 8222:1987), which has been technically revised.

This revision includes an equation for calculation of the density of water in the range 1,0 °C to 40 °C derived from density determinations on water carried out at the CSIRO National Measurement Laboratory, Australia, and published in 1994. It is expressed in terms of the International Temperature Scale of 1990, ITS-90. The equation in ISO 8222:1987 was based on work published in 1971 by PTB, Germany, expressed in terms of the International Practical Temperature Scale of 1968, IPTS-68.

Annex A forms a normative part of this International Standard. Annex B is for information only.

## Introduction

When meter proving tanks or other containers are calibrated with a primary measure using water, correction factors are required to make allowance for the effects of temperature during the calibration on the volume of water that is transferred and on the capacities of the primary measure and container.

The corrections take account of differences in the volume of water, and of the capacities of the measure and the tank, arising from the following temperature-related effects.

- a) The change in volume of the calibrating liquid (water) caused by any change in its temperature from the time it is measured in the measure to the time when the total volume has been transferred to or drawn from the tank being calibrated.

NOTE Although this International Standard is applicable to volumes transferred to, or drawn from, a tank, it has been written in terms of the volume transferred to the tank.

- b) Changes in the capacities of the measure and the tank being calibrated caused by any differences between the temperatures of their shells and their standard reference (calibration) temperature(s).

# Petroleum measurement systems — Calibration — Temperature corrections for use when calibrating volumetric proving tanks

## 1 Scope

This International Standard specifies multiplication factors for the correction of the volume of water transferred from a primary measure to a tank for changes arising from temperature differences during the determination of the capacity of the tank at reference temperature.

NOTE This International Standard does not set out a calibration procedure nor consider the uncertainties in temperature measurement, for which reference should be made to other standards.

Equations are given in annex A for the determination of the density of air-free and air-saturated, pure water in the temperature range 1,0 °C to 40 °C for temperatures expressed in terms of the ITS-90 International Temperature Scale.

A calculation routine is also provided in annex B for the combined water and metal correction factor that is applied when determining the capacity of the tank at reference temperature.

## 2 Symbols and definitions

For the purposes of this International Standard, the symbols defined in Table 1 apply.

Table 1 — Symbols

Symbol	Quantity	Unit
$C_c$	Combined correction factor	1
$C_{tdw}$	Correction factor for expansion of the calibrating liquid (water) over the temperature range $t_1$ to $t_2$ where $C_{tdw} = \frac{\rho_1}{\rho_2}$	1
$t_{sm}$	Standard reference temperature of the measure	°C
$t_{st}$	Standard reference temperature of the tank being calibrated	°C
$t_1$	Temperature of the water in the measure and of its shell	°C
$t_2$	Temperature of the water in the tank being calibrated at the completion of the calibration and of the shell of the tank	°C
$\alpha_{V1}$	Cubical expansion coefficient of the shell of the measure	°C <sup>-1</sup>
$\alpha_{V2}$	Cubical expansion coefficient of the shell of the tank being calibrated	°C <sup>-1</sup>
$\rho_1$	Density of water at temperature $t_1$	kg/m <sup>3</sup>
$\rho_2$	Density of water at temperature $t_2$	kg/m <sup>3</sup>

## 3 Temperatures

### 3.1 The corrections apply for temperatures in the range 1,0 °C to 40 °C.

For practical reasons, the temperature difference between the temperature of the measure and that of the tank shall not exceed 5,0 °C.