

Methods for

Volumetric measurement of liquid hydrocarbons —

Part 2: Turbine meter systems

[ISO title: Liquid hydrocarbons — Volumetric measurement by turbine meter systems]

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Petroleum Standards Committee (PTC/-) to Technical Committee PTC/12 upon which the following bodies were represented:

- Association of Commodity Cargo Superintendents and Surveyors
- British Gas Corporation
- Department of Energy (Gas Standards)
- Department of Trade and Industry (National Engineering Laboratory)
- Department of Trade and Industry (National Weights and Measures Laboratory)
- Department of Transport (Marine Directorate)
- General Council of British Shipping
- Institute of Petroleum
- Institution of Gas Engineers
- Royal Institution of Naval Architects
- Salvage Association
- UK Offshore Operators' Association Ltd.
- United Kingdom Petroleum Industry Association Limited

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National foreword

This Part of this British Standard has been prepared under the direction of the Petroleum Standards Committee. It is identical with ISO 2715 “*Liquid hydrocarbons — Volumetric measurement by turbine meter systems*” published in 1981 by the International Organization for Standardization (ISO).

Part 1 of this British Standard “Displacement meter systems (other than dispensing pumps)” was published in 1981 and is identical with ISO 2714:1980 “*Liquid hydrocarbons — Volumetric measurement by displacement meter systems other than dispensing pumps*”. Both of these ISO standards have been prepared by Sub-committee 2, Dynamic petroleum measurement, of ISO Technical Committee ISO/TC 28, Petroleum products and lubricants, in which the UK is an active participant.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words “International Standard” appear, referring to this standard, they should be read as “Part of this British Standard”.

Cross-references

International Standard	Corresponding British Standard
ISO 2714:1980	BS 6169 <i>Methods for volumetric measurement of liquid hydrocarbons</i> Part 1:1981 <i>Displacement meter systems (other than dispensing pumps)</i> (Identical)
ISO 6551:1982	BS 6439:1983 <i>Recommendations for fidelity and security of dynamic measurement of petroleum liquids and gases in cabled transmission as electric and/or electronic data</i> (Identical)

With reference to the footnote associated with clause 2, ISO 6551 has now been published.

ISO 4124 is in course of preparation and will be considered by the responsible BSI committee when the draft is available.

Additional information. With reference to 3.3.5 b), it should be noted that not more than 9 999 pulses can be recorded on a four digit counter and that for each batch the reading discrimination required will determine the number of pulses that should be registered and computed.

With reference to the first paragraph of 5.3, the third sentence should not be taken to imply that it is normal practice to measure crude oils with solids present. The presence of small amounts of wax may be acceptable, but other solids, e.g. sand, can cause damage to the meter.

NOTE *Textual errors.* With reference to 5.3.2, in the final paragraph, line 3, “valves” should read “values”. With reference to 3.3.5 b), in line 8, “Indicate” should read “Indication”.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

0 Introduction

Turbine meters consist essentially of a rotor which senses the mean velocity of a flowing stream. The moving liquid imparts a rotational or tangential velocity to the rotor which is proportional to the rate of flow. The movement of the rotor is detected by mechanical, optical, magnetic or electrical means and is recorded on a read-out device. The volume so registered must be compared with a known volume by proving.

This International Standard has been prepared as a guide for those concerned with the design, installation, operation and maintenance of turbine metering assemblies for liquid hydrocarbons. Annex A gives details of the parts and characteristics of turbine meters, and Annex B provides a trouble-shooting guide.

Information on displacement meters appears in ISO 2714, *Liquid hydrocarbons — Volumetric measurement by displacement meter systems other than dispensing pumps*. Future International Standards will deal with other types of meters, accessory equipment, provers and proving, the calculation of petroleum quantities, and specialized applications of metering systems containing turbine meters.

1 Scope and field of application

1.1 Scope

This International Standard specifies the characteristics of turbine meters and gives rules for systematically applying consideration to the nature of the liquids to be measured, to the installation of a metering system, and to the selection, performance, operation and maintenance of the same.

1.2 Field of application

The field of application is any division of the petroleum industry in which measurement is required. The content of this International Standard is general. It can be applied to the metering of different hydrocarbon liquids, to the use of turbine meters from any manufacturer, and to the various applications encountered. It does not necessarily apply to two-phase fluids.

2 References

ISO 4124, *Petroleum metering systems — Measurement control charts and statistical methods*¹⁾.

ISO 6551, *Petroleum liquids and gases — Fidelity and security of dynamic measurement — Electric and/or electronic pulsed data cabled transmission*¹⁾.

3 System design and selection of meters and ancillary equipment

3.1 Design considerations

All types of metering installations shall meet the following requirements:

- They shall be suitable for the maximum and minimum flow rates, the maximum permissible operating pressure, the temperature range and the type of liquid to be measured. If necessary, protective devices shall be included to limit or to control the operation within the design conditions of the metering installation.
- National or state regulations for electrical equipment in hazardous areas shall be complied with if there is a possibility of a hazardous atmosphere being present at the installation site.
- All construction materials in contact with the hydrocarbon liquid shall neither affect nor be affected by the liquid.
- There shall be provisions for proving the meter for the entire range of normal operating conditions.

3.2 Selection of turbine meter and ancillary equipment

3.2.1 Consideration shall be given to, and the manufacturer consulted regarding, the following when selecting a meter and its ancillary equipment:

- space for the meter installation and, where applicable, the proving facility;
- class and type of end connections installed on meter;
- the properties of the liquid on which the meter will be required to operate, including viscosity, density ranges, vapour pressure, corrosiveness and lubricating properties;
- the nature and quantity of abrasive and corrosive contaminants that may be carried in the liquid stream, including the size and distribution of solid matter;
- operating rates of flow, maximum and minimum, and whether flow will be continuous, intermittent or fluctuating;
- range of operating pressures and pressure losses across the meter when run at the maximum expected flow rate;

¹⁾ At present at the stage of draft.

- g) temperature range within which the meter will be required to operate, and applicability of automatic temperature compensation;
- h) maintenance methods and cost; and spare parts required;
- j) type, method and frequency of proving;
- k) the meter characteristics including linearity, maximum allowable pressure loss, and frequency and voltage output (see Annex A, Figure 2);
- m) types of read-out devices or indicating systems to be employed and signal preamplification (see Annex A, Figure 3);
- n) compatibility of ancillary meter read-out equipment and flow rate indication; and the method of meter registration adjustment, if applicable;
- p) power supply requirements for continuous or intermittent meter read-out;
- q) electrical code requirements;
- r) security of electrical transmission system.

3.2.2 Automatic temperature compensators, if installed, shall be chosen to respond to the temperature of the measured liquid within the required measurement tolerances under all ambient conditions.

3.3 Selection of read-out devices

3.3.1 Special consideration shall be given to the selection of read-out devices for a turbine meter system to prevent possible difficulties arising from climate, system layout and electrical incompatibilities. These include:

- a) *Climate*. Ascertain the need for electrical safety, weatherproofing, corrosion- or fungus-proofing devices. Evaluate the high and low temperature and humidity extremes, and protect accordingly.
- b) *System layout*. Provide easy access for maintenance and obtain recommended spare parts for items, such as electronic digital read-outs and electromechanical registers, that have a predictable failure rate. Alternative or back-up devices and stand-by power supplies are suggested where continuous service is essential.
- c) *Electrical incompatibilities*. All read-out devices shall be compatible with the turbine meter and the transmission system to which they are connected. In those instances where a read-out device is a link in a data transmission system, special care shall be taken to ensure that it has an output compatible with the data transmission system.

3.3.2 Read-out devices are available which perform a number of different functions. They shall be selected to ensure read-out in the desired form. The limits of each individual read-out device shall be noted so that it may perform optimally as part of the turbine meter system. Read-out devices may be either analog or digital.

3.3.3 Optimum discrimination is obtained with a digital read-out device which counts the individual pulses produced by the turbine meter to plus or minus one count, for a given interval. The basic pulse counter does not necessarily display flow or volumetric units until after logic functions are performed with the appropriate factors to convert the accumulated pulses into units of volume or flow rate.

A variety of electronic digital read-out devices is available for use with turbine meters. The following outline indicates the types and classes in general use and includes devices for special application.

3.3.4 Pulse counters which indicate every pulse received from the turbine meter usually incorporate one or more illuminated display units. Counters shall be compatible with meter output voltage and frequency. These counters may be classified as follows:

- a) *Proving counters*, in which a special gating circuit in the counter is triggered by switches in the proving system to start and stop the counter. This type of proving counter may be supplemented when the meter pulse rate is low by multiple electronic timers utilized to provide acceptable discrimination in the proving results.
- b) *Digital flow rate indicators*, in which a gating circuit in the counter starts and stops the counter over a preselected time interval. A fixed preselected time base provides uncorrected flow rate indication; a variable preselected time interval can provide corrected digital flow rate indication, since meter, temperature and pressure correction factors may be incorporated in the time base in order to provide a corrected read-out.

3.3.5 Computing counters are those in which the read-out is in terms of the number of pulses or multiples of pulses received by the counter. The read-out display of these counters may be by means which require that the incoming pulses be divided. These counters may be classified as follows:

- a) *Fixed ratio computing counters*, in which the incoming pulses are normally divided by 10, 100, 1 000 etc., so that the display is 1/10, 1/100, 1/ 1 000, etc., of the total pulses received. Some of these units are designed to divide by a fixed number other than a multiple of 10.