

Australian Standard[®]

**LIQUID HYDROCARBONS—
VOLUMETRIC MEASUREMENT
BY TURBINE METER SYSTEMS**

This Australian standard was prepared by Committee ME/49, Oil and Gas Measurement. It was approved on behalf of the Council of the Standards Association of Australia on 7 July 1983 and published on 5 September 1983.

The following interests are represented on Committee ME/49:

Australian Gas Association
Australian Institute of Petroleum Limited
Australian Institute of Physics
Australian Liquefied Petroleum Gas Association
Australian Petroleum Exploration Association Limited
CSIRO, Division of Applied Physics
Department of Industry and Commerce
Department of Mines and Energy, S.A.
Department of Minerals and Energy, Vic.
Department of Resources and Energy
Institution of Engineers Australia
National Standards Commission
The Pipeline Authority

Review of Australian Standards. *To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.*

Full details of all Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

This standard was issued in draft form for comment as DR 82031.



Documents
Document Sharing Hub

STANDARDS AUSTRALIA

RECONFIRMATION
OF
AS 2651—1983
Liquid hydrocarbons—Volumetric measurement by turbine meter systems

RECONFIRMATION NOTICE

Technical Committee ME-049 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 23 December 2015.

The following are represented on Technical Committee ME-049:

Australian Institute of Petroleum
Australian Petroleum Production and Exploration Association
Institute of Instrumentation, Control and Automation Australia
National Association of Testing Authorities Australia
National Measurement Institute

NOTES

Australian Standard[®]

**LIQUID HYDROCARBONS—
VOLUMETRIC MEASUREMENT
BY TURBINE METER SYSTEMS**

First published 1983

Incorporating:
Amdt 1—1984

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7262 3108 8

PREFACE

This standard was prepared by the Association's Committee on Oil and Gas Measurement.

The standard is based on international standard ISO 2715 — 1981 with which it is technically identical. Minor editorial changes have been made where required so that the standard is consistent with SAA format.

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

Information on displacement meters appears in AS 2652, Liquid Hydrocarbons— Volumetric Measurement by Displacement Meter Systems Other than Dispensing Pumps. Future standards, both national and international, 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.

© Copyright — STANDARDS AUSTRALIA

Users of Standards are reminded that copyright subsists in all Standards Australia publications and software. Except where the Copyright Act allows and except where provided for below no publications or software produced by Standards Australia may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing from Standards Australia. Permission may be conditional on an appropriate royalty payment. Requests for permission and information on commercial software royalties should be directed to the head office of Standards Australia.

Standards Australia will permit up to 10 percent of the technical content pages of a Standard to be copied for use exclusively in-house by purchasers of the Standard without payment of a royalty or advice to Standards Australia.

Standards Australia will also permit the inclusion of its copyright material in computer software programs for no royalty payment provided such programs are used exclusively in-house by the creators of the programs.

Care should be taken to ensure that material used is from the current edition of the Standard and that it is updated whenever the Standard is amended or revised. The number and date of the Standard should therefore be clearly identified.

The use of material in print form or in computer software programs to be used commercially, with or without payment, or in commercial contracts is subject to the payment of a royalty. This policy may be varied by Standards Australia at any time.

CONTENTS

	<i>Page</i>
SECTION 1. SCOPE AND GENERAL	
1.1 Scope	4
1.2 Application	4
1.3 Referenced Documents	4
1.4 Definition	4
SECTION 2. SYSTEM DESIGN AND SELECTION OF METERS AND ANCILLARY EQUIPMENT	
2.1 Design Considerations	5
2.2 Selection of Turbine Meter and Ancillary Equipment	5
2.3 Selection of Read-out Devices	5
SECTION 3. INSTALLATION	
3.1 General	7
3.2 Flow Conditioning	7
3.3 Valves	7
3.4 Piping Installation	7
3.5 Electrical Installation	8
SECTION 4. METER PERFORMANCE	
4.1 General	10
4.2 Meter Factor	10
4.3 Causes of Variation in Meter Factor Value and Their Impact on Calculation of Petroleum Volumes	10
SECTION 5. OPERATION AND MAINTENANCE OF METERING SYSTEMS	
5.1 General	12
5.2 Conditions Affecting Operation	12
5.3 Meter Maintenance	12
5.4 Meter Factor Control Charts	12
APPENDICES	
A Turbine Meters—Parts and Characteristics	14
B Trouble-shooting Guide	20

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
for

**LIQUID HYDROCARBONS—VOLUMETRIC MEASUREMENT BY TURBINE
METER SYSTEMS**

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This standard sets out the characteristics of turbine meters and gives requirements for their design and selection. It includes requirements for their installation in metering systems and describes how a system produces, or can be made to produce, accurate measurements.

This standard includes recommended operating and maintenance procedures for turbine meter systems.

NOTES:

1. A description of the parts and characteristics of turbine meters is given in Appendix A.
2. A trouble-shooting guide for turbine metering systems is given in Appendix B.

1.2 APPLICATION. The field of application is any division of the petroleum industry in which measurement is required. The content of this 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.

1.3 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

AS 1514 Glossary of Terms Used in Metrology
Part 1—General Terms and Definitions

AS 2430 Classification of Hazardous Areas
Part 1—Explosive Gas Atmospheres

AS 2520 Petroleum Measurement Tables

AS 2707 Petroleum Liquids and Gases—
Fidelity and Security of Dynamic
Measurement—Cabled Transmission
of Electric and/or Electronic Pulsed
Data

AS 3000 SAA Wiring Rules

ISO 4124 Petroleum Metering Systems—
Measurement Control Charts and
Statistical Methods*

1.4 DEFINITION. For the purpose of this standard, the following definition applies:

Approved—approved by the Operating Authority and includes obtaining the approval of the relevant Statutory Authority where this is legally required. Approval requires a conscious act and is generally given in writing.

The definitions and terms applicable to metrology shall be in accordance with AS 1514, Part 1.

* In course of preparation.

SECTION 2. SYSTEM DESIGN AND SELECTION OF METERS AND ANCILLARY EQUIPMENT

2.1 DESIGN CONSIDERATION. All types of metering installations shall be approved and shall comply with the following requirements:

- (a) 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.
- (b) Electrical equipment in hazardous areas (see AS 2430, Part 1) shall comply with AS 3000.
- (c) All materials in contact with the hydrocarbon liquid shall neither affect nor be affected by the liquid.
- (d) There shall be provisions for proving the meter for the entire range of normal operating conditions.

2.2 SELECTION OF TURBINE METER AND ANCILLARY EQUIPMENT.

2.2.1 General. Consideration shall be given to, and the manufacturer consulted regarding, the following when a meter and its ancillary equipment are selected:

- (a) Space for the meter installation and, where applicable, the proving facility.
- (b) Class and type of end connections installed on meter.
- (c) The properties of the liquid on which the meter will be required to operate, including viscosity, density ranges, vapour pressure, corrosiveness, and lubricating properties.
- (d) 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.
- (e) Operating rates of flow, maximum and minimum, and whether flow will be continuous, intermittent, or fluctuating.
- (f) Range of operating pressures and pressure losses across the meter when run at the maximum expected flow-rate.
- (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 Appendix A, Fig. A2).
- (m) Types of read-out devices or indicating systems to be employed and signal preamplification (see Appendix A, Fig. A3).
- (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.

2.2.2 Temperature Compensators. 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.

2.3 SELECTION OF READ-OUT DEVICES.

2.3.1 General. 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 as follows:

- (a) *Climate.* Ascertain the need for electrical safety, weatherproofing, corrosion-proofing or fungus-proofing of 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-out 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.

2.3.2 Type of Read-out Device. 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.

2.3.3 Digital Read-out Devices.

2.3.3.1 General. 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 types and classes in general use and devices for special application are described in Clauses 2.3.3.2 and 2.3.3.3.

2.3.3.2 Pulse counters. 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