

Australian/New Zealand Standard™

Gas meters—In-service compliance testing



AS/NZS 4944:2006

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Australian Electrical and Electronic Manufacturers Association
Electrical Regulatory Authorities Council
Electricity Engineers Association (New Zealand)
Energy Networks Association
Engineers Australia
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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-011, Electricity Metering Equipment through its Subcommittee EL-011-02—In-service compliance of electricity and gas meters.

The objective of this Standard is to provide the gas metering industry with guidance for the timely sampling, testing and assessment of in-service compliance of populations of gas meters.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

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FOREWORD

This Standard is intended to provide a basis for the maintenance of the metrological performance (in-service compliance) of gas meters by utilities and metering providers. It forms the basis for a performance based asset management scheme.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard Gas meters—In-service compliance testing

1 SCOPE

This Standard specifies requirements for the timely sampling, testing, and assessment of in-service compliance of populations of diaphragm gas meters with a maximum flow rate of up to and including 25 m³/h used for fiscal measurements.

2 APPLICATION

This Standard is intended for use by utilities or meter providers responsible for maintaining metrological performance (in-service compliance) of meters throughout the life of the meters. It does not apply to—

- (i) meter populations that are not large enough to provide a statistically meaningful sample;
- (ii) meters that have been tampered with or damaged;
- (iii) other devices such as volume correctors or pressure regulators.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard

AS

- | | |
|--------|---|
| 1199 | Sampling procedures and tables for inspection by attributes |
| 1199.1 | Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection |
| 2490 | Sampling procedures and charts for inspection by variables for percent nonconforming |
| 4647 | Domestic diaphragm gas meters |
|
 | |
| ISO | |
| 2854 | Statistical interpretation of data—Techniques of estimation and tests relating to means and variances |
| 2859 | Sampling procedures for inspection by attributes |
| 2859-1 | Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection |

4 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

4.1 Definitions relating to meters

4.1.1 Gas meter

Gas meters in accordance with this Standard shall be diaphragm gas volume meters in which the gas volume is measured by means of measuring chambers with deformable walls.

4.1.2 *Maximum flow rate (Q_{max})*

The maximum flow rate of air expressed in m³/h declared by a meter supplier to be able to be passed through a meter at a specified pressure absorption.

NOTES:

- 1 AS 4647 provides advice on pressure absorption measurement.
- 2 The limit of pressure absorption is traditionally 125 Pa although other values could be declared by a meter supplier. The medium (air) should be stated on the meter badge.

4.1.3 *Minimum flow rate (Q_{min})*

The minimum flow rate of air declared by a meter supplier to be able to be measured by a gas meter within declared meter error.

4.2 **Definitions relating to the process**

4.2.1 *Acceptable quality level (AQL)*

In a sampling plan, a quality level that corresponds to a relatively high probability of acceptance. It is the maximum percent nonconforming or the maximum number of nonconformities per hundred items or units of product that, for the purposes of sampling inspection, can be considered satisfactory as a process average.

4.2.2 *Attribute*

A characteristic that is appraised in terms of whether it does or does not meet (e.g. go or no-go) a given requirement.

4.2.3 *Initial compliance period*

A period of time allowed to a meter population or meter type to remain in-service without retesting or replacement. The initial compliance period may be taken from either the date of initial installation or the date of initial verification of a new meter or refurbished meter. The compliance period determination process is described by this Standard.

4.2.4 *Inspection*

The activity of measuring, testing or otherwise examining meters for determining conformity with the specified requirements.

4.2.5 *Inspection by attributes*

Inspection wherein the meter is classified simply either as conforming or nonconforming, or the number of nonconformities in the meter is counted, with respect to given requirements.

NOTE: See AS 1199.1 for more information on inspection by attributes.

4.2.6 *Inspection by variables*

A method that consists of measuring a quantitative characteristic for each item of a population or a sample taken from this population. The quantitative characteristic is used to establish statistically the acceptability of the population from the result obtained from the items in a sample.

NOTES:

- 1 See AS 2490 for more information on inspection by variables.
- 2 The 's' method of AS 2490 has been chosen as the most appropriate for use in this Standard.

4.2.7 *Lower error limit (L)*

An error limit that defines the lower compliance boundary for an individual meter.

4.2.8 *Ongoing in-service compliance period*

A period of time allowed for a meter population or meter type to remain in service in accordance with Table 5. It starts from the year of the latest inspection.

4.2.9 Outliers

An outlier (or an outlying observation) is one that appears to deviate markedly from other observations in the sample in which it occurs. A single outlier, even when it lies within specification limits, may produce an increase in variability, change the mean and consequently lead to rejection of the lot.

4.2.10 Pattern or type approval

The process whereby an impartial body examines the pattern or type (design) of an instrument prototype against a set of national or international metrological specifications.

4.2.11 Population

A quantity of meters that is considered uniform.

4.2.12 's' method

A method of assessing the acceptability of a population by using the estimate of the standard deviation of the population based on measurements of all the meters in a sample.

4.2.13 Sample

One or more meters taken from a population and intended to provide information about the population.

4.2.14 Upper error limit (U)

An error limit that defines the upper compliance boundary for an individual meter.

4.2.15 Variable

A quantitative characteristic of a population or a sample taken from the population.

4.2.16 Verification

The process whereby instruments are inspected to ensure that they comply with the approved pattern or type; are calibrated to ensure that they are operating within the maximum permissible errors; and are stamped and sealed as evidence of conformity.

NOTE: In Australia, the National Measurement Institute is the body responsible through the national measurement acts for the granting of pattern approvals for gas meters and the appointment of authorities for the initial verification of gas meters.

5 COMPARISON OF ATTRIBUTES INSPECTION WITH VARIABLES INSPECTION

Inspection by attributes is often simpler than inspection by variables, it requires fewer detailed records, and is generally faster. The administration of inspection is easier. When inspecting by attributes, it is customary to group together all quality characteristics of equivalent importance, and to establish one quality level for the group as a whole. The decision to accept or reject a quantity of product is then based on whether the quality level for the group of characteristics is achieved. By contrast, where variables inspection is used the decision to accept or reject is based on whether each characteristic meets its set quality level.

The variables method requires a successful test for normality.

The variables method has the advantage that it requires a smaller sample size than the attributes method to attain a given degree of protection against incorrect decisions. The attributes method has advantages in that it is essentially free of assumptions, and is simpler to use. Its larger sample sizes may be worthwhile for these reasons. For a description of the techniques used, and the basis of the calculations required, see AS 1199.1 for attributes inspection and AS 2490 for the 's' method of variables inspection.

NOTE: Appendix A gives additional information on the comparison of attributes inspection with variables inspection.

6 IN-SERVICE COMPLIANCE TESTING

6.1 General

In-service compliance testing is an economical method of determining whether a population of gas meters, installed in service for a number of years, is continuing to operate in accordance with the meters' metrological specifications.

NOTE: Australia's National Measurement Act requires gas meters to be of an approved pattern and verified.

6.2 Implementation

6.2.1 *Installed and verified meters*

At the date of implementation of this Standard the current populations of any existing pattern approved meter, upon verification are deemed to have an initial in-service compliance period of 15 years. This allowance may include future additions to an existing population, e.g. a population verified or installed in the same year as the implementation of this Standard.

Meter populations in excess of the deemed initial compliance period shall be tested within 2 years of this Standards implementation date.

In-service compliance test results of installed or verified meter populations should be applied to Table 5 to determine the ongoing in-service compliance period.

Examples of classification are as follows:

Example 1

This Standard is implemented in 2005.

A population of diaphragm meters was manufactured in 1984. Because these meters exist at the time of implementation of this Standard, the population is deemed to have a compliance period of 15 years.

Because the meter population exceeds the deemed compliance period it must be tested to ensure ongoing compliance. The testing must be completed within 2 years, i.e. by the end of 2007.

Example 2

This Standard is implemented in 2005.

A population of diaphragm meters was manufactured in 1995.

Because these meters exist at the time of implementation of this Standard, the population is deemed to have a compliance period of 15 years. Therefore the meters are deemed to comply until 2010.

The meter population must be tested in 2011 to ensure ongoing compliance.

6.2.2 *New and refurbished meter types*

The population of any new pattern or type (or variant of an existing pattern or type) of meter or any refurbished new meter type placed into service shall undergo compliance testing within a period of not less than three years and not exceeding five years of being placed into service. Applying the results of this testing to Table 4 will determine the compliance period for that meter pattern or type. This period is known as the initial in-service compliance period.

In-service compliance test results of installed or verified meter populations should be applied to Table 5 to determine the ongoing in-service compliance period.