

Australian Standard™

Electricity metering

Part 1: General purpose induction watthour meters



This Australian Standard was prepared by Committee EL-011, Electricity Metering. It was approved on behalf of the Council of Standards Australia on 10 May 2004 and published on 3 June 2004.

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STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 1284.1—2004

Electricity metering

Part 1: General purpose induction watt-hour meters

RECONFIRMATION NOTICE

Technical Committee EL-011 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.

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NOTES

Australian Standard™

Electricity metering

Part 1: General purpose induction watthour meters

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PREFACE

This Standard was prepared by the Standards Australia Committee on Electricity Metering Equipment to supersede AS 1284.1—1991.

Changes to the 1991 edition are as follows:

- (a) Removal of requirements for adjusting devices.
- (b) Simplification of requirements for termination for bottom-connected meters.
- (c) Removal of requirements for pointer registers.
- (d) Removal of requirements for basic torque.
- (e) Removal of requirements for an internal sighting strip.

This Standard is Part One of a series covering electricity meters. The series consists of the following Standards.

AS

1284	Electricity metering
1284.1	Part 1: General purpose induction watthour meters (this Standard)
1284.4	Part 4: Socket mounting system
1284.5	Part 5: General purpose electronic watthour meters
1284.6	Part 6: Ripple control receivers for tariff and load control
1284.7	Part 7: Internal clocks for meters and load control devices
1284.9	Part 9: Electronic watthour meters (Classes 0.2 S and 0.5 S)
1284.10.1	Part 10.1: Data exchange for meter reading, tariff and load control—Direct local data exchange via hand-held unit (HHU)—IEC Standard interface
1284.10.2	Part 10.2: Data exchange for meter reading, tariff and load control—Direct local data exchange via hand-held unit (HHU)—ANSI Standard interface
1284.11	Part 11: Single-phase multifunction watthour meters
1284.12	Part 12: Polyphase multifunction (non-demand) watthour meters (Class 1)
1284.13	Part 13: In-service compliance testing

The Standard specifies requirements for meters with the objective of ensuring that they will generally be accurate to within 2 percent for periods in excess of 20 years under harsh environmental conditions. To allow for drift in calibration known to occur over long periods of service, some of the limits specified in this Standard are more stringent than those for IEC 62053-11, Class 2.

The Standard adopts the single classification ‘general purpose’ for meters intended for domestic, commercial and general industrial use and thus avoids confusion with the IEC accuracy classifications for which the criteria are different.

A need is recognized for limited numbers of meters of higher accuracy for use in much less onerous field conditions. It is considered that this can be adequately covered by specifying compliance with IEC 62053-11, *Electricity metering equipment (a.c.)—Particular requirements*, Part 11: *Electromechanical meters for active energy (classes 0,5, 1 and 2)* or with IEC 62053-22, *Electricity metering equipment (a.c.)—Particular requirements*, Part 22: *Static meters for active energy (classes 0,2 S and 0,5 S)*.

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STANDARDS AUSTRALIA

**Australian Standard
Electricity metering****Part 1: General purpose induction watthour meters**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for general purpose single-rate and multi-rate induction watthour meters (hereinafter referred to as 'meters') for the measurement of 50 Hz a.c. electrical energy in domestic, industrial or commercial premises.

The Standard specifies terminal arrangements and connections for bottom-connected meters, also contact blade arrangements and connections for single-element single-phase 2-wire plug-in meters by cross-reference to AS 1284.4.

NOTE: This Standard includes guidance to purchasers of meters. Appendix A provides information which should be supplied with enquiry and order to facilitate the specification and purchase of meters.

1.2 APPLICATION

For plug-in meters, this Standard shall be read in conjunction with AS 1284.4.

1.3 REFERENCED DOCUMENTS

The documents referred to in this Standard are listed in Appendix B.

1.4 DEFINITIONS

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

1.4.1 Definitions related to the meter**1.4.1.1** *Bottom-connected meter*

A meter intended for mounting on a panel with external wiring connected directly to its terminals.

1.4.1.2 *CT-operated meter*

A meter intended for use with an external current transformer (CT), as indicated on the nameplate.

1.4.1.3 *Direct-connected meter*

A meter intended for use without an external measurement transformer, i.e., for direct connection to the circuit being metered.

1.4.1.4 *Induction meter*

A meter in which currents in fixed coils react with the currents induced in the moving element, generally a disc or discs, causing movement.

1.4.1.5 Multi-rate meter

A meter with two or more registers which provide for registration at one or another tariff rate according to the time, the load, or some other variable.

1.4.1.6 Plug-in meter

A meter having a base fitted with contact blades and intended for insertion in a socket.

1.4.1.7 Transformer-operated meter

A meter intended for use with one or more external measurement transformers.

1.4.1.8 Watthour meter (active-energy meter)

An integrating instrument which measures active energy in watthours or in decimal multiples thereof.

1.4.2 Definitions related to components**1.4.2.1 Base**

The back of the meter to which are attached the frame, the cover, and the terminals (or terminal block) or contact blades.

1.4.2.2 Braking element

The part of the meter which produces a braking torque by the action of its magnetic flux upon the currents induced in the moving element.

1.4.2.3 Case

The base and the main cover.

1.4.2.4 Current circuit

The winding of the driving element and the internal connections of the meter through which flows the current of the circuit to which the meter is connected.

1.4.2.5 Current terminal

A terminal through which the measured current flows.

1.4.2.6 Decimal drum

A drum with an associated multiplication factor of 1/10 or 1/100.

1.4.2.7 Digital register

A counting mechanism indicating by means of figures (on drums or by other means) the quantity of energy consumed.

1.4.2.8 Driving element

A working part of the meter which produces a torque by the action of its magnetic fluxes upon the currents induced in the moving element. It generally comprises electromagnets and their control devices. Herein referred to as 'element'.

1.4.2.9 Drum

A cylindrical scale of 10 equal divisions numbered 0 to 9.

1.4.2.10 Frame

The part to which are affixed the driving elements, the rotor bearings, the register, usually the braking element, and sometimes the adjusting devices.

1.4.2.11 Main cover

The enclosure on the front of the meter, made either wholly of transparent material or opaque material provided with window(s) through which the movement of the rotor can be seen and the register can be read.

1.4.2.12 Register changeover device

The means by which the appropriate register is brought into action to the exclusion of any other register.

1.4.2.13 Register (counting mechanism)

That part of the meter which registers the energy measured by the meter.

1.4.2.14 Register indicator

The means provided to indicate which register is in operation.

1.4.2.15 Rotor

The moving element of the meter upon which the magnetic fluxes of fixed windings and of braking elements act and which operates the register.

1.4.2.16 Socket

A device for fixing at the metering location of an electrical installation, having jaws intended for making a detachable connection with the blades of a plug-in meter or plug-in load control device.

1.4.2.17 Terminal block (bottom-connected meter)

A support made of insulating material on which all or some of the terminals of the meter are grouped together.

1.4.2.18 Terminal cover (bottom-connected meter)

A cover that covers the meter terminals and, generally, the ends of the external wires or cables connected to the terminals.

1.4.2.19 Test drum

The far right-hand drum of a register having each of its 10 divisions further divided into 10 equal subdivisions intended to be read in conjunction with a reference mark on the register.

1.4.2.20 Voltage circuit

The winding of the driving element and the internal connections of the meter supplied with the voltage of the circuit to which the meter is connected.

1.4.2.21 Voltage terminal

A terminal to which the measured voltage is applied.

1.4.3 Characteristic terms**1.4.3.1 Distortion factor**

The ratio of the r.m.s. value of the harmonic content (obtained by subtracting from a non-sinusoidal alternating quantity its fundamental term) to the r.m.s. value of the non-sinusoidal quantity. The distortion factor is usually expressed as a percentage.

1.4.3.2 Influence quantity or factor

Any quantity or factor other than the measured quantity, the effects of which may modify the measured results.

1.4.3.3 *Meter constant*

A constant expressing the relationship between the energy registered by the meter and the corresponding number of revolutions of the rotor, either in revolutions per kilowatthour (abbreviated to rev/Kw.h) or as watthours per revolution (abbreviated to W.h/rev).

1.4.3.4 *Percentage error of meter*

That value given by the equation—

$$\text{Percentage error} = \frac{\text{energy registered by the meter} - \text{true energy}}{\text{true energy}} \times 100$$

NOTES:

- 1 Since the true energy value cannot be determined, it is approximated by a value with a stated uncertainty that can be traced to standards agreed upon between user and manufacturer or to national standards.
- 2 A meter that registers 99 percent of the true energy has an error of minus 1 percent.

1.4.3.5 *Transformer ratio constant*

The factor determined by the product of the ratios of the measurement transformers by which the energy registration of the meter must be multiplied to obtain the energy in the primary circuit.

1.4.4 **Rated values**

NOTE: The terms voltage and current indicate r.m.s. values unless otherwise specified.

1.4.4.1 *Basic current (I_b)*

The value of current on which the relevant performance of the meter is based.

1.4.4.2 *Basic speed*

The nominal speed of rotation of the rotor when the meter is at reference conditions and carries basic current at unity power factor.

1.4.4.3 *Basic torque*

The nominal torque on the rotor when at rest, when the meter is at reference conditions and carries basic current at unity power factor.

1.4.4.4 *Rated maximum current ($I_{\max}$)*

The highest value of current at which the meter purports to comply with this Standard.

1.4.5 **Reference conditions**

The conditions on which the performance of the meter is based (see Table 4.1).

1.4.6 **Tests**

1.4.6.1 *Routine test*

A test made by the manufacturer on each meter.

1.4.6.2 *Type test*

A test made on one specimen or a small number of specimens of each design.

1.5 **CONDITIONS FOR OPERATION IN SERVICE**

Meters shall be suitable for operation in a minimum ambient temperature of -10°C and for operation at rated maximum current in an ambient temperature peaking at 45°C and averaging not more than 35°C in daily cycles.

NOTE: Where a direct-connected meter is to be operated at ambient temperatures exceeding 45°C , the meter should not be operated continuously at rated maximum current.

SECTION 2 C O N S T R U C T I O N A L R E Q U I R E M E N T S

2.1 GENERAL

The construction of the meter shall be suitable for its purpose in all respects and shall have assurance of permanence in all mechanical, electrical and magnetic characteristics. In particular, the meter shall comply with the following requirements:

- (a) All parts subject to corrosion under normal working conditions shall be effectively protected against corrosion due to atmospheric causes. Any protective coating shall not be liable to damage by ordinary handling or be injuriously affected by exposure to air under ordinary conditions of service.
- (b) The exposed surfaces of the electromagnetic laminations shall be coated with an approved material to prevent rusting or flaking of the inhibited surface of the lamination steel.
- (c) The case shall be made from a rigid thermally stable insulating material.
- (d) The double-insulation requirements of AS/NZS 3100 shall be complied with.
- (e) All insulating material used shall be non-hygroscopic and shall not release inside the meter gases or vapours which are likely to corrode or discolour internal parts of the meter, particularly when the meter is subject to current overloads of short duration.
- (f) When measured in accordance with Appendix C, the noise level of a meter (including any changeover device) shall not exceed 40 dB(A) above a reference level of 20 μ Pa.

2.2 CASE AND TERMINAL COVER

2.2.1 Mechanical strength

The meter shall have adequate mechanical strength and be constructed so that it can withstand the conditions of rough handling and transport that may be expected.

Where the meter is rigidly supported and struck three times on every potentially weak point of the case and terminal cover using the test hammer shown in Figure 2.1, the meter shall show no damage likely to affect its performance; in particular, live parts shall not have become exposed, the case and terminal cover shall show no visible cracks, and there shall not have been such distortion as to interfere with moving parts, damage insulation barriers, or reduce creepage distances or clearances.

2.2.2 Ignitability and combustion propagation

The case and terminal cover shall withstand the glow wire test specified in AS/NZS 60695.2.11 with test temperatures of the wire being as follows:

- | | |
|----------------------------|----------------|
| (a) For the case | 650 $\pm$ 10°C |
| (b) For the terminal cover | 750 $\pm$ 10°C |
| (c) For the terminal block | 960 $\pm$ 10°C |

2.2.3 Entry of objects, dust and moisture

2.2.3.1 Entry of sealing wire

Where the cover and terminal cover are in place, it shall not be possible for 0.7 mm diameter sealing wire to enter any compartment containing live parts.

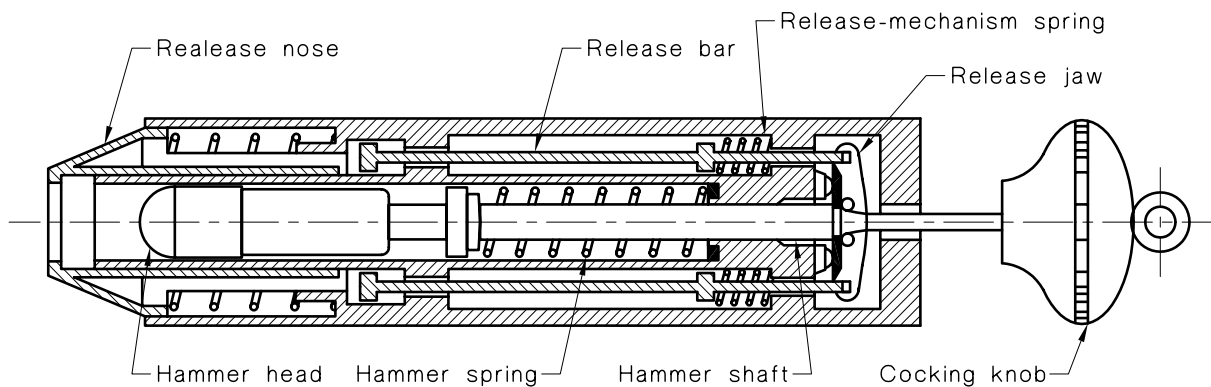
2.2.3.2 Enclosure classification

Where a bottom-connected meter is mounted vertically on a 300 mm × 300 mm panel, the case and terminal cover shall provide protection to classification IP 53 in accordance with AS 60529. A plug-in meter shall comply with the relevant requirement of AS 1284.4.

2.2.3.3 Protection against corrosion by salty air

When tested in accordance with the following requirements, the meter shall not exhibit any visible corrosion or other effect likely to affect the operation of the meter in the short or long term:

- (a) Specification AS 60068.2.11.
- (b) Duration 72 h.
- (c) Meter energization:
 - (i) Voltage circuit Voltage zero.
 - (ii) Current circuit(s) $I_{\max}$.
 - (iii) Switching 6 h on, 6 h off.



NOTE: The apparatus consists of three main parts: the body, the striking element and the spring-loaded release nose.

The body comprises the housing, the striking element guide, the release mechanism and all parts rigidly fixed thereto. The mass of this assembly is 1250 g.

The striking element comprises the hammer head, the hammer shaft and the cocking knob. The mass of this assembly is 250 g.

The hammer head has a hemispherical face of radius 10 mm and is of polyamide having a Rockwell hardness of R 100; it is fixed to the hammer shaft in such a way that the distance from its tip to the plane of the front of the nose, when the striking element is on the point of release, is 20 mm.

The nose has a mass of 60 g and the nose spring is such that it exerts a force of 20 N when the release jaws are on the point of releasing the striking element.

The hammer spring is adjusted so that the product of the compression, in millimetres, and the force exerted, in newtons, equals 1000, the compression being approximately 20 mm. With this adjustment, the impact energy is 0.5 ± 0.05 N.m.

The release mechanism springs are adjusted so that they exert just sufficient pressure to keep the release jaws in the closed position.

The apparatus is cocked by pulling the cocking knob back until the release jaws engage with the groove in the hammer shaft.

The blows are applied by pushing the release nose against the sample in a direction perpendicular to the surface at the point to be tested. The pressure is slowly increased so that the nose moves back until it is in contact with the release bars, which then move to operate the release mechanism and allow the hammer to strike.

FIGURE 2.1 TEST HAMMER

2.2.4 Visibility of internal parts

The cover shall either be made of transparent material or incorporate a window or windows to permit a clear view of the nameplate, the register and a portion of the periphery of the rotor disc. Removal of a window intact shall be impossible without breaking of the security seal.

Transparent plastics materials shall have the following properties:

- A heat deflection temperature of at least 95°C when tested in accordance with AS 1369 at 1.81 MPa.
- Resistance to weathering, and maintenance of the above properties after exposure to ultraviolet radiation.
- No noticeable deterioration or loss in transparency due to ultraviolet radiation when tested in accordance with Appendix D.

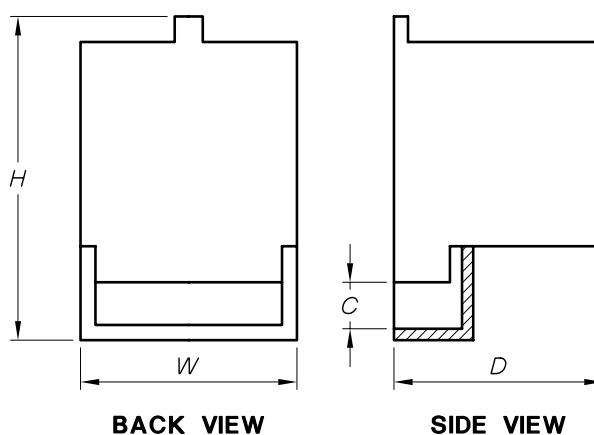
A plastics window or window area shall be protected (by means of raised edges, projections or the like) against scratching should the meter be placed face down on a flat surface.

2.2.5 Fixing screws (bottom-connected meter)

The cover and the terminal cover shall be provided with captive fixing screws.

2.3 DIMENSIONS

A bottom-connected meter shall conform to Figure 2.2. A plug-in meter shall conform to the dimensions specified in AS 1284.4. Dimension C shall provide sufficient space to install cables having the maximum size for the terminal rating of the meter in accordance with Table 2.1.



millimetres			
Type of meter	Maximum overall height, including terminal cover and top lug	Maximum overall width	Maximum overall depth
	H	W	D
Single-element meter	280	160	150
Multi-element meter	330	180	150

FIGURE 2.2 DIMENSIONS OF BOTTOM-CONNECTED METERS