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**Alternating-current watt-hour meters
(for direct connection) — Part 1:
General measuring instrument**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

Consequently **JIS C 1211**:1995 was withdrawn and replaced with this Standard.

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JIS C 1211 consists of the following 2 parts under the general title “*Alternating-current watt-hour meters (for direct connection)*”:

Part 1: General measuring instrument

Part 2: Measuring instruments used in transaction or certification

Alternating-current watt-hour meters (for direct connection)—Part 1: General measuring instrument

Introduction

This Japanese Industrial Standard has been established in order to specify the technical requirements needed for watt-hour meters (for direct connection) as general specifications. Since this Standard does not include the requirements concerning the marking method, the watt-hour meters cannot be given the marking as stipulated in Article 19 of the Industrial Standardization Law, which indicates their conformity to this Standard.

1 Scope

This Standard specifies the normal watt-hour meters for general use, that are independently used without combining with an instrument transformer in single-phase two-wire system, single-phase three-wire system, three-phase three-wire system and three-phase four-wire system circuits (Type III single-element direct-connection type meters and Type III multi-element direct connection type meters) (hereafter referred to as “meters”).

In addition, the transmitter of a watt-hour meter (for direct connection) for centralized and automatic meter reading shall be in accordance with Annex A. Furthermore, for the meters equipped with auxiliary devices, this Standard shall be applied to the watt-hour meters under the condition that the auxiliary devices are combined.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 1101 *Slotted head screws*

JIS B 1135 *Slotted head wood screws*

JIS C 1210 *General rules for electricity meters*

JIS C 1281 *Weather-proof performance of electricity meters*

JIS C 3307 *600 V Polyvinyl chloride insulated wires*

JIS C 4003 *Thermal evaluation and classification of electrical insulation*

JIS C 60068-2-6 *Environmental testing Part 2: Tests—Test Fc: Vibration (sinusoidal)*

JIS C 60068-2-27 *Basic environmental testing procedures Part 2: Tests, Test Ea and guidance: Shock*

3 Classification

The classification of meters by the rated voltage, rated current, rated frequency and weather resistance shall be as given in table 1 according to the phase and the wire system.

Table 1 Rated voltage, rated current, rated frequency and weather resistance

Phase and wire system	Rated voltage V	Rated current A	Rated frequency Hz	Weather resistance
Single-phase two-wire system	100 120 200 240	30 120	50 60	Normal weatherproof Reinforced weatherproof
Single-phase three-wire system	100			
Three-phase three-wire system	200			
Three-phase four-wire system	100 240			
NOTE : The rated voltage of a meter refers to the voltage applied to a voltage circuit, and for the three-phase three-wire system, it refers to line voltage, and for the three-phase four-wire system, it refers to phase voltage.				

4 Performance

4.1 General

The performance of a meter shall be in accordance with the requirements specified in 4.2 to 4.7, and JIS C 1281.

4.2 Allowable limits of measurement error

When the meter is tested in accordance with 6.2.1, the measurement error shall not exceed the allowable limits specified in table 2 according to the load current.

Table 2 Allowable limits of measurement error

Load current (% with respect to rated current)	Power factor	Allowable limit %
3.3 to 100	1	± 2.0
6.7 to 100	0.5 (lagging current)	± 2.5

4.3 Electrical performance

4.3.1 Starting current

When the meter is tested in accordance with 6.2.2 a), the rotor shall start and the rotation shall continue.

4.3.2 Creeping

When the meter is tested in accordance with **6.2.2 b)**, the rotor shall not make one or more revolutions.

4.3.3 Influence of self-heating

When the meter is tested in accordance with **6.2.2 c)**, the variation in error due to self-heating shall not exceed the limits specified in table 3.

Table 3 Limits of variation in error due to self-heating

Time min	Power factor	Limit of variation in error %
0 to 30	1	1.0
	0.5 (lagging current)	
30 to 120	1	0.5
	0.5 (lagging current)	

4.3.4 Current characteristics

When the meter is tested in accordance with **6.2.2 d)**, the variation in error generated due to the change of load current shall not exceed the limits specified in table 4.

Table 4 Current characteristics

Load current (% with respect to rated current)	Power factor	Limit of variation in error %
3.3 to 100	1	1.5
6.7 to 100	0.5 (lagging current)	2.0

4.3.5 Influence of unbalanced load

The influence of unbalanced load shall be as follows.

- a) When the multi-element meter is tested in accordance with **6.2.2 e) 1)**, the variation in error with respect to the balanced load condition shall not exceed the limit of 2.5 % at 50 % of the rated current [power factor 1 and 0.5 (lagging current)].
- b) When the multi-element meter is tested in accordance with **6.2.2 e) 2)**, the error shall not exceed the allowable limits given in table 5 according to the load current by phase and wire system.

Table 5 Allowable limits of error

Phase and wire system	Load current (% with respect to rated current)	Power factor	Allowable limit %
Single-phase three-wire system	6.7 to 50	1	±3.0
	13.3 to 50	0.5 (lagging current)	
Three-phase three-wire system	5.8 to 50	1	
	11.5 to 50	0.5 (lagging current)	
Three-phase four-wire system	10 to 50	1	
	20 to 50	0.5 (lagging current)	

4.3.6 Temperature characteristics

When the meter is tested in accordance with **6.2.2 f)**, the variation in error generated due to the change of ambient temperature shall not exceed the limits specified in table 6 for each type of meter.

Table 6 Limits of variation in error due to temperature change

Type of meter	Ambient temperature °C	Power factor	Limit of variation in error %
Normal weatherproof meter	-10 to +40	1	0.6
		0.5 (lagging current)	1.0
Reinforced weatherproof meter	-10 to +40	1	0.6
		0.5 (lagging current)	1.0
	40 to 50	1	0.8
		0.5 (lagging current)	1.2

4.3.7 Voltage characteristics

When the meter is tested in accordance with **6.2.2 g)**, the variation in error generated due to the change of voltage shall not exceed the limit of 1.0 % at power factors 1 and 0.5 (lagging current).

4.3.8 Frequency characteristics

When the meter is tested in accordance with **6.2.2 h)**, the variation in error generated due to the change of frequency shall not exceed the limit of 1.0 % at power factor 1 and 2.0 % at power factor 0.5 (lagging current).

4.3.9 Influence of external magnetic field

When the meter is tested in accordance with **6.2.2 i)**, the variation in error generated due to the given magnetic field shall not exceed the limit of 1.0 %.

4.3.10 Influence of waveform

When the meter is tested in accordance with **6.2.2 j)**, the variation in error generated due to the inclusion of third harmonics shall not exceed the limit of 1.0 %.

4.3.11 Power loss of voltage circuit

When the meter is tested in accordance with **6.2.2 k)**, the power loss of a voltage circuit shall not exceed the limits specified in table 7 for each element.

Table 7 Power loss of voltage circuit

Distinction	Power loss W
Single-phase two-wire system 100 V 30 A	1.2
Others	1.8

4.3.12 Power loss of current circuit

When the meter is tested in accordance with **6.2.2 l)**, the power loss of a current circuit shall not exceed the limits specified in table 8 for each element.

Table 8 Power loss of current circuit

Rated current A	Power loss W
30	2.0
120	3.0

4.3.13 Influence of overcurrent

When the meter is tested in accordance with **6.2.2 m)**, the meter shall be free from any unsuitable temperature rise, electric damage or mechanical damage, and the change in error generated by making overcurrent pass shall not exceed the limit of 1.0 % in any case.

4.4 Mechanical performance

4.4.1 Variation in error under light load

When the meter is tested in accordance with **6.2.3 a)**, the variation in error shall not exceed the limit of 1.0 %.

4.4.2 Influence of register

When the meter is tested in accordance with **6.2.3 b)**, the variation in error when a register is removed shall not exceed the limit of 1.5 %. Furthermore, if the register is a cyclometer type register, the variation in error when the counting figure drum steps up shall not exceed the limit of 1.0 %.

4.4.3 Influence of inclination

When the meter is tested in accordance with **6.2.3 c)**, the variation in error with respect to a normal posture shall not exceed the limits specified in table 9.

Table 9 Limits of variation in error due to inclination

Load current (% with respect to rated current)	Limit of variation in error %
3.3	2.0
50 to 100	1.0

4.4.4 Noise

When the meter is tested in accordance with **6.2.3 d)**, the noise emanating from it shall not exceed 30 dB.

4.4.5 Influence of vibration

When the meter is tested in accordance with **6.2.3 e)**, it shall be free from any mechanical damage. Furthermore, the variation in error generated by applying vibration shall not exceed the limits specified in table 10, and each of the requirements in **4.3.1**, **4.3.2** and **4.4.1** shall be satisfied.

Table 10 Limits of variation in error due to vibration and impact

Load current (% with respect to rated current)	Power factor	Limit of variation in error %
3.3 to 100	1	1.0
6.7 to 100	0.5 (lagging current)	1.2

4.4.6 Influence of impact

When the meter is tested in accordance with **6.2.3 f)**, it shall be free from any mechanical damage. Furthermore, the variation in error generated by applying the impact shall not exceed the limits specified in table 10, and each of the requirements in **4.3.1**, **4.3.2** and **4.4.1** shall be satisfied.

4.4.7 Driving torque

When the meter is tested in accordance with **6.2.3 g)**, the driving torque for each number of elements of the meter shall be not less than the values specified in table 11.

Table 11 Minimum driving torque

Unit: mN·m

Meter	Minimum driving torque
Single-element meter	1.08
Multi-element meter	1.47

4.5 Temperature rise of current coil and terminal

When the meter is tested in accordance with **6.2.4**, the temperature rise of the surface of a current coil and the terminal for each type of meters shall not exceed the limits specified in table 12.

Table 12 Limits of temperature rise of current coil and terminal

Unit: °C

Type of meter	Limit of temperature rise ^{a)}	
	Surface of current coil	Terminal
Normal weatherproof meter	65	40
Reinforced weatherproof meter	55	40
Note ^{a)} The above temperature rise limits are applicable to the case where Class A insulating material specified in JIS C 4003 is used for the current coil.		

4.6 Insulation performance

4.6.1 Insulation resistance

When the meter is tested in accordance with **6.2.5 a)**, the insulation resistance shall be not less than 5 MΩ.

4.6.2 Commercial-frequency withstand voltage

When the meter is tested in accordance with **6.2.5 b)**, it shall endure the commercial-frequency withstand voltage.

4.6.3 Lightning-impulse withstand voltage

When the meter is tested in accordance with **6.2.5 c)**, there shall not be any abnormalities such as discharge from a voltage coil, a current coil, a lead wire, etc., or disconnection of a voltage coil.

4.7 Durability

When the meter is tested in accordance with **6.2.6**, the variation in error for each lapse of time of 500 h immediately after the start of test shall not exceed the limits specified in table 13, and each of the requirements in **4.3.1**, **4.3.2** and **4.4.1** shall be satisfied.

Table 13 Limits of variation in error in durability test

Load current (% with respect to rated current)	Limit of variation in error %
100	0.7
3.3	0.9

5 Dimensions

The dimensions of a meter shall be as follows. However, the meters of backside connection type may be specified otherwise.

Other dimensions than given in this Standard shall be in accordance with **JIS C 1210**.

- a) The outside dimensions of a meter shall be not more than the values specified in table 14 and table 15 according to symbols in figure 1 and figure 2.

Table 14 Maximum outside dimensions of normal weatherproof meters

Unit: mm

Symbol	Explanation of symbol	Single-phase two-wire system		Single-phase three-wire system and three-phase three-wire system		Three-phase four-wire system	
		30 A meter	120 A meter	30 A meter	120 A meter	30 A meter	120 A meter
<i>A</i>	Height of meter	160	206	217	273	330	360
<i>B</i>	Width of meter	145	151	178	200	210	240
<i>C</i>	Depth of meter	115	134	130	136	200	200

Table 15 Maximum outside dimensions of reinforced weatherproof meters

Unit: mm

Symbol	Explanation of symbol	Single-phase two-wire system		Single-phase three-wire system and three-phase three-wire system		Three-phase four-wire system	
		30 A meter	120 A meter	30 A meter	120 A meter	30 A meter	120 A meter
<i>A</i>	Height of meter	216	262	295	331	420	460
<i>A'</i>	Height of meter excluding terminal cover	170	217	227	283	340	370
<i>B</i>	Width of meter	145	151	178	200	210	340
<i>C</i>	Depth of meter	115	134	130	136	200	200

- b) The dimensions of a mounting hole and a terminal part of the rated-current 30 A meter shall be as given in table 16 according to symbols in figure 1.