

JIS

JAPANESE INDUSTRIAL STANDARD

Alternating-Current Watt-Hour Meters (for Direct Connection)

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Alternating-Current Watt-Hour Meters
(for Direct Connection)

C 1211-1979

1. Scope

This Japanese Industrial Standard specifies normal watt-hour meters independently used not in combination with instrument transformers in single-phase 2-line, single-phase 3-line, three-phase 3-line, and three-phase 4-line circuits (Type III single-element direct-connection type meters and Type III multi-element direct-connection type meters), hereinafter referred to as the "meters".

Other requirements than those specified in this standard shall be as specified in JIS C 1210.

For meters provided with auxiliary devices, this standard shall be applied to their watt-hour meter units in the condition in which those auxiliary devices are combined.

For transmitters of transmitter incorporating watt-hour meters used for centralized meter examination and automatic meter examination, the requirements of Appendix shall be applied.

Remark: The units and numerical values given in { } in this standard are in accordance with the International System of Units (SI) and are appended for reference.

2. Classification

The classes of rated voltage, rated current, and rated frequency of meters shall be as specified in Table 1 according to the phase and line systems.

Applicable Standards and Reference Standards: See page 40.

Table 1

Phase and line system	Rated voltage V	Rated current A	Rated frequency Hz
Single-phase 2-line	100	30 120	50 60
	120		
	200		
	240		
Single-phase 3-line	100		
Three-phase 3-line	200		
Three-phase 4-line	100		
	240		

Remark: The rated voltage of a meter means the voltage applied to the voltage circuit, the line voltage to the three-phase 3-line system, and the phase voltage to the three-phase 4-line system.

3. Performances

3.1 General Performances The performances of meters shall meet the following requirements and also the requirements of JIS C 1281.

3.2 Allowable Limits of Measuring Errors When meters are tested according to 5.2.1, the measuring error, hereinafter referred to as the "error", expressed in percentage error, shall not exceed the limits of Table 2 according to the load current.

Table 2

Load current (% based on rated current)	Power factor	Allowable limits %
3.3 to 100	1	± 2.0
6.7 to 100	0.5 (lagging current)	± 2.5

3.3 Electric Performances

3.3.1 Starting Current When the meter is tested according to 5.2.2 (1), the rotor shall start and continue its rotation.

3.3.2 Creeping When the meter is tested according to 5.2.2 (2), the rotor shall not rotate by one rotation or more.

3.3.3 Influence of Self-Heating When meters are tested according to 5.2.2 (3), the variation in error due to self-heating shall not exceed the limits of variation in error specified in Table 3.

Table 3

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)	

3.3.4 Current Characteristics When meters are tested according to 5.2.2(4), the variation in error produced by the variation in load current shall not exceed the limit of variation in error specified in Table 4.

Table 4

Range of load current (% based on 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

3.3.5 Influence of Unbalanced Load

- (1) When multi-element meters are tested according to 5.2.2 (5) (a), the variation in error with respect to the balanced load condition shall not exceed the limit of 2.5 % at 50 % of rated current [power factor 1 and 0.5 (lagging current)].
- (2) When multi-element meters are tested according to 5.2.2 (5) (b), the error shall not exceed the limits specified in Table 5 according to the load current for each phase and line system.

Table 5

Phase and line system	Load current (% based on rated current)	Power factor	Allowable limit %
Single-phase 3-line system	6.7 to 50	1	± 3.0
	13.3 to 50	0.5 (lagging current)	
Three-phase 3-line system	5.8 to 50	1	
	11.5 to 50	0.5 (lagging current)	
Three-phase 4-line system	10 to 50	1	
	20 to 50	0.5 (lagging current)	

3.3.6 Temperature Characteristics When meters are tested according to 5.2.2 (6), the variation in error produced by the variation in ambient temperature shall not exceed the limit of variation in error specified in Table 6 for each type of meter.

Table 6

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

3.3.7 Voltage Characteristics When meters are tested according to 5.2.2 (7), the variation in error produced by the variation in voltage shall not exceed the limit of 1.0 % at power factors of 1 and 0.5 (lagging current).

3.3.8 Frequency Characteristics When meters are tested according to 5.2.2 (8), the variation in error produced by the variation in frequency shall not exceed the limit of 1.0 % at a power factor of 1, and the limit of 2.0 % at a power factor of 0.5 (lagging current).

3.3.9 Influence of External Magnetic Field When meters are tested according to 5.2.2 (9), the variation in error produced by the application of an external magnetic field shall not exceed the limit of 1.0 %.

3.3.10 Influence of Waveform When meters are tested according to 5.2.2 (10), the variation in error produced by the inclusion of a third harmonic wave shall not exceed the limit of 1.0 %.

3.3.11 Power Loss of Voltage Circuit When meters are tested according to 5.2.2 (11), the power loss of the voltage circuit shall not exceed the value specified in Table 7 for each element.

Table 7

Division	Power loss W
Single-phase 2-line system 100 V 30 A	1.2
Other systems	1.8

3.3.12 Power Loss of Current Circuit When meters are tested according to 5.2.2 (12), the power loss of the current circuit shall not exceed the value specified in Table 8 for each element.

Table 8

Rated current A	Power loss W
30	2.0
120	3.0

3.3.13 Influence of Overcurrent When meters are tested according to 5.2.2 (13), any improper temperature rise or electric or mechanical damage shall not occur, and the variation in error produced by the passing of an overcurrent shall not exceed the limit of 1.0 % in any case.

3.4 Mechanical Performances

3.4.1 Variation in Error at Light Load When meters are tested according to 5.2.3 (1), the variation in error shall not exceed the limit of 1.0 %.

3.4.2 Influence of Register When meters are tested according to 5.2.3 (2), the variation in error produced when the register is detached shall not exceed the limit of 1.5 %.

For cyclometer type registers, the variation in error produced when the counting drum steps up shall not exceed the limit of 1.0 %.

3.4.3 Influence of Inclination When meters are tested according to 5.2.3 (3), the variation in error with respect to the normal position shall not exceed the limit of variation in error specified in Table 9.

Table 9

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

3.4.4 Noise When meters are tested according to 5.2.3 (4), the noise generated by the meter shall not exceed 30 dB.

3.4.5 Influence of Vibration When meters are tested according to 5.2.3 (5), no mechanical damage shall occur.

The variation in error produced by the application of vibrations shall not exceed the limit of variation in error specified in Table 10 and the meters shall meet the requirements of 3.3.1, 3.3.2, and 3.4.1 respectively.

Table 10

Load current (% based on 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

3.4.6 Influence of Impact When meters are tested according to 5.2.3 (6), no mechanical damage shall occur.

The variation in error produced by the application of impact shall not exceed the limit of variation in error specified in Table 10 and the meters shall meet the requirements of 3.3.1, 3.3.2, and 3.4.1 respectively.

3.4.7 Driving Torque When meters are tested according to 5.2.3 (7), the driving torque for each type of meter shall be not less than the value specified in Table 11.

Table 11

Unit: gf.cm ($\mu\text{N}\cdot\text{m}$)

Type of meter	Driving torque
Single-element meter	11 {10.8}
Multi-element meter	15 {14.7}

3.5 Rise in Temperature of Current Coil and Terminals When meters are tested according to 5.2.4, the rise in temperature of the surfaces of the current coil and terminals shall not exceed the limits of rise in temperature specified in Table 12.

Table 12

Unit: °C

Type of meter	Limits of rise in temperature ⁽¹⁾	
	Surface of current coil	Terminal
Normal weatherproof meter	65	40
Reinforced weatherproof meter	55	40

Note ⁽¹⁾ These limits of rise in temperature are applicable to the case in which Class A insulating materials [see JIS C 4003] are used in the current coil.

3.6 Insulation Performances

3.6.1 Insulation Resistance When the meter is tested according to 5.2.5 (1), the insulation resistance shall be not less than 5 M Ω .

3.6.2 Commercial Frequency Withstand Voltage When the meter is tested according to 5.2.5 (2), it shall pass the test.

3.6.3 Lightning Impulse Withstand Voltage When the meter is tested according to 5.2.5 (3), there shall not occur such abnormalities as discharging in the voltage coils, current coils, and lead wires, or the like, or the breakage of wire in the voltage coil.

3.7 Durability When the meter is tested according to 5.2.6, the variation in error, with respect to the error measured directly after starting the test, for every 500 h thereafter shall not exceed the limits of variation in error specified in Table 13 and in addition, the meters shall meet the requirements of 3.3.1, 3.3.2, and 3.4.1 respectively.

Table 13

Load current (% based on rated current)	Limit of variation in error %
100	0.7
3.3	0.9

4. Dimensions

The dimensions of meter shall meet the following requirements. However, the meter of the backside connection type may be exempted from the application of such requirements.

- (1) The outside dimensions of the meter shall be not more than the values specified in Table 14 and Table 15 according to the symbols shown in Fig. 1.

Table 14. Normal Weatherproof Meters

Symbol	Explanation of symbol	Single-phase 2-line system		Single-phase 3-line and three-phase 3-line systems		Three-phase 4-line system	
		30 A meter	120 A meter	30 A meter	120 A meter	30 A meter	120 A meter
A	Height of meter	160	206	217	273	330	360
B	Lateral width of meter	145	151	178	200	210	240
C	Depth of meter	115	134	130	136	200	200

Unit: mm

Table 15. Reinforced Weatherproof Meters

Symbol	Explanation of symbol	Single-phase 2-line system		Single-phase 3-line and three-phase 3-line systems		Three-phase 4-line system	
		30 A meter	120 A meter	30 A meter	120 A meter	30 A meter	120 A meter
A	Height of meter	216	262	295	331	420	460
A'	Height of meter with terminal cover removed	170	217	227	283	340	370
B	Lateral width of meter	145	151	178	200	210	340
C	Depth of meter	115	134	130	136	200	200

Unit: mm

- (2) The dimensions of the meter mounting holes and terminal parts of 30 A rated current meter shall conform to the values specified in Table 16 according to the symbols shown in Fig. 1.

Table 16

Unit: mm

Symbol	Explanation of symbol	Single-element meter	Multi-element meter
D	Distance of meter mounting holes	134 to 145	—
Q	Diameter of meter mounting holes	5.5 ⁽²⁾	5.5 ⁽²⁾
P	Diameter of terminal holes	5 min.	5 min.
S	Distance from meter mounting face to the centre of terminal holes	10.5 min.	10.5 min.
X	Depth of terminal holes	22 min.	22 min.
G	Distance from the centre line of meter to the centre lines of 2 S and 2 L terminal holes	11.5 to 12.5	—
H	Distance between the centre lines of 1 S and 2 S terminal holes and between 2 L and 1 L terminal holes	17.5 to 20	—
H ₁ to H ₇	Distance between the centre lines of neighbouring terminal holes	—	12 min. ⁽³⁾

Notes ⁽²⁾ Flat-head wood screws of nomination M 5.1 specified in JIS B 1135 and oval countersunk head machine screws of nomination M 4.5 specified in JIS B 1101 may be used.

⁽³⁾ The distance between terminals at the same electric potential may be otherwise specified.