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**Alternating-current watt-hour meters
(for direct connection) — Part 2:
Measuring instruments used in
transaction or certification**

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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Consequently **JIS C 1211**: 1995 was withdrawn and partially replaced with this Standard.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 2: Measuring instruments used in transaction or certification

Introduction

This Japanese Industrial Standard is established for the purpose of specifying the technical standards and test methods concerning structure and performance requirements of the alternating-current watt-hour meters (for direct connection), among other requirements stipulated for the specified measuring instruments given in Measurement Act. The conformance of the watt-hour meter with this Standard, by itself, is not to certify that the meter has passed the verification test stipulated in Measurement Act. Furthermore, the watt-hour meters (for direct connection) cannot be given the marking stipulated in Article 19 of the Industrial Standardization Law, which indicates their conformity with this Standard.

1 Scope

This Standard specifies the induction type and the electronic normal watt-hour meters which are used for measurement in transaction or certification in Japan, and used independently 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 (hereafter referred to as “meters”).

Other requirements than specified in this Standard shall be in accordance with **JIS C 1210**.

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 C 1210 *General rules for electricity meters*

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*

JIS K 2246 *Rust preventive oils*

JIS Z 2371 *Methods of salt spray testing*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in **JIS C 1210** and the following definitions apply.

3.1 indication mechanism

a set of scale marks which indicate a measurement value continuously or intermittently at regular intervals

3.2 separable indication mechanism

an indication mechanism which is separated from the main body of a meter by a cord, etc., or externally connected to it by a connector, etc.

3.3 instrumental error

the rate of the value obtained by subtracting a true value from a measurement value to the true value

NOTE : In **JIS C 1211-1**, it is referred to as “error.”

3.4 instrumental error test

a test to judge, by measuring the instrumental error of a meter, whether the meter conforms to the technical standards concerning structure stipulated in Measurement Act

3.5 verification

an inspection of specified measuring instruments stipulated in Measurement Act

NOTE : It is stipulated in the Measurement Act that the verifications are to be performed, depending on the classification of the specified measuring instrument, by the prefectural governor, a designated verification body, National Institute of Advanced Industrial Science and Technology, and Japan Electric Meters Inspection Corporation.

3.6 inspection during use

an inspection of performance, etc. of meters being used in the market, conducted after the manufacture of electric meters and instrument transformers

3.7 verification tolerance

tolerance expressed by the absolute value of an instrumental error in verification

3.8 user's tolerance

tolerance expressed by the absolute value of an instrumental error in inspection during use

3.9 type approval marking

marking which indicates that the meter belongs to a certified type of specified measuring instruments stipulated in the Measurement Act

3.10 electronic meter

a meter which measures and operates by using electronic parts such as semiconductors

3.11 induction type meter

a meter which operates by electric currents induced in an induction movable element (generally a disk) due to electric currents passing in a fixed coil

3.12 power switching normal watt-hour meter

a watt-hour meter which, upon insertion of money, etc. passes electric energy of an amount set to be equivalent to the inserted money

3.13 Type II meter

a meter, for direct connection, of which the rated current is 20 A or 60 A (excluding 60 A electronic meters)

3.14 Type III meter

a meter, for direct connection, of which the rated current is 30 A or 120 A, and 60 A electronic meter for direct connection

3.15 Type IV meter

a meter, for direct connection, of which the rated current is 200 A

3.16 Type V meter

a meter, for direct connection, of which the rated current is 250 A

3.17 transmitter

a device which generates the electric pulse proportional to electric energy for use in transaction or certification

3.18 transmitter-incorporating meter

a meter equipped with a transmitter

3.19 output mechanism

a mechanism which transmits data of measurement values, etc. to a computer, etc.

3.20 meter with an output mechanism

a meter equipped with an output mechanism

3.21 indoor meter

a meter which can be used in a place with no exposure to rain or direct sunlight

3.22 indoor weatherproof meter

a meter having a weather-resistance structure, withstanding use in a place with no exposure to rain but directly exposed to sunlight

3.23 normal weatherproof meter

a meter installed outdoors, but inside the rainfall line, or indoors, having a weather-resistance structure to endure use in a place where it would be directly exposed to sunlight and occasionally exposed to partial rainfall spatter

3.24 reinforced weatherproof meter

a meter installed outdoors and outside the rainfall line, having a weather-resistance structure to endure use in a place where it would be directly exposed to sunlight and rain

3.25 element

a set of actuator in the induction type meter which gives driving torque to a rotor axis, and a part in the electronic meter in which conversion to the electric quantity which is proportional to the electric power obtained by multiplying input voltage and input current is performed

3.26 measurement pulse

the pulse proportional to the electric energy which is output for the purpose of measuring the instrumental error of a meter

3.27 meter constant

a value which expresses the number of rotor revolutions per 1 kWh of a meter in the induction type meter, and a value which expresses the number of measurement pulses per 1 kW or 1 kWh in the electronic meter

3.28 pulse constant

a value which expresses the number of pulses per 1 kW or 1 kWh of a transmitter

3.29 indicator

a device which displays the measurement indication, etc. of electric energy

3.30 auxiliary power supply circuit

a circuit to which the voltage for operating an indicator is applied, which refers to the part of the circuit between auxiliary power terminals of the indicator

3.31 compound electric meter

a meter consisting of two or more electric meters structurally combined in one, in which two or more units of the combined meters are of the same type, and the electric meters concerned are equipped with the same detection part and the central processing unit

4 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 a phase and a wire system.

Table 1 Classification of meters

Phase and wire system	Rated voltage V	Rated current A	Rated frequency Hz	Weather resistance
Single-phase two-wire system	100 120 200 240	20 30 60 120 200 250	50 60	Indoor Indoor weatherproof Normal weatherproof Reinforced weatherproof
Single-phase three-wire system	100			
Three-phase three-wire system	100 200			
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, phase voltage.				

5 Marking

5.1 Meter

The following matters shall be clearly and indelibly marked on the conspicuous part of a meter.

- Type of meter (“Normal watt-hour meter”)
- Symbol of type
- Phase and wire system of applicable circuit
- Rated voltage (phase voltage for the three-phase four-wire system), rated current and rated frequency specific to the meter
- Meter constant specific to the meter
- Pulse symbol and pulse constant for those meters provided with transmitters
- Manufacturing number
- Manufacturer’s name or registered trademark

NOTE : Registered trademark refers to that of Article 2, paragraph 2 of Trade-mark Law (Law No. 127 of 1959).

- Year of manufacture (based on Christian year)
- For the indoor meters, the indication “Indoor type”
- For the indoor weatherproof meters, the indication “Indoor weatherproof type”
- For the reinforced weatherproof meters, the indication “Reinforced weatherproof type”

- m) For the power switching normal watt-hour meters, the indication “Power switching normal watt-hour meter”, and location of insertion of money, etc., kind of money, etc. that can be used and watt-hour per one unit of money, etc.

5.2 Separable indication mechanism

The separable indication mechanism shall bear a marking of a pulse symbol and a pulse constant on a conspicuous part.

6 Performance

6.1 Verification tolerance

When the meter is tested in accordance with **7.1**, the instrumental error (which is expressed in instrumental error percentage) shall satisfy the verification tolerance in table 2 according to the load current for each division of the meter by the rated current.

Table 2 Verification tolerance of alternating-current watt-hour meters (for direct connection)

Division of meter by rated current	Load current (percentage with respect to rated current)	Power factor	Verification tolerance %
Type II meter	5, 50 and 100	1	2.0
	20 and 100	0.5 (lagging current)	2.5
Type III meter	3.3, 50 and 100	1	2.0
	20 and 100	0.5 (lagging current)	2.5
Type IV meter	2.5, 50 and 100	1	2.0
	20 and 100	0.5 (lagging current)	2.5
Type V meter	2, 50 and 100	1	2.0
	20 and 100	0.5 (lagging current)	2.5

6.2 Electrical performance

6.2.1 Start-up

When the meter is tested in accordance with **7.2.1**, the rotor shall continue to rotate, if it is an induction type meter, and measurement pulse shall continue to be generated, if it is an electronic meter.

6.2.2 Creeping

When the meter is tested in accordance with **7.2.2**, the rotor shall not make one or more revolutions, if it is an induction type meter, and measurement pulse shall not be generated, if it is an electronic meter.

6.2.3 Influence of self-heating

When the meter is tested in accordance with **7.2.3**, the difference in instrumental error due to self-heating shall not exceed the limits in table 3.

Table 3 Limit of difference in instrumental error due to self-heating

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

6.2.4 Current characteristics

When the meter is tested in accordance with **7.2.4**, the difference in instrumental error generated by the change of load current shall not exceed the limits in table 4, and the instrumental error shall satisfy the tolerance in table 4.

Table 4 Limit of difference in instrumental error due to current change and tolerance on instrumental errors

Division of meter by rated current	Load current (percentage with respect to rated current)	Power factor	Limit of difference between maximum and minimum instrumental errors %	Tolerance on instrumental error %	
			Positive phase sequence	Positive phase sequence	Negative phase sequence ^{a)}
Type II meter	5, 10, 20, 50 and 100	1	1.5	±2.0	±2.0
	10, 20, 50 and 100	0.5 (lagging current)	2.0	±2.5	±2.5
Type III meter	3.3, 6.7, 10, 20, 50 and 100	1	1.5	±2.0	±2.0
	6.7, 10, 20, 50 and 100	0.5 (lagging current)	2.0	±2.5	±2.5
Type IV meter	2.5, 5, 10, 20, 50 and 100	1	1.5	±2.0	±2.0
	5, 10, 20, 50 and 100	0.5 (lagging current)	2.0	±2.5	±2.5
Type V meter	2, 4, 10, 20, 50 and 100	1	1.5	±2.0	±2.0
	4, 10, 20, 50 and 100	0.5 (lagging current)	2.0	±2.5	±2.5
Note ^{a)} This applies to the three-phase meters which operate in a state of negative phase sequence.					

6.2.5 Influence of unbalanced load

The influence of unbalanced load on single-phase three-wire system meters, three-phase three-wire system meters and three-phase four-wire system meters shall be as follows.

- a) When the meter is tested in accordance with **7.2.5 a)**, the difference of the obtained instrumental error from that in 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 meter is tested in accordance with **7.2.5 b)**, the instrumental error shall satisfy the tolerance in table 5.

Table 5 Tolerance on instrumental error due to unbalanced load

Phase and wire system	Division of meter by rated current	Load current (percentage with respect to rated current)	Power factor	Tolerance on instrumental error %
Single-phase three-wire system	Type II meter	10, 20 and 50	1	±3.0
		20 and 50	0.5 (lagging current)	
	Type III meter	6.7, 10, 20 and 50	1	
		13.3, 20 and 50	0.5 (lagging current)	
	Type IV meter	5, 10, 20 and 50	1	
		10, 20 and 50	0.5 (lagging current)	
	Type V meter	4, 10, 20 and 50	1	
		8, 20 and 50	0.5 (lagging current)	
Three-phase three-wire system	Type II meter	8.7, 20 and 50	1	
		17.3 and 50	0.5 (lagging current)	
	Type III meter	5.8, 10, 20 and 50	1	
		11.5, 20 and 50	0.5 (lagging current)	
	Type IV meter	4.3, 8.7, 20 and 50	1	
		8.7, 20 and 50	0.5 (lagging current)	
	Type V meter	3.5, 8.7, 20 and 50	1	
		6.9, 20 and 50	0.5 (lagging current)	
Three-phase four-wire system	Type II meter	15, 20 and 50	1	
		30 and 50	0.5 (lagging current)	
	Type III meter	10, 20 and 50	1	
		20 and 50	0.5 (lagging current)	
	Type IV meter	7.5, 20 and 50	1	
		15 and 50	0.5 (lagging current)	
	Type V meter	6, 20 and 50	1	
		12 and 50	0.5 (lagging current)	

6.2.6 Temperature characteristics

The temperature characteristics shall be as follows.

- a) When the meter is tested in accordance with **7.2.6 a)**, the difference in instrumental error generated due to the change of ambient temperature for each type of the meter shall not exceed the limits in table 6.

Table 6 Limit of difference in instrumental error due to temperature changes

Type of meter	Ambient temperature °C	Power factor	Limit of difference in instrumental error %
Indoor meter	-10 to 40	1	0.6
Indoor weatherproof meter		0.5 (lagging current)	1.0
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

- b) In the case of the transmitter-incorporating meter, the transmitter or separable indication mechanism shall function without any hindrance at a temperature in the range of -10 °C to 40 °C (-10 °C to 50 °C for the reinforced weatherproof meter). Furthermore, when the test is performed in accordance with **7.2.6 b)**, the number of pulses generated in the transmitter shall be proportional to the electric energy, and the separable indication mechanism shall indicate the electric energy correctly according to the number of pulses.
- c) In the case of the meter with an output mechanism, the output mechanism shall function without any hindrance at a temperature in the range of -10 °C to 40 °C (-10 °C to 50 °C for the reinforced weatherproof meter). Furthermore, when the test is performed in accordance with **7.2.6 c)**, the output mechanism shall output the measurement values correctly.
- d) In the case of the power switching normal watt-hour meter, its power switching device shall function without any hindrance at a temperature in the range of -10 °C to 40 °C. Furthermore, when the test is performed in accordance with **7.2.6 d)**, the operation of opening and closing, etc. of the power switching device shall be normal.

6.2.7 Voltage characteristics

The voltage characteristics shall be as follows.

- a) When the meter is tested in accordance with **7.2.7 a)**, the difference in instrumental error generated due to the voltage change of $\pm 10\%$ with respect to the rated voltage, according to the load current for each division of meter by the rated current shall not exceed the limits in table 7.

Table 7 Limit of difference in instrumental error due to voltage changes

Division of meter by rated current	Load current (percentage with respect to rated current)	Power factor	Limit of difference in instrumental error %
Type II meter	10 and 100	1	1.0
	100	0.5 (lagging current)	
Type III meter	6.7 and 100	1	
	100	0.5 (lagging current)	
Type IV meter	5 and 100	1	
	100	0.5 (lagging current)	
Type V meter	4 and 100	1	
	100	0.5 (lagging current)	

- b) The electronic meter shall function without any hindrance at a voltage of 80 % of the rated voltage. Furthermore, when the test is performed in accordance with **7.2.7 b)**, the indication of the indication mechanism shall operate correctly in proportion to the number of pulses which measure the electric energy.
- c) In the case of the transmitter-incorporating meter, the transmitter or the separable indication mechanism shall function without any hindrance at a voltage in the range of 80 % to 110 % of the rated voltage of the auxiliary AC power supply. Furthermore, when the test is performed in accordance with **7.2.7 c)**, the number of pulses generated in the transmitter shall be proportional to the electric energy, and the separable indication mechanism shall indicate the electric energy correctly according to the number of pulses.
- d) When the meter with an output mechanism is tested in accordance with **7.2.7 d)**, the output mechanism shall output the measurement values correctly at a voltage in the range of 80 % to 110 % of the rated voltage of the auxiliary AC power supply.
- e) In the case of the power switching normal watt-hour meter, the power switching device shall function without any problem at a voltage in the range of 80 % to 110 % of the rated voltage of the auxiliary AC power supply. Furthermore, when the test is performed in accordance with **7.2.7 e)**, the operation of opening and closing, etc. of the power switching device shall be normal.

6.2.8 Frequency characteristics

When the meter is tested in accordance with **7.2.8**, the difference in instrumental error generated due to the frequency change of ± 5 % with respect to the rated frequency, according to the load current for each division of meter by the rated current shall not exceed the limits in table 8.

Table 8 Limit of difference in instrumental error due to frequency change

Division of meter by rated current	Load current (percentage with respect to rated current)	Power factor	Limit of difference in instrumental error %
Type II meter	10 and 100	1	1.0
	50	0.5 (lagging current)	2.0
Type III meter	6.7 and 100	1	1.0
	50	0.5 (lagging current)	2.0
Type IV meter	5 and 100	1	1.0
	50	0.5 (lagging current)	2.0
Type V meter	4 and 100	1	1.0
	50	0.5 (lagging current)	2.0

6.2.9 Influence of external magnetic field

The influence of external magnetic field shall be as follows.

- a) When the meter is tested in accordance with **7.2.9 a)**, the difference in instrumental error generated by giving an external magnetic field according to the load current for each division of meter by the rated current shall not exceed the limits in table 9.

Table 9 Limit of difference in instrumental error due to external magnetic field

Division of meter by rated current	Load current (percentage with respect to rated current)	Limit of difference in instrumental error %
Type II meter	10	1.0
Type III meter	6.7	
Type IV meter	5	
Type V meter	4	

- b) When the transmitter-incorporating meter is tested in accordance with **7.2.9 b)**, the number of pulses generated in the transmitter shall be correctly proportional to the electric energy.
- c) When the meter with an output mechanism is tested in accordance with **7.2.9 c)**, the output mechanism shall output the measurement values correctly.
- d) When the power switching normal watt-hour meter is tested in accordance with **7.2.9 d)**, the operation of opening and closing, etc. of the power switching device shall be normal.

6.2.10 Influence of waveform

When the meter is tested in accordance with **7.2.10**, the difference in instrumental error generated due to the inclusion of third harmonics shall not exceed the limit of 1.0 %.

6.2.11 Influence of overcurrent

The influence of overcurrent shall be as follows.

- a) When the meter is tested in accordance with **7.2.11 a)**, improper temperature rise, or electric or mechanical damage shall not occur, and the difference in instrumental error generated by passing overcurrent shall not exceed the limit of 1.0 %.
- b) When the transmitter-incorporating meter is tested in accordance with **7.2.11 b)**, the number of pulses generated in the transmitter shall be correctly proportional to the electric energy.
- c) When the meter with an output mechanism is tested in accordance with **7.2.11 c)**, the output mechanism shall output the measurement values correctly.
- d) When the power switching normal watt-hour meter is tested in accordance with **7.2.11 d)**, the operation of opening and closing, etc. of the power switching device shall be normal.

6.2.12 Influence of reverse current

The influence of the reverse current on the induction type meter equipped with a reversal preventing device or the electronic meter equipped with a function in which reverse current is not measured shall be as follows.

- a) When the meter is tested in accordance with **7.2.12 a)**, in the case of the induction type meter, the rotor shall stop before it rotates once, and in the case of the electronic meter, measurement pulses shall not be generated.
- b) When the transmitter-incorporating meter is tested in accordance with **7.2.12 b)**, in the case of the induction type meter, the number of pulses generated in the transmitter shall not exceed the number of pulses generated when the rotor makes one revolution, and in the case of the electronic meter, a pulse shall not be generated in the transmitter.
- c) When the meter with an output mechanism is tested in accordance with **7.2.12 c)**, the output mechanism shall output the measurement values correctly.

6.2.13 Influence of voltage unbalance

For the electronic meter equipped with the function of open-phase protection, when it is tested in accordance with **7.2.13**, the difference of the obtained instrumental error from that in the voltage balance condition shall not exceed the limit of 4.0 %.

6.2.14 Influence of interruption to service

The influence of interruption to service shall be as follows.

- a) The electronic meter, when tested in accordance with **7.2.14 a)** and **7.2.14 b)**, shall indicate the electric energy correctly.