

JIS

JAPANESE INDUSTRIAL STANDARD

Var-hour meters

JIS C 1263^{—1995}

Translated and Published

by

Japanese Standards Association

Printed in Japan

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

1. Scope This Japanese Industrial Standard specifies the var-hour meters with or without transmitter (hereafter referred to as "meters") which are used in combination with instrument transformer or are used for the summation measurement of energy in multicircuits of current composing system, in three-phase 3-wire system and three-phase 4-wire system.

Further, matters other than specified in this Standard shall be in accordance with JIS C 1210.

Also, for meters with auxiliary device, this Standard shall apply to the var-hour meter under the condition where the auxiliary device is attached.

In this Standard, instrument transformers used in combination with multicircuit summation meters shall be in accordance with Annex 1, and the combination with transformer and allowable limit of overall error shall be in accordance with Annex 2.

Remarks 1. This Standard shall be applied when the voltage and current have approximately sinusoidal waveform.

2. This Standard shall be applied solely to the meters with a reverse rotation or reverse measuring preventing device.

3. The following standards are cited in this Standard:

JIS B 1101 Slotted head machine screws

JIS B 1135 Slotted head wood screws

JIS C 0911 Vibration testing procedure for electric machines and equipment

JIS C 0912 Shock testing procedure for electric machines and equipment

JIS C 1210 General rules for electricity meters

JIS C 1216 Alternating-current watt-hour meters (for connection through instrument transformer)

JIS C 1281 Weather-proof performance of electricity meters

JIS C 1602 Thermocouples

JIS C 1736 Instrument transformers for metering service

JIS C 4003 Classification of materials for insulation of electrical machinery and apparatus

4. In this Standard, the units and numerical values in { } are based on the traditional unit system and are appended for informative reference.

2. Classification

2.1 Used circuit The circuit used for multi-circuit summation meters in the current composing system shall be two-separate circuit and three-separate circuit.

Further, the meter used in this circuit shall be only a meter of three-phase 4-wire system used in combination with current transformer.

2.2 Classification by system configuration The classification of meters by system configuration shall be as given in Table 1.

Table 1. System configuration and inner connection diagram

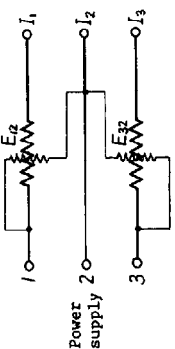
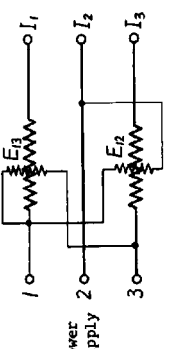
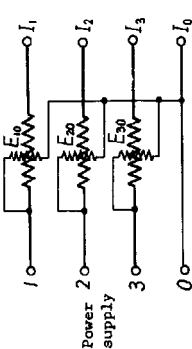
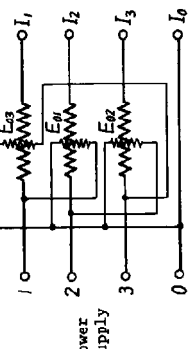
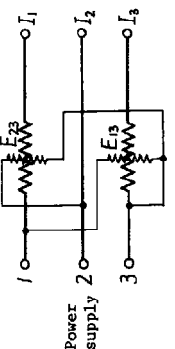
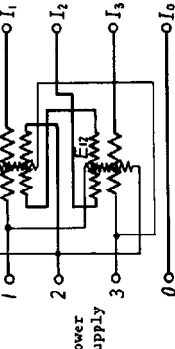
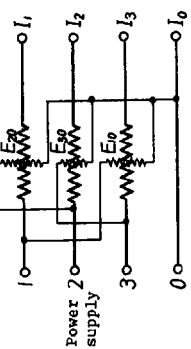
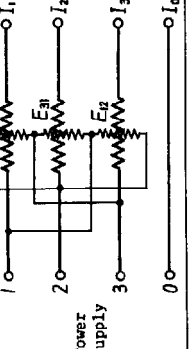
Symbol of system	Used circuit	Internal phase angle of element	Number of elements	Inner connection diagram	Symbol of system	Used circuit	Internal phase angle of element	Number of elements	Inner connection diagram
A-1	Three-phase 3-wire system	180° (for lagging current)	2		B-3	Three-phase 3-wire system	120° (for lagging current)	2	
		0° (for leading current)					-60° (for leading current)		
A-2	Three-phase 4-wire system	180° (for lagging current)	3		B-4	Three-phase 4-wire system	120° (for lagging current)	3	
		0° (for leading current)					-60° (for leading current)		
B-1	Three-phase 3-wire system	60° (for lagging current)	2		C-1	Three-phase 3-wire system	90° (for lagging current)	2	
		-120° (for leading current)					-90° (for leading current)		
B-2	Three-phase 4-wire system	60° (for lagging current)	3		C-2	Three-phase 4-wire system	90° (for lagging current)	3	
		-120° (for leading current)					-90° (for leading current)		

Table 1. (continued)

Symbol of system	Used circuit	Internal phase angle of element	Number of elements	Inner connection diagram	Symbol of system	Used circuit	Internal phase angle of element	Number of elements	Inner connection diagram
C-3 (V type)	Three-phase 3-wire system	90° (for lagging current) -90° (for leading current)	2		C-5 (Cross type)	Three-phase 3-wire system	90° (for lagging current) -90° (for leading current)	2	
C-4 (Extended V type)	Three-phase 3-wire system	90° (for lagging current) -90° (for leading current)	2		C-6 (Y type)	Three-phase 4-wire system	90° (for lagging current) -90° (for leading current)	3	

Remarks 1. The meters of System B and System C shall be used with balanced voltage and in designated phase sequence.

2. In this inner connection diagram, the resistance to be connected in series or in parallel to the voltage coil or current coil is omitted.

2.3 Ratings The classification of meters by the rated voltage, rated current and rated frequency shall be as given in Table 2.

Table 2. Ratings

Classification		Rated voltage V	Rated current A	Rated frequency Hz
Meter used in combination with current transformer only	Three-phase 4-wire system	240	5	50 60
Meter used in combination with voltage transformer and current transformer	Three-phase 3-wire system	110		
	Three-phase 4-wire system	$\frac{110}{\sqrt{3}}$ 110		

Remarks: The rated voltage of meters means the voltage applied to the voltage circuit, which is the line-to-line voltage for three-phase 3-wire system and the line-to-neutral voltage for three-phase 4-wire system.

2.4 Meter constant The classification of meter constants shall be expressed by the number of revolutions of the rotor per 1 kvarh as prescribed in Table 3.

Table 3. Meter constants

Unit: rev/kvarh

Phase and wire system	Meter constant
Three-phase 3-wire system	1000, 1200, 2400
Three-phase 4-wire system	250, 400, 600, 1000, 1600, 2400

2.5 Pulse constant Pulse constants for meters with transmitter shall be the integral multiple of 100, and are expressed by the number of pulses from the transmitter per 1 kvarh.

3. Performances

3.1 General performance Performances of meters shall, except the matters specified below, be in accordance with performances of normal weatherproof meters of JIS C 1281.

3.2 Allowable limit of error of measurement When a meter is tested as specified in 5.2.1, the error of measurement (hereafter referred to as "error" and expressed by percentage) shall not exceed the allowable limit specified in Table 4 corresponding to the load current.

Table 4. Allowable limits of measurement error

Load current ⁽¹⁾ (% of rated current)	Power factor ⁽²⁾	Allowable limit %
10 to 120	0	± 2.5
20 to 120	0.866	± 2.5
10	0.866	± 3.0

Notes (1) Allowable limit at the load current of power factor 0.866 other than current herein specified shall be determined by interpolation method.

(2) In this Standard, the tests at power factor 0 and 0.866 shall be carried out at lagging current for meters for lagging current and at leading current for meters for leading current.

3.3 Electrical performances

3.3.1 Starting current When the test of 5.2.2 (1) is carried out on the meter, the rotor shall start and shall continue the rotation.

3.3.2 Creeping When the test of 5.2.2 (2) is carried out on the meter, the rotor shall not rotate one revolution or more.

3.3.3 Influence of self-heating When the test of 5.2.2 (3) is carried out on the meter, the variation of errors due to self-heating shall not exceed the limit of variation of errors specified in Table 5.

Table 5. Limits of variation of error due to self-heating

Time min	Power factor	Limit of variation of errors %
0 to 30	0	1.0
	0.866	
30 to 120	0	0.5
	0.866	

3.3.4 Current characteristics When the test of 5.2.2 (4) is carried out on the meter, the variation of errors, due to variation of load current shall not exceed 2.0 %.

3.3.5 Influence of unbalanced load

- (1) When the test of 5.2.2 (5)(a) is carried out on the meter, the variation of error from that of the balanced load condition shall not exceed the limit specified in Table 6.
- (2) When the test of 5.2.2 (5)(b) is carried out on the meter, the error shall not exceed the limit specified in Table 6 corresponding to the load current in each phase and wire system.

Table 6. Allowable limits

System	Load current (% of rated current)	Power factor	Allowable limit %
Three-phase 3-wire system	8.7 to 100	0	± 3.0
	17.3 to 100	0.866	
Three-phase 4-wire system	15 to 100	0	
	30 to 100	0.866	

3.3.6 Temperature characteristics When the test of 5.2.2 (6) is carried out on the meter, the variation of error due to the variation of ambient temperature shall not exceed the limit of 1.0 % in any case.

3.3.7 Voltage characteristics When the test of 5.2.2 (7) is carried out on the meter, the variation of error due to the variation of voltages shall not exceed the limit of 1.0 % in any case.

3.3.8 Frequency characteristics when the test of 5.2.2 (8) is carried out on the meter, the variation of error due to the variation of frequency shall not exceed the limit of 2.0 % in any case.

3.3.9 Power factor characteristics When the test of 5.2.2 (9) is carried out on the meter, the variation of error due to the variation of power factor shall not exceed the limit of 2.0 %.

3.3.10 Influence of external magnetic field When the test of 5.2.2 (10) is carried out on the meter, the variation of error due to the application of external magnetic field shall not exceed the limit of 1.0 %.

3.3.11 Apparent power loss of voltage circuit When the test of 5.2.2 (11) is carried out on the meter, the apparent power loss of the voltage circuit shall not exceed 10 VA in each element. However, the loss shall not exceed 15 VA for meters with transmitter.

3.3.12 Apparent power loss of current circuit When the test of 5.2.2 (12) is carried out on the meter, the apparent power loss of the current circuit shall not exceed 5 VA in each element.

3.3.13 Influence of overcurrent When the test of 5.2.2 (13) is carried out on the meter, no unsuitable temperature rise nor electrical or mechanical damage shall occur, and the variation of error due to passing the overcurrent shall not exceed 1.0 % in any case.

3.4 Mechanical performance

3.4.1 Variation of error at low load When the test of 5.2.3 (1) is carried out on the meter, the variation of error shall not exceed 1.0 %.

3.4.2 Influence of register At the test of 5.2.3 (2) on the meter, the variation of error when the register is detached shall not exceed 2.0 %.

Further, for drum-type registers, the variation of error caused when the digit wheel advances shall not exceed the limit of 1.5 %.

3.4.3 Influence of inclination When the test of 5.2.3 (3) is carried out on the meter, the variation of error from that at the normal working position shall not exceed the limit of Table 7.

Table 7. Limit of variation of error

Load current (% of rated current)	Limit of variation of error %
5	2.0
50 to 100	1.0

3.4.4 Noise When the test of 5.2.3 (4) is carried out on the meter, the noise generated shall not exceed 30 dB.

3.4.5 Influence of vibration When the test of 5.2.3 (5) is carried out on the meter, no mechanical damage shall occur.

The variation of error due to the application of vibration shall not exceed the limit specified in Table 8 and the provisions of 3.3.1, 3.3.2 and 3.4.1 shall be satisfied.

Table 8. Limit of variation of error

Load current (% of rated current)	Power factor	Limit of variation of error %
10 to 120	0	1.2
20 to 120	0.866	1.2
10	0.866	1.5

3.4.6 Influence of impact When the test of 5.2.3 (6) is carried out on the meter, no mechanical damage shall occur.

The variation of error due to the application of impact shall not exceed the limit specified in Table 8 and the provisions of 3.3.1, 3.3.2 and 3.4.1 shall be satisfied.