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Watt-hour, var-hour and maximum demand indicators for telemetering— Part 1: General measuring instrument

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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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Consequently **JIS C 1283**:1979 was withdrawn and replaced with this Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS C 1283 series consists of the following 2 parts under the general title "*Watt-hour, var-hour and maximum demand indicators for telemetering*:

Part 1: General measuring instrument

Part 2: Measuring instruments used in transaction or certification

Watt-hour, var-hour and maximum demand indicators for telemetering— Part 1: General measuring instrument

Introduction

This Japanese Industrial Standard has been prepared in order to specify the technical requirements needed for watt-hour, var-hour and maximum demand indicators for telemetering as general measuring instrument. Since this Standard does not include the requirements concerning the marking method, the indicators can not 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 separate type indicators and multi-circuit summation indicators for telemetering, which indicate the watt-hour, var-hour and maximum demand by receiving pulses transmitted from general-use watt-hour meters, i.e. transmitter-incorporating watt-hour meters and transmitter-incorporating var-hour meters that are used in combination with instrument transformers in three-phase three-wire system and three-phase four-wire system circuits (hereafter referred to as “indicators”).

The watt-hour indicators for centralized meter reading for telemetering shall be in accordance with Annex B. This Standard applies to composing metering of addition only in the multi-circuit summation indicators.

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 1211-1 *Alternating-current watt-hour meters (for direct connection)—Part 1: General measuring instrument*

JIS C 1216-1 *Alternating-current watt-hour meters (for connection through instrument transformer)—Part 1: General measuring instrument*

JIS C 1263-1 *Var-hour meters—Part 1: General measuring instrument*

JIS C 1281 *Weather-proof performance of 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*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions in the following apply.

3.1 watt-hour indicator

a device which indicates the watt-hour by receiving pulses transmitted from a transmitter-incorporating watt-hour meter

3.2 var-hour indicator

a device which indicates the var-hour by receiving pulses transmitted from a transmitter-incorporating var-hour meter

3.3 maximum demand indicator

a device which indicates the maximum demand by receiving pulses transmitted from a transmitter-incorporating watt-hour meter

3.4 watt-hour indicator with a maximum demand indicator

a device which indicates the watt-hour and maximum demand by receiving pulses transmitted from a transmitter-incorporating watt-hour meter

3.5 multi-circuit summation indicator

a device in the category of **3.1** to **3.4** which, incorporating a pulse synthesizer, registers watt-hours, var-hours and maximum demands by receiving pulses transmitted from the transmitter-incorporating meters in each of the 2- to 4-circuits, then totalizes and indicates thus measured values

3.6 driving device

transmitter-incorporating watt-hour meters or transmitter-incorporating var-hour meters which transmit the electric pulses in proportion to watt-hours or var-hours

3.7 pulse synthesizer

a device in multi-circuit summation indicator that totalizes pulses transmitted from the driving device in each circuit and generates a pulse output

3.8 demand interval

the interval of time based on which the average power is determined

3.9 demand power

the average of power during the demand interval

3.10 maximum demand power

the maximum demand power during a measuring period of demand power

3.11 pusher

the mechanism in a pointer-type maximum demand indicator that advances the demand pointer to indicate the maximum demand power (maximum demand pointer) repeatedly according to the demand power of each demand interval

3.12 demand index

the indication which indicates the demand power repeatedly by every demand interval in a digital display type maximum demand meter

3.13 auxiliary power supply circuit

the circuit on which the voltage to operate an indicator is applied i.e. the circuit between the auxiliary power supply terminals of the indicator

3.14 rated load

the power (including the reactive power) applied to a driving device as the load when the secondary side of the instrument transformer is at the rated voltage, rated current, rated frequency and power factor 1 (0 in reactive power) (the total load of all circuits in the case of multi-circuit summation indicator)

3.15 rated input pulse

the number of input pulses per minute into an indicator corresponding to the transmitted pulses from the driving device at the rated load, expressed in the unit of pulse/min

3.16 mechanism error

the error of a maximum demand indicator itself, and is expressed as the percentage of the difference between the power value indicated in the rated demand interval and the power value corresponding to the number of input impulses divided by the latter

3.17 pulse count error

the error in pulse counting in a maximum demand indicator, which is expressed by u (%) in the following formula where n is the counted number, m is the number of input circuits, R is pulse constant (pulse/kWh), T is rated demand interval (min) and P is load power (kW):

$$u = \frac{m}{n} \times 100(\%)$$

$$= \frac{m}{P} \times \frac{60}{T} \times \frac{100}{R}(\%)$$

3.18 indication error

the total error when an indicator and a driving device are combined, which is expressed as the algebraic sum of the mechanism error and the error of driving device

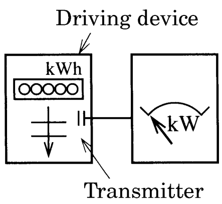
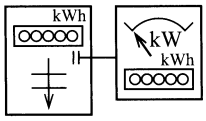
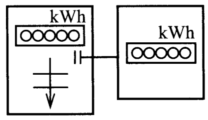
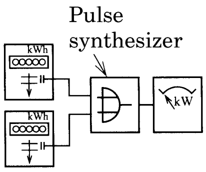
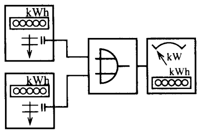
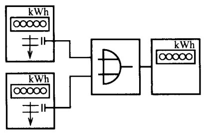
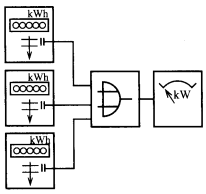
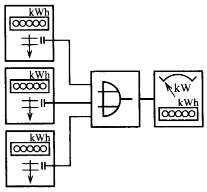
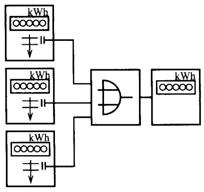
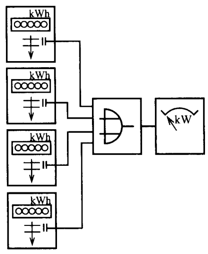
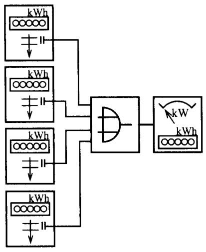
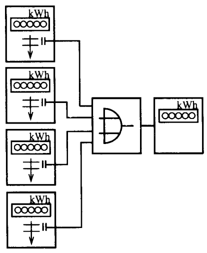
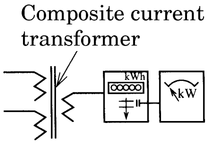
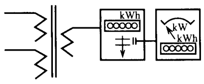
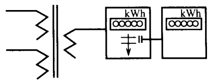
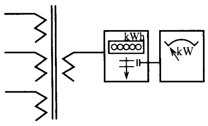
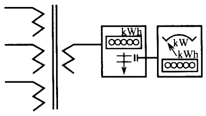
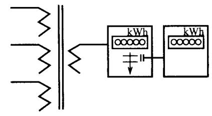
3.19 overall indication error

the total error when an indicator, a driving device and instrument transformer(s) are combined, which is expressed by the algebraic sum of the indication error and the resultant error (of instrument transformer)

4 Combination of indicator and driving device

The combination system of indicators and driving device shall be in accordance with table 1. The driving device, when the summation system is current composing system, shall not be of any system else than the three-phase four-wire system used in combination with only a current transformer.

Table 1 Combination of indicator and driving device

Summation system	Number of circuits	System symbol	Maximum demand indicator	System symbol	Watt-hour indicator with maximum demand indicator	System symbol	Watt-hour indicator or var-hour indicator
—	1	1A-3		1B-3		1C-3 (1D-3)	
Pulse composing	2	2A-4		2B-4		2C-4 (2D-4)	
	3	3A-4		3B-4		3C-4 (3D-4)	
	4	4A-4		4B-4		4C-4 (4D-4)	
Current composing	2	2A-6		2B-6		2C-6 (2D-6)	
	3	3A-6		3B-6		3C-6 (3D-6)	

NOTE 1 Maximum demand indicators illustrated are of pointer type.

NOTE 2 The symbols in parentheses are for var-hour meters, in which case, the unit in the diagrams, kWh, is replaced with kvarh.

5 Classification

5.1 Indicator

The indicators are classified into watt-hour indicators, var-hour indicators, maximum demand indicators and watt-hour indicators with maximum demand indicator.

5.2 Indication system

The indication systems in maximum demand indicators are classified into those of pointer type and digital display type.

5.3 Driving device

The driving devices are classified into precision watt-hour meters, special precision watt-hour meters and var-hour meters.

The driving device shall be in accordance with **JIS C 1210**, **JIS C 1216-1**, **JIS C 1263-1** and **JIS C 1281**, as appropriate.

5.4 Number of applicable circuits and summation system

Classification of multi-circuit summation indicators according to the number of applicable circuits and the summation system shall be as given in table 2.

Table 2 Number of applicable circuits and summation system

Number of applicable circuits	Summation system [a)]
Two, three or four circuits	Pulse composing system
Two or three circuits	Current composing system
Note [a)] There are two kinds of summation system in multi-circuit summation indicators, one is the (5 + 5)A system in which the sum of the rated loads of each circuit serves as the rated load of the indicator and the other is the 5A system in which the rated load of any one of the circuits serves as the rated load of the indicator. However, the 5A system is applicable only to two-circuit summation indicators of pulse composing system.	

5.5 Rated demand interval, rated voltage and rated frequency

The classification according to the rated demand interval, rated voltage and rated frequency shall be as follows.

a) The rated demand interval of maximum demand indicators is 30 min.

b) The rated voltage of auxiliary power supply is 110 V and the rated frequency is 50 Hz or 60 Hz.

6 Performance

6.1 Performance of watt-hour indicator and var-hour indicator

6.1.1 Electrical performance

When an indicator is subjected to the test of **8.3.1 a**), the indication of the register shall correctly progress corresponding to the number of input pulses. The apparent power loss of auxiliary power supply circuit shall be as specified in **f**).

a) **Response to input pulse** The indicator, when tested in accordance with **8.3.1 a**) **1**), shall operate normally according to the number of input pulses.

b) **Influence of auxiliary power supply** The indicator, when tested in accordance with **8.3.1 a**) **2**), shall operate normally over the specified extent of auxiliary power supply.

c) **Influence of external magnetic field** The indicator, when tested in accordance with **8.3.1 a**) **3**), shall operate normally in the specified external magnetic field.

d) **Influence of temperature** The indicator, when tested in accordance with **8.3.1 a**) **4**), shall operate normally at the specified temperature.

e) **Influence of humidity** The indicator, when subjected to the test of **8.3.1 a**) **5**), shall operate normally at the specified humidity.

f) **Apparent power loss of auxiliary power supply circuit** When the indicator is tested in accordance with **8.3.1 a**) **6**), the apparent power loss of the auxiliary power supply circuit shall not exceed 15 VA.

6.1.2 Mechanical performance

When the indicator is subjected to the test in **8.3.1 b**), the indication of the register shall correctly progress corresponding to the number of input pulses. The noise shall be as specified in **d**).

a) **Influence of inclination** The indicator, when tested in accordance with **8.3.1 b**) **1**), shall operate normally at the specified inclination.

b) **Influence of vibration** The indicator, when tested in accordance with **8.3.1 b**) **2**), shall operate normally without any mechanical damage under the specified vibration.

c) **Influence of impact** The indicator, when tested in accordance with **8.3.1 b**) **3**), shall operate normally without any mechanical damage under the influence of the specified impact.

d) **Noise** The indicator, when tested in accordance with **8.3.1 b**) **4**), shall not emit noise exceeding 60 dB.

6.1.3 Insulation performance

The insulation performance of the indicator shall satisfy the following.

a) **Insulation resistance** The indicator, when tested in accordance with **8.3.1 c**) **1**), shall have the minimum insulation resistance of 5 MΩ.

b) **Commercial-frequency withstand voltage** The indicator, when tested in accordance with **8.3.1 c**) **2**), shall withstand the specified voltage.

c) **Lightning-impulse withstand voltage** The indicator, when tested in accordance with **8.3.1 c**) **3**), shall be without any abnormalities such as discharge and breaking of wires in the auxiliary power supply circuit, lead wires, etc.

6.1.4 Durability

When the indicator is tested in accordance with **8.3.1 d**), for each lapse of continuous operation, the indication of the register shall progress corresponding to the input impulses.

6.2 Performance of maximum demand indicator

6.2.1 Allowable limits of mechanism error

When the indicator is tested in accordance with **8.3.2 a**), the mechanism error shall not exceed the allowable limits specified in table 3.

The allowable limits of indication error and overall indication error shall be as given in Annex A.

Table 3 Allowable limit of mechanism error

Input pulse (% with respect to rated input pulse)	Allowable limit %	
	Pointer type	Digital display type
20	—	±2.0
35	±2.0	—
50 to 120	±1.0	±1.0

6.2.2 Electrical performance

The electrical performance of the indicator shall satisfy the following.

a) **Response to input pulse** When the indicator is tested in accordance with **8.3.2 b**) **1**), the display of the maximum demand indicator shall progress corresponding to the number of input pulses.

b) **Limit of demand interval** When the indicator is tested in accordance with **8.3.2 b**) **2**), the difference between the measurement time interval and the rated demand interval shall not exceed 10 s.

c) **Influence of auxiliary power supply** When the indicator is tested in accordance with **8.3.2 b**) **3**), the mechanism error shall not exceed the limit of 1.0 % with respect to the rated input pulse and the specimen shall comply with the requirement of **b**).

d) **Influence of external magnetic field** When the indicator is tested in accordance with **8.3.2 b**) **4**), the variation in mechanism error caused by external magnetic field shall not exceed the limits specified in table 4.

Table 4 Limit of variation in error caused by external magnetic field

Input pulse (% with respect to rated input pulse)	Limit of variation in error %	
	Pointer type	Digital display type
20	—	1.5
35	1.5	—
100	1.0	1.0

e) **Influence of temperature** When the indicator is tested in accordance with **8.3.2 b**) **5**), the mechanism error at the specified temperature shall not exceed the limits specified in table 5.

Table 5 Limit of mechanism error related to temperature

Input pulse (% with respect to rated input pulse)	Limit of mechanism error %	
	Pointer type	Digital display type
20	—	±2.0
35	±2.0	—
100	±1.0	±1.0

f) **Influence of humidity** When the indicator is tested in accordance with **8.3.2 b**) **6**), the mechanism error at the specified humidity shall not exceed the limits specified in table 5.

g) **Apparent power loss of auxiliary power supply circuit** When the indicator is tested in accordance with **8.3.2 b**) **7**), the apparent power loss of the auxiliary power supply circuit shall not exceed 15 VA.

6.2.3 Mechanical performance

The mechanical performance of the indicator shall satisfy the following.

a) **Variation in mechanism error** When the indicator is tested in accordance with **8.3.2 c**) **1**), the variation in mechanism error shall not exceed the limits specified in table 6.

Table 6 Variation in mechanism error

Input pulse (% with respect to rated input pulse)	Limit of mechanism error %	
	Pointer type	Digital display type
20	—	2.0
35	2.0	—
100	1.0	1.0

b) **Influence of inclination** When the indicator is tested in accordance with **8.3.2 c**) **2**), the variation in mechanism error caused by the inclination shall not exceed the limits specified in table 4.

c) **Influence of vibration** When the indicator is tested in accordance with **8.3.2 c**) **3**), it shall be free from mechanical damage, and the variation in mechanism error caused by the vibration shall not exceed the limits specified in table 4. Further, the variation in mechanism error shall not exceed the limits specified in table 6.

d) **Influence of impact** When the indicator is tested in accordance with **8.3.2 c**) **4**), it shall be free from mechanical damage, and the variation in mechanism error caused by the impact shall not exceed the limits specified in table 4. Further, the variation in mechanism error shall not exceed the limits specified in table 6.

e) **Noise** When the indicator is tested in accordance with **8.3.2 c**) **5**), it shall not emit noise exceeding 60 dB.

6.2.4 Insulation performance

The insulation performance of the indicator shall satisfy the following.

a) **Insulation resistance** The indicator, when tested in accordance with **8.3.2 d**) **1**), shall have the minimum insulation resistance of 5 MΩ.

b) **Commercial-frequency withstand voltage** The indicator, when tested in accordance with **8.3.2 d**) **2**), shall withstand the specified voltage.

c) **Lightning-impulse withstand voltage** The indicator, when tested in accordance with **8.3.2 d**) **3**), shall be without any abnormalities such as discharge and breaking of wires in the auxiliary power supply circuit, lead wires, etc.

6.2.5 Durability

When the indicator is tested in accordance with **8.3.2 e**), the variation of mechanism error in each 1 000 h with respect to that measured immediately after starting the test shall not exceed the limits specified in table 4. Further, the variation in mechanism error shall not exceed the limits specified in table 6.

6.3 Performance of pulse synthesizer

6.3.1 Electrical performance

When the pulse synthesizer is tested in accordance with **8.3.3 a**), its output pulses, as well as being in accordance with the pulse symbols specified in **7.2.1**, shall correspond to the input impulses in number. For the requirement concerning the apparent power loss of the auxiliary power supply circuit, however, **f**) shall be followed.

a) **Response to input pulse** The pulse synthesizer, when tested in accordance with **8.3.3 a**) **1**), shall operate normally in the range of the input pulses.

b) **Influence of auxiliary power supply** The pulse synthesizer, when tested in accordance with **8.3.3 a**) **2**), shall operate normally over the specified extent of auxiliary power supply.

c) **Influence of external magnetic field** The pulse synthesizer, when tested in accordance with **8.3.3 a**) **3**), shall operate normally in the specified external magnetic field.

d) **Influence of temperature** The pulse synthesizer, when tested in accordance with **8.3.3 a**) **4**), shall operate normally at the specified temperature.

e) **Influence of humidity** The pulse synthesizer, when tested in accordance with **8.3.3 a**) **5**), shall operate normally at the specified humidity.

f) **Apparent power loss of auxiliary power supply circuit** When the pulse synthesizer is tested in accordance with **8.3.3 a**) **6**), the apparent power loss of the auxiliary power supply circuit shall not exceed 15 VA.

6.3.2 Mechanical performance

When the pulse synthesizer is tested in accordance with **8.3.3 b**), its output pulses, as well as being in accordance with the pulse symbols specified in **7.2.1**, shall correspond to the input impulses in number. For the requirement concerning noise, however, **d**) shall be followed.

a) **Influence of inclination** The pulse synthesizer, when tested in accordance with **8.3.3 b**) **1**), shall operate normally at the specified inclination.

b) **Influence of vibration** The pulse synthesizer, when tested in accordance with **8.3.3 b**) **2**), shall operate normally without any mechanical damage under the specified vibration.

c) **Influence of impact** The pulse synthesizer, when tested in accordance with **8.3.3 b**) **3**), shall operate normally without any mechanical damage under the influence of the specified impact.

d) **Noise** The pulse synthesizer, when tested in accordance with **8.3.3 b**) **4**), shall not emit noise exceeding 60 dB.

6.3.3 Insulation performance

The insulation performance of the pulse synthesizer shall satisfy the following.

a) **Insulation resistance** The pulse synthesizer, when tested in accordance with **8.3.3 c**) **1**), shall have the minimum insulation resistance of 5 MΩ.

b) **Commercial-frequency withstand voltage** The pulse synthesizer, when tested in accordance with **8.3.3 c**) **2**), shall with stand the specified voltage.

c) **Lightning-impulse withstand voltage** The pulse synthesizer, when tested in accordance with **8.3.3 c**) **3**), shall be without any abnormalities such as discharge and breaking of wires in the auxiliary power supply circuit, lead wires, etc.

6.3.4 Durability

When the pulse synthesizer is tested in accordance with **8.3.3 d**), its output pulses, as well as being in accordance with the pulse symbols specified in **7.2.1**, shall correspond to the input impulses in number.

7 Structure and dimensions

7.1 Components

The components of an indicator shall be as follows.

a) A watt-hour indicator or var-hour indicator shall consist of a register and a pulse receiver.

b) A pointer type maximum demand indicator shall consist of a single scale, maximum demand pointer, pusher, timing device, maximum demand pointer resetting device and pulse receiver.

c) A digital display type maximum demand indicator shall consist of a maximum demand drums, demand register, timing device, maximum demand drum resetting device and pulse receiver.

d) A multi-circuit summation indicator shall be composed of a pulse synthesizer in addition to the said components, if pulse composing system is employed.

7.2 Indicator

7.2.1 Pulse reception system and pulse transmission system

The pulse reception system and pulse transmission system of indicators and pulse synthesizers are classified according to the difference in the wire-system of transmission circuit, a.c. or d.c. system, existence or non-existence of polarity, pulse voltage, pulse current, pulse capacity, pulse width and minimum rest time, and the pulse transmission system determined by the combination of such factors is denoted by symbols.

7.2.2 Pulse receiver

The pulse receiver shall be so structured that it receives the pulses from the driving device and surely transmits the action corresponding to the pulse signal to the register and maximum demand drum.

7.2.3 Watt-hour indicator and var-hour indicator

The registers of watt-hour indicators and var-hour indicators shall be as follows.

a) The register shall operate correctly, and no difference shall appear between the indication of the register and the indication of watt-hour or var-hour on the driving device.

b) The register shall be of cyclometer type, the meter plate shall be so structured that reading of indication is easy, kWh or kvarh shall be used as the unit of measurement and clearly marked as given in the example of figure 1.

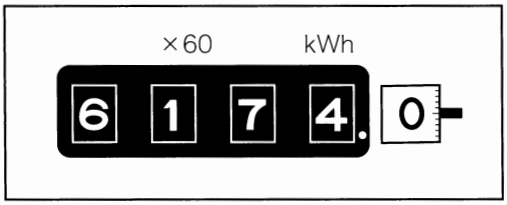
In special cases, MWh or Mvarh may be used.

c) The figures of five digits shall be indicated on the meter plate. The figure windows shall be arranged as shown in the example of figure 1.

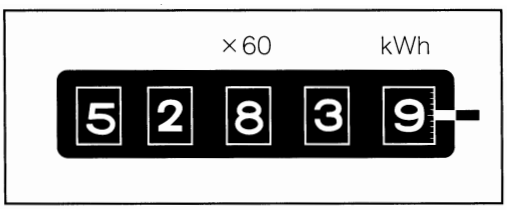
d) The counting figure drum at the lowest digit shall be of gradually progressing type to allow reading of 1/100 revolution.

e) The size of figures on the counting figure drum shall be at least 4 mm in width and 5 mm in height. However, the width of figure in the last digit, regardless of whether it is in decimal position or integer position, may be made slightly smaller.

f) In a meter plate containing a decimal point, the integer places and decimal places shall be clearly distinguishable as shown in the example of figure 1.



a) With decimal point



b) Without decimal point

NOTE : In a var-hour indicator, kWh in the figure should be replaced by kvarh.

Figure 1 Example of indication on meter plate

7.2.4 Pointer type maximum demand indicator

The single scale, maximum demand pointer, pusher, timing device and maximum demand pointer resetting device of a pointer type maximum demand indicator shall be as follows.

a) **Single scale**

1) The direction of scaling shall be as shown in the example of figure 2.

2) The length of scale from zero scale to the rated load indication point shall be 125 mm or more.

The length of scale is expressed by the length of arc connecting the tips of subscale marks.

3) The maximum scale value shall be 120 % of the indication value at the rated load, as the standard.

4) The scale spacing shall be not less than 0.6 mm when measured between centers of two adjacent scale marks at their ends near the revolution center of maximum demand pointer.

If the scale spacing is 1.2 mm or more, an auxiliary scale mark may further be inserted between two scale marks.

5) The length of subscale marks shall be 2 mm to 2.5 mm and the thickness of all the scale marks shall be 0.15 mm as the standard.

6) Each scale division shall correspond to 1, 2 or 5, or their integral multiple of a power of 10, and the scale value, in the unit of kW, shall be clearly marked on the scale plate as shown in the example of figure 2.

In special cases, MW may be used.

7) At the scale mark corresponding to 35 % of the rated load, the mark ▲ shall be marked as shown in the example of figure 2.