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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by the Japan Electrical Manufacturers' Association (JEMA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS C 4908**:1995 is replaced with this Standard.

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Capacitors for electrical apparatus

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of **IEC 60252-1** published in 2001, the second edition of **IEC 61048** published in 1999 and the first edition of **IEC 61049** published in 1991 with some modifications of the technical contents.

The portions given sidelines or dotted underlines are the matters in which the contents of the original International Standards have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies the following capacitors among those principally built-in the electrical apparatus, which are used with a rated voltage of not more than AC 1 000 V in a single phase circuit at commercial frequency.

The capacitors in this Standard mean the ones employing the evaporated metal film, metal foil or a combination of these as the electrodes, impregnated paper, plastic film or their complex or unimpregnated plastic film as the dielectrics.

- a) Capacitors used in a single phase circuit being connected with the winding of an induction motor except AC electrolytic capacitors used only for motor starting
- b) Capacitors used being connected with a discharge lamp circuit for power factor improvement except capacitors not intended for power factor improvement but assembled in the same capacitor case as the power factor improvement one

NOTE : The International Standards corresponding to this Standard are as follows.

IEC 60252-1 : 2001 *AC motor capacitors—Part 1: General—Performance, testing and rating—Safety requirements—Guide for installation and operation*

IEC 61048 : 1999 *Auxiliaries for lamps—Capacitors for use in tubular fluorescent and other discharge lamp circuits—General and safety requirements*

IEC 61049 : 1991 *Capacitors for use in tubular fluorescent and other discharge lamp circuits. Performance requirements*

Overall evaluation: MOD

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

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 0920 *Degrees of protection provided by enclosures (IP Code)*

NOTE : Corresponding International Standard: IEC 60529 *Degrees of protection provided by enclosures (IP Code)* (IDT)

JIS C 2318 *Balanced biaxially oriented polyethylene terephthalate films used for electrical purposes*

JIS C 2320 *Electrical insulating oils*

JIS C 2330 *Biaxially oriented polypropylene (PP) films for capacitors*

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

NOTE : Corresponding International Standard: IEC 60068-2-6 *Environmental testing—Part 2: Tests—Test Fc: Vibration (sinusoidal)* (IDT)

JIS C 60068-2-20 *Basic environmental testing procedures Part 2: Tests. Test T: Soldering*

NOTE : Corresponding International Standard: IEC 60068-2-20 *Environmental testing. Part 2: Tests. Test T: Soldering* (IDT)

JIS C 60068-2-21 *Environmental testing—Part 2-21: Tests—Test U: Robustness of termination and integral mounting devices*

NOTE : Corresponding International Standard: IEC 60068-2-21 *Environmental testing—Part 2-21: Tests—Test U: Robustness of terminations and integral mounting devices* (MOD)

JIS G 3303 *Tinplate and blackplate*

JIS H 4160 *Aluminium and aluminium alloy foils*

3 Terms and definitions

For the purposes of this Standard, the following definitions apply.

3.1 self-healing

phenomenon in which a capacitor instantaneously restores its function through disappearance of a very small area of electrode adjoining the breakdown point when a part of dielectric breaks down

3.2 metallized capacitor

a capacitor in which electrodes consist of evaporated metallic deposit, and it has self-healing ability

3.3 aluminum foil capacitor

a capacitor in which electrodes consist of only metal foil, and it does not have self-healing ability

3.4 capacitor element or element

minimum structural unit of a capacitor consisting of electrodes separated by a dielectric

3.5 case

a vessel containing capacitor element

3.6 sealing structure (1)

such construction that capacitor elements are protected from external atmosphere by enclosing the elements with a case

3.7 sealing structure (2)

such construction that the capacitor elements are protected from external atmosphere by filling the case having an opening with fillers or by enclosing or moulding the capacitor elements with resins without the case

3.8 insulating distance

generic name of clearance (minimum distance of space between the insulated two exposed live parts) and creepage distance (minimum distance along a insulating material connected between the two exposed live parts)

3.9 terminal

metal fitting or lead wire to bring out the conductor from the element to outside of the case and to connect with the wire

3.10 bushing

an article which insulates the metal case and terminals when the conductor is brought out from the element outside of the case

3.11 discharge resistor

a resistor connected across terminals of a capacitor for discharging the residual electric charge when the capacitor is disconnected individually from the power supply

3.12 capacitor with a built-in safety device

a metallized capacitor accommodating a device which can disconnect the capacitor from the power supply to increase its safety when abnormality occurs in the capacitor

3.13 capacitor with safety mechanism

a metallized capacitor in which each element has a function to disconnect the abnormal part from the power supply to increase its safety when abnormality occurs in the capacitor

3.14 stable short circuit

such state that the terminal voltage is maintained at nearly zero without emitting smoke or noticeable leakage of impregnant when short circuit state takes place due to generation of abnormality inside the capacitor

3.15 rated frequency (f_N)

frequency required for the capacitor usage

3.16 rated voltage (U_N)

r.m.s. value of the sinusoidal voltage of design which capable of applying continuously across the terminals of the capacitor

3.17 rated capacitance (C_N)

capacitance value of capacitor of design at 20 °C

The unit is microfarad (μF).

3.18 rated current (I_N)

current derived when the rated voltage at the rated frequency is applied to the rated capacitance

It is calculated according to the formula (1).

$$I_N = 2\pi f_N C_N U_N \times 10^{-6} \dots\dots\dots (1)$$

where, I_N : rated current (A)
 f_N : rated frequency (Hz)
 C_N : rated capacitance (μF)
 U_N : rated voltage (V)

3.19 rated capacity (Q_N)

reactive power derived when the rated voltage at the rated frequency is applied to the rated capacitance

It is calculated according to the formula (2).

$$Q_N = 2\pi f_N C_N U_N^2 \times 10^{-6} \dots\dots\dots (2)$$

where, Q_N : rated capacity (var)
 f_N : rated frequency (Hz)
 C_N : rated capacitance (μF)
 U_N : rated voltage (V)

3.20 current duration class

target time in designing a capacitor rationally in correlation with the service duration of the apparatus in which the capacitor is used

3.21 highest permissible temperature (t_c)

limit of temperature permissible for the hottest spot on the capacitor case when the capacitor and apparatus equipped with the capacitor are in normal operation and the temperature is almost stabilized

3.22 lowest permissible temperature

limit of ambient temperature on the lower temperature side at which the capacitor can be used without trouble

3.23 maximum permissible voltage

limit of r.m.s. value of the composite voltage which is not detrimental to practical service when the voltage is applied continuously across terminals of the capacitor

Instantaneous overvoltage is excluded.

The meaning of “is not detrimental to practical service” here is that the effect will not cause shortening of the life noticeably, whereas the performance or the like may not always conform to the specified values at the rated conditions (the same to **3.24** and **3.25**).

NOTE : The maximum permissible voltage includes the following overvoltage.

- a) Overvoltage due to fluctuation of supply voltage

- b) Overvoltage due to characteristics of apparatus with which the capacitor is equipped
- c) Voltage increased due to higher harmonic current of the circuit

3.24 maximum permissible current

limit of r.m.s. value of the composite current which is not detrimental to practical service when the current is passed continuously through terminals of the capacitor

NOTE : The maximum permissible current includes the following current.

- a) Current increased due to higher harmonic current of the circuit
- b) Current increased due to temporary overvoltage of not more than the maximum permissible voltage
- c) Current increased due to the plus side tolerance of the rated capacitance

3.25 maximum permissible capacity

limit of the capacity (var) which is not detrimental to practical service when the capacitor is used continuously

NOTE : The maximum permissible capacity includes the following increased capacity.

- a) Capacity increased due to higher harmonic voltage of the circuit
- b) Capacity increased due to temporary overvoltage of not more than the maximum permissible voltage
- c) Capacity increased due to the plus side tolerance of the rated capacitance

3.26 loss factor

ratio of the value of capacitor loss (W) to the value of capacity (var) of the capacitor

3.27 type inspection

inspection performed to verify that the representative capacitor satisfies the construction, performance, etc. which this Standard requires

3.28 acceptance inspection

inspection performed to all capacitors before shipment

4 Standard service conditions

The standard service conditions shall be as follows, and unless otherwise specified, the capacitors are used under these conditions.

- a) **Lowest permissible temperature** The lowest permissible temperature shall be either -25°C or -10°C .
- b) **Relative humidity** The relative humidity shall be not more than 85 %.
- c) **Altitude** The altitude shall be as follows.
 - 1) Not more than 2 000 m for capacitors used in induction motors
 - 2) Not more than 3 000 m for capacitors used in discharge lamp circuits

5 Overload service conditions

The overload service conditions shall be as follows.

- a) **Maximum permissible voltage** The maximum permissible voltage shall be 110 % of the rated voltage.
- b) **Maximum permissible current** The maximum permissible current shall be 130 % of the rated current. However, when the measured value of capacitance is on the plus side within the range of tolerances, only by that portion, further current increase shall be permitted.
- c) **Maximum permissible capacity** The maximum permissible capacity shall be 135 % of the rated capacity. However, when the measured value of capacitance is on the plus side within the range of tolerances, only by that portion, further capacity increase shall be permitted.

6 Classification

6.1 Classification by use

The classification by use and each symbol shall be as given in table 1.

Table 1 Classification by use

Use	Symbol
For motor	MC
For discharge lamp	LC

6.2 Classification by element, sealing and safety structure and existence of discharge resistor

Classifications by the element, sealing and safety structure, and the existence of discharge resistor and symbols thereof shall be as given in table 2.

Table 2 Classification by element, sealing and safety structure and existence of discharge resistor

Element structure	Sealing structure	Symbol	Safety structure	Symbol	Discharge resistor
Metallized capacitor	Sealing structure (1)	SH (1)	With a built-in safety device	P1	Exist (symbol R)
			With safety mechanism	P2	Not exist (without symbol)
			None	—	
	Sealing structure (2)	SH (2)	With safety mechanism	P2	
			None	—	
Aluminum foil capacitor	Sealing structure (1)	NH (1)	—	—	
	Sealing structure (2)	NH (2)	—	—	

7 Ratings

The ratings shall be as given in table 3.

Table 3 Ratings

Item		For motor					For discharge lamp	
Rated frequency	Hz	50 60 50/60 in common						
Rated voltage	V	1 000 max. under agreement between parties concerned with delivery						
Rated capacitance	μF	0.1 to 120						
Current duration class (symbol)	h	40 000 (40 D)	25 000 (25 D)	10 000 (10 D)	2 000 (2 D)	40 000 (40 D)		
Lowest permissible temperature (symbol)	°C	-10 (A)				-25 (B)		
Highest permissible temperature (symbol)	°C	55 (L)	60 (N)	65 (X)	70 (M)	75 (Y)	80 (H)	85 (Z)

8 Performances**8.1 Dielectric withstand voltage**

The capacitor shall withstand the test voltage when the test voltage specified in table 13 is applied for the specified time in accordance with the test method specified in 10.3.

However, during the test voltage application across terminals for metallized capacitors, an instantaneous breakage accompanying self-healing may be permitted.

8.2 Capacitance

The capacitance shall fall within the range of tolerances on the rated capacitance marked on the capacitor when measured in accordance with the test method specified in 10.4.

The tolerances on capacitance and their symbols shall be as given in table 4.

Table 4 Tolerances on capacitance

Tolerances on capacitance %	Symbol
± 15	L
± 10	K
± 10 – 5	U
± 5	J

8.3 Insulation resistance

The insulation resistance between the terminals connected together and the case, converted to that for one terminal, shall be not less than 2 000 MΩ when measured in accordance with the test method specified in 10.5.