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**AC supplied electronic ballasts for
fluorescent lamps**

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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 Japan Electric Lamp Manufacturers' Association (JELMA)/Japanese Standards Association (JSA) 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 8117:2006** is replaced with this Standard.

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AC supplied electronic ballasts for fluorescent lamps

Introduction

This Japanese Industrial Standard was established in 1992. In the revision at this time, the contents have been added or modified such that this Standard is applicable to the electronic ballasts for high frequency fluorescent lamps.

In addition, **JIS C 8147-1**, **JIS C 8147-2-3** and **JIS C 8120**, which are related Japanese Industrial Standards conforming to the corresponding International Standards, are cited for parts where alignment with the International Standards is possible.

1 Scope

This Standard specifies the a.c. supplied electronic ballasts for fluorescent lamps intended for use indoor or in luminaire, to light fluorescent lamps specified in **JIS C 7601** [excluding compact type fluorescent lamps (integral with starter) in **4.2.1 c**)] and the low pressure mercury germicidal discharge lamps specified in **JIS C 7605** (hereafter referred to as “lamps”), which have a rated input voltage not exceeding 300 V at 50 Hz, 60 Hz, or 50/60 Hz in common and a rated secondary voltage not exceeding 1 000 V and are used in general place (hereafter referred to as “ballasts”). However, the ballasts without enclosure and integrated with a luminaire are excluded.

The ballasts integrated with a luminaire are as shown in **3.1.3** (integral lamp control gear) of **JIS C 8147-1**.

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 0025 *Basic environmental testing procedures Part 2: Tests Test N: Change of temperature*
- JIS C 0920 *Degrees of protection provided by enclosures (IP Code)*
- JIS C 1102 *(Standard series) Direct acting indicating analogue electrical measuring instruments and their accessories*
- JIS C 1302 *Insulation resistance testers*
- JIS C 1509-1 *Electroacoustics—Sound level meters—Part 1: Specifications*
- JIS C 1509-2 *Electroacoustics—Sound level meters—Part 2: Pattern evaluation tests*
- JIS C 1602 *Thermocouples*
- JIS C 4908 *Capacitors for electrical apparatus*
- JIS C 6481 *Test methods of copper-clad laminates for printed wiring boards*
- JIS C 7601 *Fluorescent lamps for general lighting service*
- JIS C 7605 *Low pressure mercury germicidal discharge lamps*
- JIS C 7617-2 *Double-capped fluorescent lamps—Part 2: Performance specifications*
- JIS C 7618-2 *Single-capped fluorescent lamps—Part 2: Performance specifications*

JIS C 8105-1 *Luminaires—Part 1: General requirements for safety*

JIS C 8118 *Ballasts for tubular fluorescent lamps—Performance requirements*

JIS C 8120 *A.C.-supplied electronic ballasts for fluorescent lamps—Performance requirements*

JIS C 8147-1 *Lamp controlgear—Part 1: General and safety requirements*

JIS C 8147-2-3 *Lamp controlgear—Part 2-3: Particular requirements for a.c. supplied electronic ballasts for fluorescent lamps*

JIS C 61000-3-2 *Electromagnetic compatibility (EMC)—Part 3-2: Limits—Limits for harmonic current emissions (equipment input current ≤ 20 A per phase)*

JIS Z 8113 *Lighting vocabulary*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS Z 8113** and the following apply.

3.1 electronic ballast

ballast which has a starting circuit and lightening circuit consisting of the whole or partial combination of semiconductor, transformer, choke coil, capacitor etc. which is constituted of the above components in an integrated form or a separate form, and which has a function to light the lamp adequately by carrying out a.c. to a.c. conversion (in general power frequency to a high frequency) by lightening of the lamp (hereafter referred to as “ballasts”)

The ballast may include auxiliary mechanisms such as noise prevention, power factor improvement and protection.

3.2 reference ballast

ballast specified in Annex C of **JIS C 8118** or Annex A of this Standard, to be used as the reference for the test of a ballast and the selection of a reference lamp

3.3 reference lamp

lamp whose characteristic change has been made small by sufficient aging previously done by operation for a long period, to be used as the load in the tests of ballasts (see **JIS C 8118** or Annex B)

3.4 independent ballast (indoor use)

ballast which can be used as installed separately from the luminaire and has such construction that all the components (excluding the lead wires and terminals) are accommodated in a flame resistant enclosure (covering all surfaces without opening) so the live parts are not accessible by a man during its service

3.5 built-in ballast (in luminaire)

ballast which is used as built in a luminaire and has such construction that all the components (excluding the lead wires and terminals) are accommodated in a flame resistant enclosure (covering all surfaces but opening which does not allow access to the internal live part may exist)

In addition, the lightening device comprised of a printed wiring board and parts on the board with the luminaire itself taken as an enclosure shall be regarded as a built-in ballast.

3.6 high output ballast

ballast by which the optical output of the lamp is larger than that of the lamp operated by the reference ballast

NOTE : This means the one with rated optical output ratio being not less than 120 %.

3.7 ballast with means of protection against overheating

ballast which accommodates a protective mechanism (thermal protective mechanism, or current fuse in the supply circuit and other overcurrent breaking mechanism whose components are especially taken into account) to prevent excess temperature rise of the surface to be mounted to a fluorescent lamp luminaire

It prevents the excess temperature rise when the temperature of interior of the ballast rises due to some abnormality, by interruption of supply circuit or by changing the action of main circuit by means of the protective circuit (there are self-resetting type and non-self-resetting type). There are two kinds stated below according to the maximum surface temperature marked on the ballast.

- a) When the maximum surface temperature is not exceeding 130 °C: the marking shall be  or  (lamp control device with a thermal protective mechanism in which operating temperature is declared)
- b) When the maximum surface temperature exceeds 130 °C: the marking shall be .

The maximum surface temperature means the highest temperature of the surface of the ballast when the ballast is tested under the conditions specified in this Standard.

Three points in the triangle shall be replaced with the value of the rated highest case temperature (°C), declared by the manufacturer under the condition of **C.7** of **JIS C 8147-1** and applied to all positions on the outside surface of the case of the lamp control device. The temperature value indicated by the three points in the triangle shall be expressed in units of 10 °C.

NOTE : The lamp control device which indicates 130 °C or less is to protect against overheat in the end of life in accordance with the marking requirements of  of the luminaire (see **JIS C 8105-1**).

When the value exceeds 130 °C, for the luminaire indicated as , the additional test shall be performed in accordance with **JIS C 8105-1** considering that the temperature sensing control is not used for the luminaire.

3.8 rated input voltage

reference value of the voltage to be applied across input terminals of the circuit including the ballast and the lamp, which is marked on the ballast

3.9 rated input frequency

reference value of frequency of the voltage to be applied across input terminals of the circuit including the ballast and the lamp, which is marked on the ballast

3.10 rated input current

reference value of the input current under such a state that the ballast is operated at the ambient temperature of 25 °C, with the reference lamp as the load, under the rated input voltage and the rated frequency and the operating conditions are stabilized, which is marked on the ballast

3.11 rated input power

reference value of the input power under such a state that the ballast is operated at the ambient temperature 25 °C, with the reference lamp as the load, under the rated input voltage and the rated frequency and the operating conditions are stabilized, which is marked on the ballast

3.12 rated secondary voltage

the voltage stationary produced on secondary side either under no-load or under lighting the applicable lamp, whichever is the higher, when the rated input voltage at the rated frequency is applied to the ballast, which is marked on the ballast

3.13 rated secondary current

current which flows through the lamp when the rated input voltage at the rated frequency is applied to the ballast and which is marked on the ballast

3.14 rated secondary short-circuit current

reference value of secondary short-circuit current flowing stationary when the rated input voltage at the rated frequency is applied to the ballast, which is marked on the ballast

3.15 rated ballast lumen factor

ratio in percentage (%) obtained by dividing the optical output when the rated input voltage at the rated frequency is applied under the ambient temperature of 25 °C, with the reference lamp being the load, to a high output type ballast and the operating conditions are stabilized, by the optical output when the lamp is lightened with the reference ballast, which is marked on the ballast

3.16 test reference voltage

the voltage to be applied across input terminals of ballast when various characteristics are measured by combining the reference ballast and the reference lamp

4 Classification

The classification of ballasts shall be as shown in table 1.

In the classification by applicable lamp, if a ballast can be used for lamps of plural starting systems and shapes, the ballast shall be classified by placing the relevant classification symbols side by side.

Table 1 Classification

Classification by applicable lamp			Classifi- cation by place of use	Classification by protection against water	Classifica- tion by power factor	Classification by maximum surface tempera- ture limited by protective device
Classification by starting system	Classification by shape	Classi- fication symbol				
Starter type	Straight type	FL	Independ- ent	No protection	Low power factor	Not exceeding 130 °C
	Circular type	FCL				
		Compact type (starter not accommodated)	CF	Built-in	Splash protec- tion (SP) Underwater protection (WT)	High power factor
Rapid start type	Straight type	FLR				
Slim-line type	Straight type	FSL				
High frequency	Straight type	FHF				
	Compact type, multiple type	FHT				
	Circular type	FHC				
	Double circular type	FHD				
NOTE : “Splash protection” refers to “splashed water” in 4.2 (Elements of the IP code and their meanings) of JIS C 0920 and “underwater protection” refers to “temporary immersion” in 4.2 of JIS C 0920 .						

5 Requirements

5.1 Requirements for safety

The requirements for safety in 5.1.1 to 5.1.15 shall be applied. For the lighting device comprised of a printed wiring board and parts on the board without an enclosure, the following requirements among the safety requirements in 5.1.1 to 5.1.15 shall be applied.

- a) 5.1.1 a), d), f), g), h) and i)
- b) 5.1.2
- c) 5.1.3
- d) 5.1.5
- e) 5.1.7
- f) 5.1.12

However, creepage distance and clearance between the luminaire and this ballast shall not be applied.

- g) 5.1.15

In addition, in the lighting device comprised of a printed wiring board and parts on the board without an enclosure, for 5.1.4, 5.1.6, 5.1.8, 5.1.9, 5.1.10, 5.1.11 and 5.1.13, when this ballast is built in the luminaire, the requirements specified in JIS C 8105-1

shall be satisfied confirmed by testing the luminaire in which this ballast is built. Furthermore, in this ballast, **3.7** is not defined. Therefore, since **5.1.14** does not apply, when this ballast is built in the luminaire, the requirements related to **JIS C 8105-1** shall be satisfied and confirmed by testing the luminaire in which this ballast is built.

NOTE : In addition, as required, it is recommended that the manufacturer of luminaires confers with the manufacturer of ballasts on the test method.

5.1.1 Construction

The construction shall be as specified in clause **17** (Construction) of **JIS C 8147-2-3** and the following.

- a) The fibrous insulating materials in contact with the winding shall be completely treated with the coil-impregnating varnishes for electrical insulation or the like.
- b) When the enclosure is filled with a filler, the filler shall be an insulating filler of waterproof material, and shall not cause cracks or leak out during service.
- c) Splash protection type ballasts and underwater protection type ballasts shall have no possibility of intrusion of water into the enclosure. The terminal or lead wire parts shall be equipped with waterproof insulating cover, insulating bushing or waterproof protection equivalent thereto.
- d) Parts made of steel or iron other than stainless steel (excluding iron ore) shall be treated to prevent rusting.
- e) The part where the lead wires pass through the box shall be treated by chamfering or other suitable means so that it will not damage the lead wire, unless protective spring, protective bushing or other suitable protective means is used. This requirement does not apply, however, if this part is made of other material than metal, and is smooth and not likely to damage the lead wires.
- f) For the ballast to be used for such a luminaire that a conductor is provided as the starting aid close to the lamps, the r.m.s. value of current flowing between the lamp circuit and the proximate conductor shall be not more than 1 mA. The components at frequencies of not less than 1 kHz but not more than 200 kHz shall not exceed the permissible current given in figure 1.
- g) Either of an overcurrent breaking mechanism (fuse in supply circuit in upstream of supply voltage rectifier, or other breaking components whose characteristic is especially taken into account) or a thermal protective mechanism shall be accommodated in a ballast. Such a mechanism shall be built in a ballast and shall not be replaced without use of tools.
- h) When the copper-clad laminates for printed circuit board used in a ballast is tested in accordance with **5.15** [Flammability (flame retardance)] of **JIS C 6481**, the flame retardance shall comply with the following requirements.
 - 1) The duration of flaming (state of combustion with flames) shall be such that the average and maximum of ten measurements in total, two on each of 5 specimens, is not more than 5 s and not more than 10 s, respectively.
 - 2) The duration of glowing (red heated state without flaming) at the second ignition shall not exceed 30 s.

- i) The rated voltage, rated current and permissible current of components or accessories shall be not less than the maximum voltage or maximum current applied to these things.

5.1.2 Terminals

The terminals shall be as follows.

- a) The terminal except that for earthing shall consist of a screw or bolt-nut of copper or copper alloy with a nominal diameter not less than 4 mm (not less than 3.5 mm in the case of press set screw) by which an insulated wire with conductor diameter of 2 mm is securely fixed. However, terminals for built-in ballasts may be a terminal of copper or copper alloy as prescribed below which can ensure electrical connection of the applicable wire specified in table 1.2 of Annex 1 of **JIS C 8147-1** or may be the following 1) or 2). Also, terminals for independent ballasts may be a terminal of copper or copper alloy as prescribed below which can ensure electrical connection of the applicable wire specified in table 1.2 of Annex 1 of **JIS C 8147-1** or may be the following 2).
 - 1) Lug terminals or eyelets of enough size for soldering.
 - 2) Terminal which has a strong construction so that it can clamp the conductor of wire by mechanical means, and which shows resistance not exceeding 30 mΩ when the rated input voltage is applied to the ballast and the resistance is calculated from the current flowing through the joint of the wire conductor and the terminal and the voltage drop at the joint, or similar terminals.
- b) The terminal except that for earthing itself shall withstand the load when the applicable wire is connected to the terminal and a tensile load of 20 N is applied gradually in the direction of connection and the direction perpendicular thereto.

5.1.3 Protective earthing

The protective earthing shall be as specified in **9.B** and **9.C** of **JIS C 8147-1** and the following.

- a) The marking expressing that the purpose of this terminal is earthing ($\oplus$, P.E, $\frac{1}{2}$, E, G, earth, earthing, earthing terminal, etc.) shall be indelibly marked on the earthing terminal or in its vicinity.
- b) Ballast with rated input voltage or rated secondary voltage exceeding 150 V, of splash protection type and of underwater protection type shall be equipped with an earthing terminal or earthing lead wire equipped on the outer face of enclosure or other suitable place. However, this does not apply to built-in ballasts.

5.1.4 Lead wire

The lead wire shall be as specified in clause **3** of Annex 1 of **JIS C 8147-1** or the following.

- a) Solid wires may be used for lead wires for use in built-in luminaires not directly connected to the power supply side.
- b) The length of the lead wire outside of the ballast shall be not less than 150 mm. However, lead wires used in a built-in ballast are excluded.

- c) The ballast shall be so designed that the force originated when the lead wire is moved will not be directly applied to the part where the lead wire is connected inside the ballast. However, this does not apply to built-in ballasts.
- d) The lead wire shall be so fixed that it can sufficiently withstand the load itself, and shall not break when a tensile load of 20 N is gradually applied in the direction of emergence.

5.1.5 Capacitor

The capacitor shall be as follows.

- a) The capacitors used on the commercial supply side of a ballast (excluding noise suppression capacitors) shall be those specified in **JIS C 4908** or those at least equivalent in performance.
- b) In a ballast equipped with a capacitor and connected to the power supply by means of plug-in blades, the voltage across the plug-in blades shall be 45 V or less 1 s after withdrawal from the blade receptacle. In other ballasts the terminal voltages on primary side and on secondary side shall be 45 V or less within 1 min from breaking of the primary circuit. However, this does not apply to ballasts with the overall capacitance of the circuit viewed from the primary side not exceeding 0.1 μF .

5.1.6 Protection from accidental contact with live parts

The protection from accidental contact with live parts shall be in accordance with **10.1** of **JIS C 8147-1** or the following.

- a) The live parts (excluding lead wires and terminals), cores, windings and electronic components shall be accommodated in a flame resistant enclosure. In the case of a choke coil or the like which is connected to the power supply in a luminaire, the core may be exposed if the winding is protected by a flame resistant enclosure.

NOTE : The “enclosure” referred to here means outer box, outer covering, etc.

- b) The metallic enclosure used as the outer box of independent ballasts, that of built-in ballast or outer coverings shall have a nominal thickness not less than 0.5 mm.
- c) Independent ballasts shall be such that the live metal parts are not accessible by a man under the normal service state.

5.1.7 Insulation from power supply

For the insulation from the power supply of the ballast of which the rated secondary voltage exceeds 300 V, the insulation between the primary and secondary windings shall be secured. However, this does not apply to those ballasts which conform to either of the following.

- a) When the lamp is removed, the secondary voltage and the voltage to ground of an output terminal do not exceed 300 V.
- b) When the lamp is removed according to the connection diagram, it is indicated that a device which automatically interrupts the primary circuit is provided.

5.1.8 Temperature rise

When the test of **6.2.11** is carried out, there shall be no indistinct marking or flow out of the filler and the temperature rise shall comply with table 2.

After completion of this test, there shall be no trouble on relighting of the lamp after the temperature has decreased by natural cooling.

Table 2 Permissible value of temperature rise

Unit: K

Measurement position		Normal temperature rise		Abnormal temperature rise
		At 100 % of rated input voltage	At 106 % of rated input voltage	At 100 % of rated input voltage
Winding	Of Class A insulation	60 max.	70 max.	125 max.
	Of Class E insulation	75 max.	85 max.	140 max.
	Of Class B insulation	85 max.	95 max.	150 max.
Enclosure		50 max.	60 max.	105 max.
Rectifier (used in supply circuit)				
Made of silicon		90 max.	—	—

5.1.9 Insulation resistance

When the test of **6.2.12** is carried out immediately after the normal temperature rise test of **6.2.11 a)**, the insulation resistance shall be not less than 5 MΩ. However, the insulation resistance at cold without temperature rise shall be not less than 30 MΩ.

NOTE : The insulation resistance at cold means the insulation resistance under such a state that the temperature of ballast is in equilibrium with the ambient temperature. In general, this equilibrium state means the state where the ballast has been allowed to stand for 12 h or more after use.

5.1.10 Dielectric withstand voltage

When the test of **6.2.13** is carried out, the specimen shall withstand the test voltage.

5.1.11 Moisture resistance and insulation properties

The moisture resistance and insulation properties shall be as specified in clause 11 (Moisture resistance and insulation properties) of **JIS C 8147-2-3** and the following.

- When the test in **6.2.13** is carried out, the specimen shall withstand the test voltage.
- There shall be no disappearance of marking or severe rusting.

5.1.12 Creepage distance and clearance

The minimum clearances (including creepage distances) between live parts of different polarity, between live parts and dead metal parts or surface of accessible non-metallic part shall comply with table 3. The minimum clearances at external terminals