

JAPANESE INDUSTRIAL STANDARD

JIS C 7601 :1997

Fluorescent lamps for general lighting service

February, 1998

ERRATA

*Page 20***Remarks 2 for subclause 9.3.6(4)****Replace the existing first paragraph (first to fifth lines) with the following:**

The effective values of voltage, current and power of lamps with starter, rapid-start lamps and slim-line lamps shall be measured with the meters of Grade 0.5 or better specified in JIS C 1102 or those at least equivalent in precision. For high-frequency operated lamps, the effective values of voltage and current shall be measured with the meters of Grade 1.0 or better specified in JIS C 1102 or those at least equivalent in precision, and the effective value of power shall be measured with the meter of Grade 2.5 or better specified in JIS C 1102 or that at least equivalent in precision. However, the voltmeter for measuring the cathode-preheating voltage of rapid-start lamp shall be Grade 1.0 or better.

Remarks: This errata is for correcting the first edition of this Standard.

Japanese Standards Association

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Fluorescent lamps for general lighting service

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

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.

This Standard contains Annexes stated as follows:

- Annex 1 (normative) Ballasts high-frequency operated lamps
- Annex 2 (normative) Measuring method of noise terminal voltage of fluorescent lamps
- Annex 3 (normative) Test method for starting of high-frequency operated lamps in circuit of neutral grounded system
- Annex 4 (normative) Starting test method of fluorescent lamps

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Fluorescent lamps for general lighting service

Introduction This Standard is a Japanese Industrial Standard prepared based on **IEC 81**, *Tubular fluorescent lamps for general lighting service* issued as fourth edition in 1984 and its Amendment 5 (1994), **IEC 901**, *Single-capped fluorescent lamps — Safety and performance requirements* issued as second edition in 1987 and its Amendment 2 (1992), **IEC 1195**, *Double-capped fluorescent lamps — Safety specifications* issued as first edition in 1993 and **IEC 1199**, *Single-capped fluorescent lamps — Safety specifications* issued as first edition in 1993. However, some of the Lamp Data Sheets of **IEC 81** and **IEC 901** are omitted due to the power supply voltages or the like.

1 Scope This Japanese Industrial Standard specifies straight, circular fluorescent lamps and compact single capped fluorescent lamps to be operated in a.c. circuits and exclusive high-frequency lighting circuit (or device) for general lighting service (hereafter referred to as "lamps" when it is unnecessary to distinguish the types, shapes, etc.)

Remarks 1 This Standard covers the lamps stated below.

- (1) Lamps, with preheated cathodes, for operation at power frequency with (the use of) starter and additionally for operation at high frequency.
 - (2) Lamps, with preheated high-resistance cathodes, for operation at power frequency with rapid starter and additionally for operation at high frequency.
 - (3) Lamps, with preheated low-resistance cathodes, for operation at power frequency with rapid starter and additionally for operation at high frequency.
 - (4) Lamps, with preheated cathodes, for operation at high frequency.
 - (5) Lamps, with non preheated cathodes, for operation at power frequency.
 - (6) Lamps, with non preheated cathodes, for operation at high frequency.
 - (7) Lamps, with preheated cathodes and with accommodated starter.
- 2** The following standards are cited in this Standard:
- JIS B 7507 *Vernier, dial and digital callipers*
 - JIS C 0073 *Fire hazard testing Part 2: Test methods — Section 1/sheet 1: Glow-wire end-product test and guidance*
 - JIS C 1102 *Electrical indicating instruments*
 - JIS C 1302 *Insulation resistance testers*
 - JIS C 1303 *High insulation resistance meters*
 - JIS C 7603 *Glow starters for fluorescent lamps*

JIS C 7708 *Glass tubing for fluorescent lamps*

JIS C 7709-1 *Lamp caps and holders together with gauges for the control of interchangeability and safety — Part 1: Lamp caps*

JIS C 7801 *General rules of testing method for lamps*

JIS C 8108 *Ballasts for fluorescent lamps*

JIS C 8117 *AC supplied electronic ballasts for fluorescent lamps*

JIS C 8324 *Lampholders and starterholders for fluorescent lamps*

JIS H 4541 *Dumet wires*

JIS Z 8113 *Glossary of lighting terms*

JIS Z 8724 *Methods of measurement for light source colour*

JIS Z 8726 *Method of specifying colour rendering properties of light sources*

JIS Z 9112 *Classification of fluorescent lamps by chromaticity and colour rendering property*

- 3 The International Standards corresponding to this Standard are given below.

IEC 81 *Tubular fluorescent lamps for general lighting service*

IEC 901 *Single-capped fluorescent lamps — Safety and performance requirements*

IEC 1195 *Double-capped fluorescent lamps — Safety specifications*

IEC 1199 *Single-capped fluorescent lamps — Safety specifications*

2 Definitions For the purpose of this Standard, in addition to the definitions of JIS Z 8113, the following definitions apply:

- (1) **compact (fluorescent) lamp** A (fluorescent) lamp which is shaped into a compact size by bending or connecting the glass tubes. There are lamps, with or without built-in starter.

Remarks 1 A self-ballasted lamp in which light emitting tube, ballast and starting means are integrated, is excluded.

2 The caps of pin type specified in JIS C 7709 shall be used.

3 The starter to be accommodated shall be a glow starter.

- (2) **fluorescent lamp for exclusive operation at high frequency (high-frequency operated lamp)** A thermal cathode type lamp operated only in combination with an exclusive circuit (or device) for operation at high frequency. This is not applicable to operating circuit systems other than the said system.

A symbol mark which indicates that the lamp is used with exclusive luminaire only (Hf mark) shall be indicated on the lamp, to prevent that the fluorescent lamp for exclusive operation at high frequency is erroneously mounted to a traditional luminaire.

- (3) **scattering protected (fluorescent) lamp** A (fluorescent) lamp, on which scattering protective film (such as transparent synthetic resin film) is coated over all the length of the lamp in order to minimize scattering of broken glass pieces in case of breakage of the lamp.
- (4) **initial characteristics** The lamp wattage, lamp current, lamp voltage and total luminous flux of a lamp after it has been aged for 100 h.
- (5) **rated lamp wattage** The lamp wattage which is marked on a lamp or officially announced by the manufacturer.
- (6) **life** The total operating time until a lamp burns out, or until total luminous flux of the lamp falls down to 70 % (60 % for lamps with symbols denoting color rendering of DL, SDL, EDL, and lamps of compact type) of the initial flux, whichever is the shorter, when the lamp is operated under specified conditions.
- (7) **rated life** The declared life based on the average value of life of the same type lamps manufactured over a long period.

3. Classification Lamps are classified according to the starting circuit system to be connected as follows:

- (1) Lamp with starter
- (2) Rapid-start lamp
- (3) High-frequency operated lamp
- (4) Slim-line lamp

4 Types and groups The types and groups of lamps shall be expressed for each class as shown in the following items:

(1) Lamp with starter

(a) Straight lamp The type of a lamp shall be represented by the following 1st to 4th terms and the group by the 1st, 2nd and 4th terms.

1st term	2nd term	3rd term	4th term
Symbol denoting class and shape	Numerical values denoting classification by size and symbols denoting smaller glass tube diameter	Symbols denoting color of light source and color rendering properties	Numerical value denoting rated lamp wattage
FL: straight	4, 6, 8, 10, 15, 20S, 20SS, 30S, 40S, 40SS S: lamp with glass tube diameter 32.5 ± 1.5 mm SS: lamp with much smaller glass tube diameter than S, i.e. 28 ± 1.5 mm	Symbols denoting classification by color of light source D: daylight N: day white W: white WW: warm white L: electric lamp For three wavelength bands, EX- shall be prefixed to the above symbols denoting classification by color of light source. Symbols denoting classification by color rendering properties which shall be added when color rendering properties are improved. -DL: color rendering A -SDL: color rendering AA -EDL: color rendering AAA	This is indicated when rated lamp wattage is smaller than the numerical value denoting the classification by size.

Remarks 1 The rated lamp wattage of a lamp which has no symbol of 4th term is equal to the numerical value denoting classification by size.

2 If the 2nd term is ended with a letter symbol, a dot (·) may be inserted between the 2nd and 3rd terms.
3 Between the 3rd and 4th terms, a slash (/) is inserted.

4 The symbols denoting light source color and color rendering properties are based on **JIS Z 9112**.

5 In scattering protected lamps, P shall be attached next to the end term.

Between the P and the end term, a dot (·) may be inserted.

Example 1 FL15EX-N (lamp with starter, straight, classification by size 15, three wavelength band day white, rated lamp wattage 15 W)

Example 2 FL40S-W-SDL (lamp with starter, straight, classification by size 40, glass tube diameter 32.5 mm, white with improved color rendering AA, rated lamp wattage 40 W)

Example 3 FL40SS-W/37 (lamp with starter, straight, classification by size 40, glass tube diameter 28 mm, white, rated lamp wattage 37 W)

Example 4 FL40SS-W/37-P (lamp with starter, straight, classification by size 40, glass tube diameter 28 mm, white, rated lamp wattage 37 W, scattering protected type)

Informative reference: A lamp which has small value of rated lamp wattage than the value denoting classification by size (lamp for the purpose of saving wattage) may be called "LW", and a lamp which has the value of rated lamp wattage equal to the value denoting classification by size, may be called "NW".

(b) **Circular lamp** The type of a lamp shall be represented by the following 1st to 4th terms and the group by the 1st, 2nd and 4th terms.

1st term	2nd term	3rd term	4th term
Symbol denoting class and shape	Numerical values denoting classification by size	Symbols denoting color of light source and color rendering properties	Numerical value denoting rated lamp wattage
FCL: circular	20, 30, 32, 40	Symbols denoting classification by color of light source D: daylight N: day white W: white WW: warm white L: electric lamp For three wavelength bands, EX- shall be prefixed to the above symbols denoting classification by color of light source.	Numerical value denoting rated lamp wattage This is indicated when rated lamp wattage is smaller than the numerical value denoting the classification by size.

- Remarks 1 Between the 3rd and 4th terms, a slash (/) is inserted.
- 2 The symbols denoting light source color and color rendering properties are based on **JIS Z 9112**.
- Example 1 FCL30W/28 (lamp with starter, circular, classification by size 30, white, rated lamp wattage 28 W)
- Example 2 FCL32EX-N/30 (lamp with starter, circular, classification by size 32, three wavelength band day white, rated lamp wattage 30 W)

- (c) **Compact lamp (without built-in starter)** The type of a lamp shall be represented by the following 1st to 3rd terms and the group by the 1st and 2nd terms.

1st term	2nd term	3rd term
Symbols denoting class and shape	Numerical values denoting rated lamp wattage	Symbols denoting color of light source and color rendering properties
FPL: P type (2 tubes) FDL: D type (4 tubes A) FML: M type (4 tubes B) FWL: W type (4 tubes C)	4, 6, 9, 13, 18, 27, 28, 30, 36, 55	EX-D: 3 wavelength band daylight EX-N: 3 wavelength band day white EX-W: 3 wavelength band white EX-WW: 3 wavelength band warm white EX-L: 3 wavelength band electric lamp

Remarks: The symbols denoting light source color and color rendering properties are based on **JIS Z 9112**.

- Example 1 FPL 36EX-WW (P type, rated lamp wattage 36 W, 3 wavelength band warm white)
- Example 2 FDL 27EX-N (D type, rated lamp wattage 27 W, 3 wavelength band day white)
- Example 3 FML 18EX-D (M type, rated lamp wattage 18 W, 3 wavelength band daylight)
- Example 4 FWL 13EX-L (W type, rated lamp wattage 13 W, 3 wavelength band electric lamp)

- (d) **Compact lamp (with built-in starter)** The type of a lamp shall be represented by the following 1st to 3rd terms and the group by the 1st and 2nd terms.

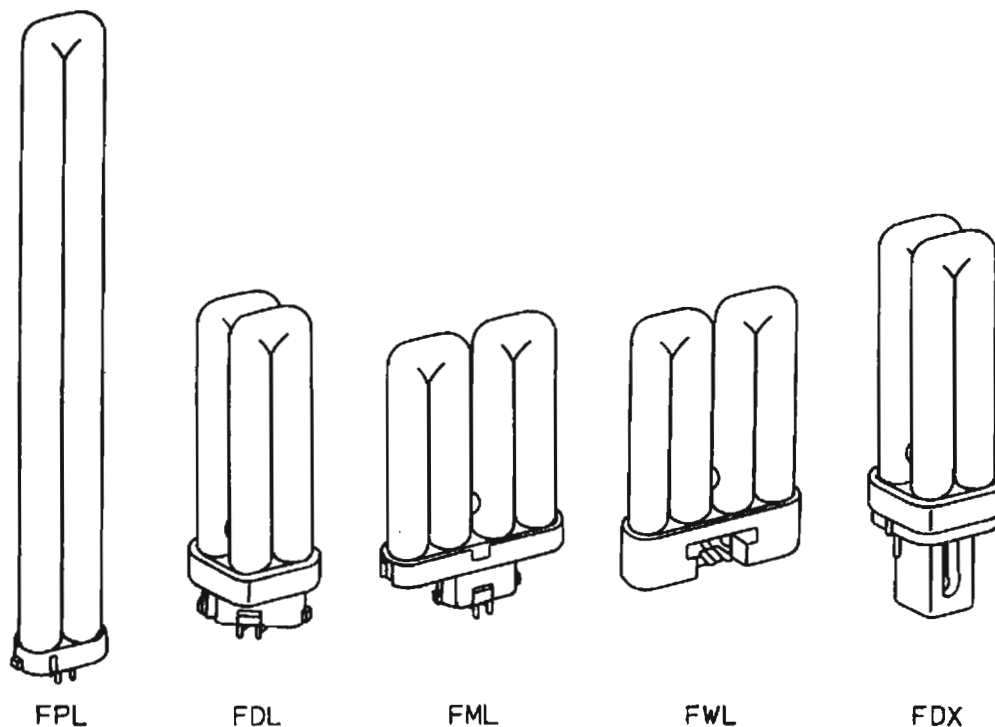
1st term	2nd term	3rd term
Symbols denoting class and shape	Numerical values denoting rated lamp wattage	Symbols denoting color of light source and color rendering properties
FPX: PX type (2 tubes) FDX: DX type (4 tubes)	5, 7, 9, 10, 11, 13, 18, 26	EX-D: 3 wavelength band daylight EX-N: 3 wavelength band day white EX-L: 3 wavelength band electric lamp

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Remarks: The symbols denoting light source color and color rendering properties are based on **JIS Z 9112**.

Example 1 FPX11EX-L (PX type, rated lamp wattage 11 W, 3 wavelength band electric lamp)

Example 2 FDX13EX-N (DX type, rated lamp wattage 13 W, 3 wavelength band day white)



(2) **Rapid-start lamp** The type of a lamp shall be represented by the following 1st to 5th terms and the group by the 1st, 2nd and 5th terms.

1st term	2nd term	3rd term	4th term	5th term
Symbol denoting class and shape	Numerical values denoting classification by size, and symbols denoting smaller glass tube diameter and high output	Symbols denoting color of light source and color rendering properties	Symbols denoting difference in construction concerning the starting aid	Numerical value denoting rated lamp wattage
FLR: straight	20S, 40S, 110H S: lamp with glass tube diameter 32.5±1.5 mm H: high output	Symbols denoting classification by color of light source. D: daylight N: day white W: white WW: warm white L: electric lamp For three wavelength bands, EX- shall be prefixed to the above symbols denoting classification by color of light source. Symbols denoting classification by color rendering properties which shall be added when color rendering properties are improved. -DL: color rendering A -SDL: color rendering AA -EDL: color rendering AAA	A: Outside surface of the glass tube is treated with water repellent, and starting aid conductor is required. M: Conductive film is coated on inside of glass tube, or conductive stripe is applied on inside or outside of glass tube.	This is indicated when rated lamp wattage is smaller than the numerical value denoting classification by size.

- Remarks
- 1 The rated lamp wattage of a lamp which has no 5th term is equal to the numerical value denoting the classification by size.
 - 2 Between the 2nd and 3rd terms a dot (.) may be inserted.
 - 3 Between the 3rd and 4th terms, a slash (/) is inserted.
 - 4 Between the 4th and 5th terms, a dot (·) or slash (/) is inserted.

5 Symbols denoting light source color and color rendering properties are based on **JIS Z 9112**.

6 In scattering protected lamps, P shall be attached next to the end term.

Between the P and the end term, a dot (·) may be inserted.

Example 1 FLR40S·D/M (rapid-start lamp, straight, classification by size 40, glass tube diameter 32.5 mm, daylight, conductive film is coated on inside of glass tube or conductive stripe is applied on inside or outside of glass tube as a starting aid, rated lamp wattage 40 W)

Example 2 FLR110H·W/A (rapid-start lamp, straight, classification by size 110, high output, white, outside surface of glass tube is treated water repellent, rated lamp wattage 110 W)

Example 3 FLR110H·W/A/100 (rapid-start lamp, straight, classification by size 110, high output, white, outside surface of glass tube is treated water repellent, rated lamp wattage 100 W)

Informative reference: A lamp which has smaller value of rated lamp wattage than the value denoting classification by size (lamp for the purpose of saving wattage), may be called "LW", and a lamp which has the value of rated lamp wattage equal to the value denoting classification by size, may be called "NW".

(3) High-frequency operated lamp

- (a) **Straight lamp** The type shall be represented by the following 1st to 3rd terms and the group by the 1st and 2nd terms.

1st term	2nd term	3rd term
Symbol denoting class and shape	Numerical values denoting rated lamp wattage	Symbols denoting color of light source
FHF: straight	16, 32, 50	Symbols denoting color of light source D: daylight N: day white W: white WW: warm white L: electric lamp For three wavelength bands, EX- shall be prefixed to the above symbols denoting classification by color of light source. Symbols denoting classification by color rendering properties which shall be added when color rendering properties are improved. -DL: color rendering A -SDL: color rendering AA -EDL: color rendering AAA

- Remarks 1 Symbols denoting light source color and color rendering properties are based on **JIS Z 9112**.
- 2 In scattering protected lamps, P shall be attached next to the end term.

Between the P and the end term, a dot (·) may be inserted.

- Example 1 FHF16EX-N (lamp for exclusive operation at high frequency, straight, rated lamp wattage 16 W, 3 wavelength band day white)
- Example 2 FHF32EX-D·P (lamp for exclusive operation at high frequency, straight, rated lamp wattage 32 W, 3 wavelength band daylight, scattering protected)
- Example 3 FHF50L-EDL (lamp for exclusive operation at high frequency, straight, rated lamp wattage 50 W, electric lamp, improved color rendering AAA)

- (b) **Compact lamp** The type of a lamp shall be represented by the following 1st to 3rd terms and the group by the 1st and 2nd terms.

1st term	2nd term	3rd term
Symbol denoting class and shape	Numerical values denoting rated lamp wattage	Symbols denoting color of light source
FHT: 6 tubes	16, 24, 32	EX-D: 3 wavelength band daylight EX-N: 3 wavelength band day white EX-L: 3 wavelength band electric lamp

Remarks: Symbols denoting light source color and color rendering properties are based on **JIS Z 9112**.

Example: FHT16EX-N (lamp for exclusive operation at high frequency, 6 tubes, rated lamp wattage 16 W, 3 wavelength band day white)



FHT

(4) **Slim-line lamp** The type of a lamp shall be represented by the following 1st to 4th terms and the group by the 1st, 2nd and 3rd terms.

1st term	2nd term	3rd term	4th term
Symbol denoting class and shape	Numerical values denoting length of lamp	Symbol denoting diameter of lamp	Symbols denoting color of light source and color rendering properties
FSL: straight	30, 42, 54, 64	T6	Symbols denoting classification by color of light source D: daylight N: day white W: white WW: warm white L: electric lamp For three wavelength bands, EX- shall be prefixed to the above symbols denoting classification by color of light source. Symbols denoting classification by color rendering properties which shall be added when color rendering properties are improved. -DL: color rendering A -SDL: color rendering AA -EDL: color rendering AAA

- Remarks 1 Symbols denoting light source color and color rendering properties are based on **JIS Z 9112**.
- 2 In scattering protected lamps, P shall be attached next to the end term.
Between the P and the end term, a dot (·) may be inserted.
- Example: FSL64T6W (slim-line lamp, straight, length 1556 mm, glass tube diameter 20 mm, white)

5 Performances

5.1 Initial cap adhesion strength When lamps excluding circular ones are tested as specified in 9.3.3, the initial cap adhesion strength shall be such that the lamp with G5 cap shall withstand a torsional moment of 0.6 Nm and the lamp with other caps, of 2 Nm.

In this procedure, the cap shall be free from any abnormalities.

5.2 Cap adhesion strength after heating When lamps excluding circular ones are tested as specified in 9.3.4, the cap adhesion strength after heating shall be such that the lamp with G5 cap shall withstand a torsional moment of 0.3 Nm, and the lamp with other caps, of 0.6 Nm.

In this procedure, the cap shall be free from any functional abnormalities.

5.3 Starting When the starting test is carried out in accordance with 9.3.5, the lamp with starter shall start within one min and then maintain the operation. The rapid start lamp and slim-line lamp shall start within 10 s, the high-frequency operated lamp within 0.1 s and they shall maintain their operation.

- Remarks 1 When lamps with starter are tested as specified in Annex 4, they should start within three times of starting and maintain the operation successively.
- 2 When compact lamps (with accommodated starter) are tested as specified in Annex 4, they should start within 10 s and maintain the operation successively.
- 3 When rapid-start lamps and slim-line lamps are tested as specified in Annex 4, they should start within 10 s and maintain the operation successively.
- 4 When high-frequency operated lamps are tested as specified in Annex 4, they should start within 5 s for the time being.

5.4 Initial characteristics When the initial characteristic test is carried out as specified in 9.3.6, the lamp wattage shall be "the value in Attached Table 1 $\pm$ (the value of lamp wattage $\times$ 0.05+0.5)", the lamp current shall be the value in Attached Table 1, and the total luminous flux shall be not less than 92 % of the value in Attached Table 1.

5.5 Light source color The light source color shall comply with the provisions of chromaticity range in JIS Z 9112 when the test is carried out as specified in 9.3.7.

5.6 Color rendering properties The color rendering properties shall comply with the provisions of color rendering index in JIS Z 9112 when the test is carried out as specified in 9.3.8.

In addition, the three wavelength band fluorescent lamp shall comply with the requirement for three wavelength band radiant flux ratio.

5.7 Cathode current The cathode currents of rapid-start lamp and high-frequency operated lamp shall conform to the relevant value given in Attached Table 1 when the test is carried out as specified in 9.3.9.

5.8 Lumen maintenance The lumen maintenance shall conform to the relevant value given in Attached Table 1 when the test is carried out as specified in 9.3.10.

5.9 High output operation characteristics When the test is carried out as specified in 9.3.11, the high output operation characteristics of the straight high-frequency operated lamp shall comply with the value given in Attached Table 1.

5.10 Strength of scattering protective film The scattering protective film shall not be broken when the test is carried out as specified in 9.3.13.

5.11 Scattering protection The broken glass pieces shall not scatter to the outside area of the circle with a radius of (lamp length+1 m) when the test is carried out as specified in 9.3.14.

5.12 Dielectric withstanding voltage of cap When the dielectric withstanding voltage test is carried out as specified in 9.3.15, the insulation between the metallic cap barrel part and the pins or the conductive parts shall withstand the test voltage without causing dielectric breakdown during the test. However, this test is not applicable to the caps of lamps equipped with internal resistor.

5.13 Cap insulation property When the cap insulation test is carried out as specified in 9.3.16, the insulation resistance between the metallic cap barrel part and the pins or conductive parts shall be not less than 0.5 MΩ.

5.14 Resistance to heat of cap insulation When the test for resistance to heat of cap insulation is carried out as specified in 9.3.17, the insulation shall not cause any change which will deteriorate the safety such as loosening of pin, crack, swelling and shrinkage.

Further, the cap after this test shall comply with the cap dimension standard of completed lamps specified in JIS C 7709-1, and the electrical tests specified in 5.12 and 5.13.

5.15 Temperature rise of lamp cap When the test is carried out as specified in 9.3.18, the temperature rise of cap exceeding the ambient temperature shall not exceed 95 K for lamps with G5 and G13 caps.

In such a case that the temperature rise of lamp cap of a certain lamp group becomes the maximum in a specific lamp class such as lamps with nominal glass tube diameter 26 mm, the test on all capped lamps of the same diameter may be omitted by carrying out the test on the lamp group only.

5.16 Resistance to fire of insulation (glow wire test) The test for resistance to fire of insulation (glow wire test) of compact lamps whose insulation at the outer periphery of cap is composed of insulating material of resin shall comply with the provisions of JIS C 0073.

The test temperature shall be 650 °C.

5.17 Resistance to abrasion of lamp mark When the test for resistance to abrasion of lamp mark is carried out as specified in 9.3.20, the specimen shall maintain such a state that the mark is legible.

As for the marking items specified in 12.1, partial lacking of letters and symbols is allowed if the marking is legible, but complete lacking of one or more letters is not allowed.

5.18 Dielectric withstand voltage of noise suppression capacitor When a noise suppression capacitor is used in a lamp with accommodated starter, the capacitor is tested as specified in 9.3.21 and the specimen shall be free from any abnormalities.

5.19 Resistance to fire of noise suppression capacitor When a noise suppression capacitor is used in a lamp with accommodated starter, the capacitor is tested as specified in 9.3.22 and the absorbent cotton covering the capacitor shall not be ignited.

5.20 Noise terminal voltage When the test is carried out as specified in 9.3.23, the noise terminal voltage in lamps with rated lamp wattage not exceeding 40 W shall not exceed 56 dB (1 μ V=0 dB) in the frequency range of 0.5265 MHz or more up to and including 5 MHz, and 60 dB (1 μ V=0 dB) in the frequency range of over 5 MHz up to and including 30 MHz.

5.21 Angular displacement of cap When the test is carried out as specified in 9.3.24, the angular displacement of cap in straight lamps shall be such that the angle of twist of each of planes including two pins (current carrying part) on both ends of tube shall not exceed 6 degrees for lamps equipped with G13 caps specified in JIS C 7709-1 and 14 degrees for lamps equipped with G5 caps. For lamps equipped with R17d caps specified in JIS C 7709-1, the angle of twist of each of planes including the major diameter of the cap projection shall not exceed 10 degrees.

6 Construction The construction of lamps shall comply with the following requirements:

- (1) The inside surface of glass tube shall be uniformly coated with fluorescent materials. However, the joint of glass tube is exempted from the above requirement.
- (2) The water repellent coat, conductive stripe or the like which is to be applied on rapid-start lamps, shall not peel off easily.
- (3) The scattering protective film applied on scattering protected lamps shall have uniform thickness and shall not peel off easily.
- (4) Mercury, argon and other suitable gases shall be contained in the glass tubes.
- (5) The connection of lead-in-wires, electrodes and caps shall be sure.

7 Materials The materials of lamps shall comply with the following requirements:

- (1) The glass tube specified in JIS C 7708 or that equivalent shall be used.
- (2) The electrodes shall be coiled tungsten filament coated with electron-emissive material, and shall be uniform in quality and free from flaws or other defects.
- (3) The lead-in wire shall be of material of good quality having high electrical conductivity, and the glass-sealed part thereof shall be used the dumet wires specified in JIS H 4541 or those equivalent thereto.

- (4) The conducting part of cap shall be brass of good quality or other suitable materials, and the insulating part of cap shall be synthetic resin or other materials appropriate to the temperature and voltage.

8 Dimensions and caps The dimensions and caps shall be as given in Attached Fig. 1 and Attached Table 1.

9 Tests

9.1 General rule of tests The test conditions and methods shall comply with following 9.2 and 9.3 in addition to compliance with JIS C 7801.

9.2 Test conditions Unless otherwise specified, the tests specified in 9.3.5 to 9.3.12 shall be carried out on the lamp placed horizontally for straight lamps, placed vertically (caps is top) for compact lamps, and placed horizontally or vertically (cap is top) for circular lamps.

In the case of high-frequency operated lamps, a substantially sinusoidal high frequency power supply of 45 ± 0.9 kHz shall be used, and for other lamps a substantially sinusoidal a.c. supply at a frequency 50 Hz or 60 Hz shall be used.

9.3 Test method

9.3.1 Construction and material test The lamp shall be examined whether it complies with the provisions of 6, 7 and 12 or not.

9.3.2 Dimensions and caps Dimensions of the lamp shall be measured by the vernier calliper specified in JIS B 7507, or a gauge or measuring instruments at least equivalent in accuracy.

9.3.3 Initial cap adhesion strength test The cap adhesion strength test shall be carried out by gradually applying twisting moment between the root of cap pins and glass tube for lamps with G5 caps and G13 caps, or between the cap barrel and glass tube for lamps with other caps than above. For lamps with G10q caps, however, this test needs not be carried out.

9.3.4 Test for cap adhesion strength after heating The caps shall be heated in a thermostatic chamber at a temperature of 120 ± 5 °C for 2000 h. For G13 caps used for lamps whose classification by size or rated lamp wattage (W) is exceeding 40, the heating temperature shall be 140 ± 5 °C. The test method shall be as stated in 9.3.3.

9.3.5 Starting test The lamp not yet subjected to the aging before initial characteristics test is allowed to stand unoperated under an ambient temperature of 20 °C to 27 °C and relative humidity of 65 % or less for 24 h or more. Then the lamp shall be tested under the same draft-free conditions, being connected as shown in Attached Fig. 2, as follows:

- (1) **Lamp with starter** The starting test voltage specified in Attached Table 1 is applied by means of the inductive ballast or test ballast specified in JIS C 8108 and by using the glow starter specified in JIS C 7603 as the starter to try the starting.

For compact lamps with built-in starter, the starting shall be tried by applying the start testing voltage given in Attached Table 1.

- (2) **Rapid-start lamp** The test shall be carried out by applying simultaneously the cathode-preheating voltage and starting test voltage specified in Attached Table 1, using the reference ballast specified in Attached Table 2. If the lamp does not start at this voltage, the starting shall be tried by raising gradually the starting test voltage up to 110 % of the value given in Attached Table 1, and the lamp which has been started by this operation shall be operated for 30 min by means of the ballast specified in **JIS C 8108** at the rated input voltage of the ballast, then left unoperated for 24 h or more, and then the above-mentioned test shall be carried out again.

Remarks 1 The cathode-preheating voltage shall be so applied as not to increase the voltage of main circuit applied on the lamp terminals, and the both circuits shall be in the same phase.

2 Two cathode-preheating transformers may be replaced by one transformer having two separate secondary windings. The transformer shall have sufficient capacity so that the voltage will not vary when it is loaded.

3 In the case of a lamp with symbol A denoting the starting aid, a metallic strip of 40 mm in width shall be located through the length of the lamp 20 mm apart from the lamp, and connected to grounded side of the power supply.

4 Metallic parts other than necessary starting device shall be kept away from the lamp as far as possible.

- (3) **High-frequency operated lamp** The test shall be carried out in such a manner that the reference ballast shown in Attached Table 2 is used, the cathode-preheating voltage specified in Attached Table 1 is applied and after 1 s the starting test voltage is applied.

If the lamp does not start at this voltage the starting shall be tried by raising gradually the starting test voltage up to 105 % of the value given in Attached Table 1, and the lamp which has been started by this procedure shall be operated for 30 min by means of the ballast of rated lamp wattage output type specified in Annex 1 at the rated input voltage of the ballast, then left unoperated for 24 h or more, and then the above-mentioned test shall be carried out again.

Remarks 1 The cathode-preheating voltage shall be so applied as not to increase the voltage of main circuit applied on the lamp terminals, and the both circuits shall be in the same phase.

2 Two cathode-preheating transformers may be replaced by one transformer having two separate secondary windings. The transformer shall have sufficient capacity so that the voltage will not vary when it is loaded.

3 A metallic strip of 40 mm in width shall be located through the length of the lamp 20 mm apart from the lamp and connected to grounded side of the power supply as the starting aid. However, the starting aid shall not be used for compact lamps.