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General rules of light emitting diodes for fiber optic transmission

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Descriptors : light-emitting devices, optoelectronic devices, fibre optics, telecommunication transmission methods, specifications, optical communication systems, light-emitting diodes

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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. Consequently, JIS C 5950:1989 has been revised and replaced with this Standard.

In this revision, conformance of provisions between JIS and International standard was taken into consideration.

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 (informative) Form of detail specification of light emitting diodes for fiber optic transmission

Annex 2 (informative) Form of detail specification for environmental test and endurance test of light emitting diodes

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General rules of light emitting diodes for fiber optic transmission

Introduction Users should note that at application of this Standard, the normative references to this Standard shall be referred at the same time. Further, it is often necessary to carry out comparison with and study on the similar standard(s), if any.

This is a Japanese Industrial Standard prepared based on **IEC 747-5, Semiconductor devices. Discrete devices and integrated circuits— Part 5: Optoelectronic devices** issued in 1992 and **IEC 747-5 Amendment 1** issued in 1994 without any modification in technical contents.

1 Scope This Japanese Industrial Standard specifies general common matters such as terms, symbols, classification, maximum ratings and performances of light emitting diodes for fiber optic transmission to be used as light source (except diodes accommodated in electronic circuit, hereafter referred to as “light emitting diode”).

Remarks 1 The normative references to this Standard are as follows.

JIS C 0301 *Graphical symbols for electrical apparatus*

JIS C 5951 *Test methods of light emitting diodes for fiber optic transmission*

2 The International Standards corresponding to this Standard are shown below.

IEC 747-1:1983 *Semiconductor devices. Discrete devices and integrated circuits— Part 1: General*

IEC 747-1 Amendment 1: 1991

IEC 747-5:1992 *Semiconductor devices. Discrete devices and integrated circuits— Part 5: Optoelectronic devices*

IEC 747-5 Amendment 1:1994

2 Definitions For the purpose of this Standard, the following principal definitions apply:

- (1) **absolute maximum ratings** The limit value which shall not be exceeded even for an instant. Any one of the specified values shall not be exceeded.
- (2) **storage temperature (T_{stg})** The allowable ambient temperature at which the diode can be stored without the power supply voltage and input signal applied.
- (3) **ambient temperature (T_a)** The temperature of the atmosphere in which the light emitting diodes are located.

- (4) **case temperature (T_c)** The temperature of the case at a specified position.
- (5) **operating temperature (T_{op})** The ambient temperature ($T_{op(a)}$) or the case temperature ($T_{op(c)}$) at which the operation of diodes is ensured under the specified voltage or current.
- (6) **radiant intensity (P_o)** The optical power which is taken out from the optical output facet of window type or open type.
- (7) **radiant power (P_l)** The optical power which is taken out from the optical output facet of optical fiber pigtail type or optical connector type.
- (8) **operating current (I_{op})** The current at which the specified optical output power is available.
- (9) **operating voltage (V_{op})** The voltage at which the specified optical output power is available.
- (10) **central emission wavelength (λ_c)** The central wavelength between two wavelengths where the optical output power is 50 % of the maximum value in the emission spectrum at the specified operating current.
- (11) **peak emission wavelength (λ_p)** The wavelength at which the optical output power shows the maximum value at the specified operating current.
- (12) **spectrum bandwidth ($\Delta\lambda$)** The difference between two wavelengths where the optical output power is 50 % of the value at the peak emission wavelength.
- (13) **rise time (t_r)** The time necessary for an optical output pulse to increase from 10 % to 90 % of the maximum value.
- (14) **fall time (t_f)** The time necessary for an optical output pulse to decrease from 90 % to 10 % of the maximum value.
- (15) **cut-off frequency (f_c)** The frequency at which the amplitude of a sinusoidal modulated optical output power produced by modulation with small sinusoidal signal at the specified bias point, decreases by 3 dB from that in low frequency region where the characteristic curve is sufficiently flat.

3 Detail specification The absolute maximum ratings, performance, outline, etc. of light emitting diode shall be specified in the detail specification.

4 Graphical symbols The graphical symbols shall comply with JIS C 0301.

5 Classification The light emitting diodes are classified as given in Table 1.

Table 1 Classification of light emitting diodes

Classification items		Kind
Item	Sub-item	
Crystal material		Aluminium gallium arsenic/gallium arsenic (Al-GaAs/GaAs), indium gallium arsenic phosphorus/indium phosphorus (InGaAsP/InP), etc.
Wavelength band		For 600 nm band, for 800 nm band, for 1 300 nm band, for 1 500 nm band, etc.
Structure of element	Light-emitting structure	Dome type, flat face type, end face emitting type, etc.
	Structure of junction	Homogeneous junction, heterogeneous junction, etc.
Structure of package	Structure of optical output end	Optical output window type, optical fiber pigtail type, optical connector type, open type, etc.
	Structure of termination	TO type, coaxial type, box type, etc.
Use		For low speed, for high speed, for digital system, for analog system, for multimode optical fiber, for single mode optical fiber, etc.

6 Maximum ratings The maximum rating of light-emitting diodes means the absolute maximum rating. The maximum ratings to be specified shall be as prescribed in the form of detail specification shown in Annex 1 and Annex 2. The values given in Table 2 to Table 4 are recommended as the standard values.

Table 2 Storage temperature (T_{stg})

Lower limit value °C	-10	-20	-30	-40	-50	-55	-60	-65	
Upper limit value °C	50	60	70	80	85	90	100	125	150

Table 3 Operating temperature (T_a or T_o)

Lower limit value °C	0	-10	-20	-30	-40	-50	-60	-65		
Upper limit value °C	40	50	60	70	80	85	90	100	125	150