Final Report by Luminaires, etc.

Evaluation Standards Working Group, Energy Efficiency

Subcommittee, Energy Efficiency & New Energy

Sectional Committee of the Advisory Committee for

Natural Resources and Energy

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Ministry of Economy, Trade and Industry

The luminaires, etc. evaluation standards working group deliberated on evaluation standards, etc. (the deliberation included the scope, categories, target fiscal year, target standard values, measurement methods, etc. of bulb-type LED covered by this report) for manufacturers and importers of self-ballasted LED-lamp (hereinafter referred to as "manufacturers, etc.") for the purpose of improving the performance of these products and prepared this report as follows.

1. Target scope [See Attachment 1]

   The self-ballasted LED-lamps covered by this report are those which belong to JIS C 8158 (Self-ballasted LED-lamps for general lighting services by voltage > 50V) in 2012 (hereinafter referred to as "JIS C 8158") and the code representing category and configuration specified is "A type (LDA)" and the code representing category of the cap is E26 and E17. "T type (LDT)" and "G type (LDG)" other than (LDA) shall be excluded from the scope because they are used enormously small number in the market such as 0.7% for LDT and 1.4% for LDG respectively. Additionally, following items shall be excluded from the scope.

①Self-ballasted LED-lamp with corresponding function for dimmer. (Because ratio for the volume of shipment of self-ballasted LED-lamp in basic year is extremely small to be 5%, and there are large variations of efficacy difference by conformance rate with dimmer.)

②Self-ballasted LED-lamp more than 90 of average color rendering evaluation number (hereinafter referred to as "Ra"). (due to only Self-ballasted LED-lamps with corresponding function for dimmer control.)

2. Matters to be considered as evaluation standards for manufacturers, etc.

(1) Target fiscal year [See Attachment 2.]

   The target fiscal year shall be FY2017.

(2) Categories for setting targets and target standard values [See Attachments 3 and 4.]

   Categories and Target Standard Values shall be in accordance with Table 1.

Table 1 Categories and Target Standard Values of Self-ballasted LED-lamps

Category	Light Source Color (see attachment 3 Table 1)	Target Standard Value [lm/W]
1	Daylight, Neutral white, White	110.0
2	Warm white, Lamp color	98.6

As regards self-ballasted LED-lamps to be shipped by manufacturers, etc. in the domestic market in the target fiscal year, it is required that the values obtained by calculating weighted averages of the energy consumption efficacy [lm/W] of those products measured according in paragraph (3) below, for each category of the table 1 according to the number of units shipped shall not be below the target standard values.

Category	Light Source Color	Color Rendering Index	[Basic Year] Weighted Average Efficacy	[Basic Year] Top Runner Value (lm/W)	[Target Fiscal Year] Target Standard Value (lm/W9	Improved Ratio from Top Runner Value (%)	Improved Ratio from Weighted Average Efficacy
1	Daylight, Neutral white, White	90 or more	-	-	87.8	-	-
2		Less than 90	77.1	104.4	110.0	5.4	42.7
3	Warm white, Lamp color	90 or more	-	-	79.0	-	-
4		Less than 90	61.3	91.1	99.0	8.7	61.5

(3) Method for measuring energy consumption efficacy [See Attachment 5]

The energy consumption efficacy shall be value obtained total luminous flux (lm) of

the self-ballasted LED-lamp divided by electric power consumption (W) of the self-ballasted LED-lamp and calculated by the following formula.

$$\text{The energy consumption efficacy} = \frac{\text{Total luminous flux (lm) of the self-ballasted LED-lamp}}{\text{Electric power consumption (W) of the self-ballasted LED-lamp}}$$

The measuring method of total luminous flux of the self-ballasted LED-lamp shall be in accordance with JIS C 7801 (Measuring methods of lamps for general lighting): 2012 and its amendment in 2012 and 2014 (hereinafter referred to as "JIS C 7801").

Additionally, the measuring method of electric power consumption of the self-ballasted LED-lamp shall be in accordance with JIS C 8157 (Self-ballasted LED-lamps for general lighting services > 50 V-Performance requirements): 2011 (hereinafter referred to as "JIS C 8157").

(4) Items to be indicated, etc.
　① Items to be indicated
　　The indicating items shall be following i) through ix).
　　a) Product name or model name
　　b) Category code
　　c) Total luminous flux
　　d) Electric power consumption
　　e) Energy consumption efficacy
　　f) Light source color
　　g) Name of manufacturer, etc.
　　h) The accredited testing laboratory (※1) should have measured iii) total luminous flux and iv) electric power consumption.
　　　(※1) The accredited testing laboratory are referred to those who are registered according to provision of Japan Industrial Standardization Act (Act No. 57, Item No. 1).

　　　(※2) Examples of the indicating items (Package)
　　　　Indicate followings on the package

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┌─────────────────────────────────────────────┐
│                                             │
│   Total luminous flux 75lm (※)              │
│                                             │
│   Electric power consumption 8W (※)         │
│   ～～～～～～～～～～～～～～～～～～～～～      │
│                                             │
│   JNLA Accredited laboratory (000000JP) test │
│                                             │
│   (＊) Refer to Instruction manual or Brochure │
│                                             │
│                                             │
└─────────────────────────────────────────────┘
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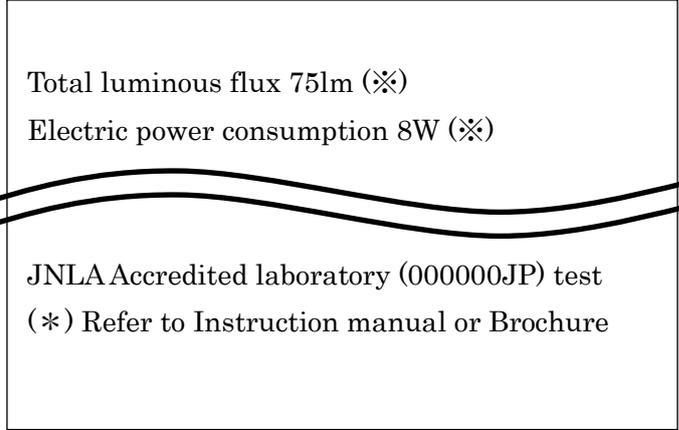
· Indicate （＊） at the side of total luminous flux and electric power consumption

"000000JP": Registry number of accredited testing laboratory who performed the measurement

· Writing manner of instruction manual and brochure, e.g. .

"These rated values are indicated with our responsibility based on test result(s) by JNLA accredited testing laboratory."

   (i) Production date or Lot code

② Matters to be complied with

1) Total luminous flux shall be indicated in lumen [lm] unit.

2) Electric power consumption shall be indicated in watt [W] unit.

3) The energy consumption efficacy shall be indicated in lumen per watt　[lm/W] unit, and shall be expressed by the number down to the first digid after the decimal point.

4) Light source color shall be indicated according to JIS Z 9112 (Classification of fluorescent lamps and light emitting diodes by chromaticity and colour rendering property)：2012 (hereinafter referred to as "JIS-Z-9112").

5) Items included in ① shall be indicated as follows;

  · Indicate on the package:a) through d) and h)

  · Indicate on instruction manual, brochure and documents presented by manufacturers, etc. at selection of the product: a) through d) and h)

  · Indicate on brochure and documents presented by manufacturers, etc. at selection of the product: e) through g)

  · Indicate on the product body: i)

3. Proposals for energy conservation

(1) Actions of Government

① From viewpoint of retrofitting incandescent lamp to high efficacy lighting such as self-ballasted fluorescent lamp (sometime called CFL) and self-ballasted LED-lamp, etc. (hereinafter referred to as "self-ballasted LED-lamp, etc.", the government should endeavor to implement necessary measures such as diffusion and publication, etc. of those products to promote actions of users and manufacturers, etc.

② The government should endeavor to use the excellent products with exceeding target standard energy consumption efficacy, according to proper color dendition Ra in JIS Z 9110 (General rules of recommended lighting levels)(hereinafter refered to as "JIS Z 9110") and corresponding the function of the dimmer at government office building, etc.

③ The government should regularly and continuously comprehend implementing status of indications by manufacturers, etc. and should endeavor to put the standard of proper evaluation into effect to propose correct and easy information in regard to energy consumption efficacy for users.

④ The government should endeavor to internationally diffuse the energy consetvation standard based on top runner method, since it is very useful method to achieve energy saving of equipment.

⑤ The government should make consideration to promote excellent products of energy consumption efficacy based on activity condition, etc. of performance testing status, production, distribution, and sales of self-ballasted LED-lamp .

(2) Actions of manufacturers, etc.
① Manufacturers, etc. shall endeavor to promote the development of energy conservation technologies for high efficacy lighting such as self-ballasted LED-lamp, etc.

② From viewpoint of diffusing self-ballasted LED-lamp with excellent energy consumption efficacy gather with proper color rendition in JIS Z 9110, manufacturers, etc. shall endeavor to provide appropriate information for users to encourage them to choose self-ballasted LED-lamp with excellent energy conservation performance utilizing Energy Conservation Label specified in JIS C 9901 (Method of calculation and representation of energy efficiency standard

achievement percentage of electrical and electronic appliances): 2010 (hereinafter referred to as "Energy Conservation Label"). Additionally, the indication content of the label should be easily understood, avoiding any misunderstanding.

③ Manufacturers, etc. shall endeavor to promote better understanding of users in regard to high efficacy lighting of self-ballasted LED-lamp, etc., and shall endeavor to explain the production of easy exchange from incandescent lamp for users to encourage them to choose, when they purchase high efficacy lighting of self-ballasted LED-lamp, etc.

④ Those manufacturers, etc. who have own test facilities shall endeavor to be registered as an accredited testing laboratory.

⑤ Manufacturers, etc. shall endeavor to provide information intending excellent energy conservation performance by proper and effective use of self-ballasted LED-lamp.

(3) Actions of users

① Users shall endeavor to choose self-ballasted LED-lamp which is excellent for energy consumption efficacy gather with proper color rendition in JIS Z 9110 and measured by accredited testing laboratory, effectively utilizing information of "Energy Conservation Label" etc. and users shall promote energy conservation by proper and effective use with positively applying the installation of energy conservation when purchasing self-ballasted LED-lamp.

② Users shall endeavor to choose appropriate self-ballasted LED-lamp, etc. considering envisaged family unit and environment to exert to the maximum extent the capability and energy conservation performance of self-ballasted LED-lamp, etc.

③ Users shall endeavor to retrofit incandescent lamp to excellent energy consumption efficiency lighting with high efficiency such as self-ballasted LED-lamp, etc.

④ Users shall endeavor to save energy by effective use with proper brightness, etc. utilizing dimmer function considering lighting purpose when using the luminaires.

(4) Actions of lighting designers who select self-ballasted LED-lamp, etc.

① Designers shall endeavor to select excellent product for energy consumption efficacy gather with proper color rendition in JIS Z 9110 effectively utilizing energy conservation information.

② Designers shall endeavor to retrofit from incandescent lamp to excellent energy

consumption efficient product such as self-ballasted LED-lamp, etc.

③ Designers shall endeavor to save energy by effective use with proper brightness for users utilizing the function for dimmer considering lighting purpose of users when selecting the luminaires.

(5) Action of sales business operators

① Sales business operators shall endeavor to sell self-ballasted LED-lamp which is excellent for energy consumption efficacy gather with proper color rendition in JIS Z 9110 and measured by raccredited testing laboratory, and shall endeavor to provide proper information for users to select self-ballasted LED-lamp which is excellent for energy consumption efficacy utilizing Energy Conservation Label, etc. Additionally, the indication content of the label, etc. should be easily understood, avoiding any misunderstanding.

② From viewpoint of providing proper information at store front, etc. sales business operators shall endeavor to implement information collection and sales personnel education in regard to energy saving of self-ballasted LED-lamp, etc.

③ Those who sell self-ballasted LED-lamp, etc. installing in the building, also shall endeavor to select and install self-ballasted LED-lamp, etc. which is excellent for energy consumption efficacy for residents of the building to use the self-ballasted LED-lamp, etc. which is excellent for energy consumption efficacy.

Target Scope of Self-ballasted LED-lamp

Applicable scope of self-ballasted LED-lamp shall be those which the code representing category and configuration specified in JIS C 8158 is "A type (LDA)" and the code representing category of the cap is "E26" and "E17". "T type (LDT)" and "G type (LDG)" other than A type (LDA) shall be excluded from the scope because they are used enormously small number in the market such as 0.7% for LDT and 1.4% for LDG respectively.

Additionally, following items shall be excluded from the scope because ①those which are used for special purpose, ②those which technical methods for measurement and evaluation have not been established, and ③those which use ratio in the market is extremely low.

①□Self-ballasted LED-lamp with corresponding function for dimmer. (Because ratio for the volume of shipment of self-ballasted LED-lamp in basic year is extremely small to be 5%, and there are large variations of efficiency difference by conformance rate with dimmer control.)

② Self-ballasted LED-lamp more than Ra 90. (Because applicable scope is only with corresponding function for dimmer.)

The code representing category and configuration of the lamp		Cap	The volume of shipment [pieces] (with dimming function)	Share
A type		E17	5,748,726 (689,480)	29.2%
		E26	13,564,146 (376,717)	68.8%
T type		-	131,973 (0)	0.7%
G type		-	297,589 (48,845)	1.4%
Total			19,742,434 (1,115,042)	

(Source) Fiscal Year 2011 Shipment Data: Voluntary Statistics of The Japan Lighting Manufacturers Association (Major 7 Companies)

Target fiscal year, etc., of self-ballasted LED-lamp

1. Target fiscal year

　Significant progress for energy consumption efficacy of self-ballasted LED-lamp shall greatly depend on the development of LED package. However, we cannot expect improvement of energy consumption efficacy every time at product development of self-ballasted LED-lamp, because the product development is implemented focusing on customer needs.

　Therefore, surveying product development for several times, we noticed that the energy consumptionefficacy has been improved with around two years interval.

　It is necessary to have at least two or three times opportunity of product development until target fiscal year to improve sufficient energy consumption efficacy.

　Therefore, it is reasonable to make FY2017 as the target fiscal year of self-ballasted LED-lamp which is six years after basic year FY2011.

2. Improvement in the target fiscal year

　The improvement ratio of the energy consumption efficacy in the target fiscal year is estimated to be 50.8% against the current weighted average efficacy value based on the premise that the number of units shipped and the product composition of each category in basic fiscal year remain unchanged.

　<Outline of estimation>
　(1) The energy consumption efficacy calculated based on the self-ballasted LED-lamps actually shipped in the basic fiscal year: 69.2 lm/W
　(2)　The energy consumption efficacy per unit calculated based on the target standard values of self-ballasted LED-lamps expected to be shipped in the target fiscal year making weighted averages with the number of units shipped: 104.3 lm/W
　(3) Improvement ratio of energy consumption efficacy:

$$\frac{(104.3–69.2)}{69.2}×100 = \ 50.8\ \%$$

Table 1 Category and Target Standard Value of Self-ballasted LED-lamp

Category	Light Source Color	Shipment record (record of 2011)	[Basic Year] Weighted Average Efficacy [lm/W]	[Basic Year] Top Runner Value [lm/W]	[Target Fiscal Year] Target Standard Value [lm/W]	Improved Ratio from Top Value [%]	Improved Ratio from Weighted Average Efficiency (%)
1	Daylight, Neutral white, White	9,134,688	77.1	104.4	110.0	5.4	42.7
2	Warm white, Lamp color	9,111,987	61.3	91.1	98.6	8.2	60.8

(Source) Fiscal Year 2011 Shipment Data: Voluntary Statistics of The Japan Lighting Manufacturers Association (Major 7 Companies)

Category	Light Source Color	[Basic Year] Weighted Average Efficacy [lm/W]	[Basic Year] Top Runner Value [lm/W]	[Target Fiscal Year] Target Standard Value [lm/W]	Improved Ratio from Top Value [%]	Improved Ratio from Weighted Average Efficiency [%]
1	Daylight color, Neutral white color, White color	77.1	104.4	110.0	5.4	42.7
2	Warm white color, Lamp color	61.3	91.1	98.6	8.2	60.8

Categories for Setting Targets of Self-ballasted LED-lamps

1. Basic idea

Self-ballasted LED-lamps shall be classified based on the principles referred to as "the basic idea concerning the development and revision of evaluation standards for manufacturers, etc. to be considered in relation to the improvement in performance of specific equipment" (the 10th Energy Efficiency Standards Subcommittee of the Advisory Committee for Natural Resources and Energy, revised on June 18, 2007) (hereinafter referred to as "the principles").

"The basic idea concerning the development and revision of evaluation standards for manufacturers, etc. to be considered in relation to the improvement in performance of specific equipment"
- Extract –

Basic idea for classification configuration and target standard value configuration

Principle 2: Specific equipment is classified based on certain indices. The indices (basic indices) are those which are deeply related to energy consumption efficiency such as physical amount and functions, and they are determined considering coefficients which consumers use as criteria when choosing products (coefficients representing consumers' needs).

Principle 3: Target standard values are determined by one value or functional formula for each category for which it is possible and appropriate to target at the same energy consumption efficiency.

Principle 4: When setting categories, additional functions are disregarded in principle. However, there may be a case in which, if the energy consumption efficiency of a product without an additional function is set as a target standard value, other products with the additional function may have to withdraw from the market because they cannot comply with the target standard value, despite the fact that the needs for the latter products are thought to be high in the market. If the probability of such case is high, then it is acceptable to make another category (sheet) for those products.

Principle 5: As regards products which are expensive but excellent in the energy consumption efficiency because of using advanced energy saving technologies, although it is possible to classify them into a separate category, it is desirable to treat them in the same category with others wherever possible so that manufacturers can actively sell the products with excellent energy consumption efficiency.

Principle 6: When setting a target standard value for a category, special products shall be excluded. However, availability of technologies employed in

such special products shall be also reviewed when studying the future
performance improvement possibly realized by technology development,
etc.

2. Specific classification method

（1）Light source color of self-ballasted LED-lamp

Considering the fact that the characteristics of self-ballasted LED-lamp become
different according to the light source color and it affects their energy consumption
efficacy, the self-ballasted LED-lamps are classified as follows.

The light source color shall be categorized into five classes of daylight, neutral
white, white, warm white, and lamp color specified in JIS Z 9112. The difference of
light color source is caused by difference of correlated color temperature (K)【Table 1】,
and since this difference affects to the value of total luminous flux, daylight, neutral
white, white are bundled together in a group, and warm white, and lamp color in the
other group considering energy consumption efficacy by shipment of FY 2011 (basic
fiscal year).

Even though products of white and warm white are not shipped at the moment,
white is classified in daylight / neutral white and warm white color is classified in
lamp color, considering difference of correlation color temperature in JIS Z 9112
classification.

Table 1 Category of light source color and classification of
correlated color temperature

Category of Light Source Color	Code	Correlated Color Temperature (K)
Daylight	D	5,700 ~ 7,100
Neutral white	N	4,600 ~ 5,500
White	W	3,800 ~ 4,500
Warm white	WW	3,250 ~ 3,800
Lamp color	L	2,600 ~ 3,250

Source : JIS Z 9112 Table 2 – Chromaticity range of LED light source color

(2) Color rendering properties of self-ballasted LED-lamp

The color rendering properties are engaged to important requirement for lighting, and the Ra minimum values are specified in detail according to application by JIS Z 9110 (General rules of recommended lighting levels): 2011 referred from CIE (Commission Internationale de I'Éclairage) publication 【Table 2】. From viewpoint of retrofitting an incandescent lamp to self-ballasted LED-lamp, higher energy conservation efficient products shall be selected with satisfying color rendering properties required by usage environment.

Average Ra of shipment record in FY2011 were 72 for category 1, 78 for category 2, 75 for overall average, and Ra of top runner value were 80 for both category 1 and category 2. The Ra 90 products alone were extremely high comparing other products. However, shipment rate is extremely small, since the products were shipped by one company.

Since products above Ra 90 shall be excluded from the scope, classification of color rendering properties category shall not be set.

Table 2 Indication division of color rendering properties

Level	Range of Ra	Application example	
		Recommendation	Allowance
1A	90≦Ra	Color matching, Clinical therapy, Art gallery	-
1B	80≦Ra<90	House, Hotel, Restaurant, Premises, Office, School, Hospital, Printing, Paint and textile factory, Shop work with severe requirement	-
2	60≦Ra<80	Shop work	Office, School
3	40≦Ra<60	Rough work	Shop work
4	10≦Ra<40	-	Passage (not corridor), storeroom

Source: CIE 29.2 "Guide On Interior Lighting 2nd ed."

3. Summary of classifications

Based on the ideas stated in paragraph 2 above, the categories are made as per Table 3 below.

Table 3 Categories of Self-ballasted LED-lamps

Category	Light Source Color
1	Daylight color, Neutral white color, White color
2	Warm white color, Lamp color

Target Standard Values for Self-ballasted LED-lamps

1. Basic idea

Target standard values are set based on the idea of Top Runner method. The specific ideas are as follows.

1) Target standard values shall be set for every category that has been defined appropriately.

2) As for categories where technological advances in the future are expected to improve the performance of products, target standard values shall allow for improvement as much as possible.

3) Target standard values shall not conflict with each other among categories.

2. Specific technologies for improving energy consumption efficacy

(1) Technical improvement in structural area

Since technology in structural area of self-ballasted LED-lamp greatly utilizes established technology in the compact fluorescent lamp, we can not expect significant technology improvement. However, approximately 2 ~ 3 % improvement would be possible to achieve by improvement of heat release technology to prevent temperature increase around element joint parts, and technical improvement of optical diffusion cover to reduce light loss in the lamp.

Therefore, total efficiency from input electricity to light flux would be improved from approx. 70 % to approx.73 %.

Additionally, since recent technical developments such as downsizing of equipment, wide light distribution, and high color rendition based on market needs are trade-off relation with energy consumption efficacy improvement, we can hardly expect for energy consumption efficacy improvement.

(2) Technological improvement for LED package performance

Energy consumption efficacy improvement would greatly depend on technical improvement of package performance. Especially regarding to chips, approximately 1 ~ 4 % would be improved with improvement of chip internal quantum efficiency and electric resistance reduction of chip content.

Table 1. Technological improvement room for self-ballasted LED-lamps

| Example of technological area	Example of improvement	Improvement of efficacy (estimation)
Structural performance	1. Improvement of heat release technologies to prevent temperature increase from element joint parts · Housing material: Improvement of heat conductivity · Fin configuration: Fin interval, Improvement of surface area · Total length: Modification of length 2. Improvement of apparatus efficiency technologies to reduce light loss at diffusion cover · Optimization of configuration and area · Improvement of permeation of diffusion material · Optimization of arrangement of structural parts and diffusion characteristics	Improve approx. 2 ~ 3 % (common in category 1 and 2)
LED package performance (LED Luminous efficacy)	· Improvement of internal quantum efficiency of chip emission layer (improvement of reunion probability between positive hole and electron) · Reduction of electric resistance in chip (improvement by reduction of forward voltage Vf) · Improvement of light emitting efficiency (by totally reduction of reflection loss and absorption)	Improve approx. 1 ~ 4 % (differs with category)

Diffusion cover

LED Package

Heat release housing

Lighting circuit

Fig. 1 Self-ballasted LED-lamp

Resin cover

Fluorescent material

LED Chip (Fig. 3)

Fig. 2 LED package

Blue light

Current

Electrode pad (anode)

Transparent electrode

p-GaN

p-AlGaN

Emission layer
InGaN

n-GaN

Electrode pad
(cathode)
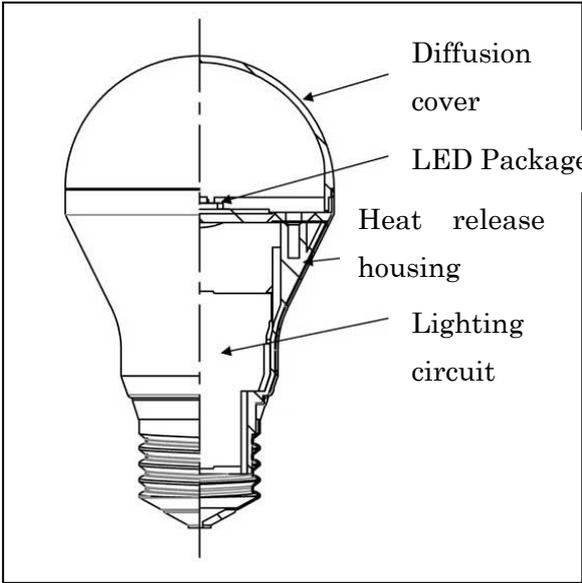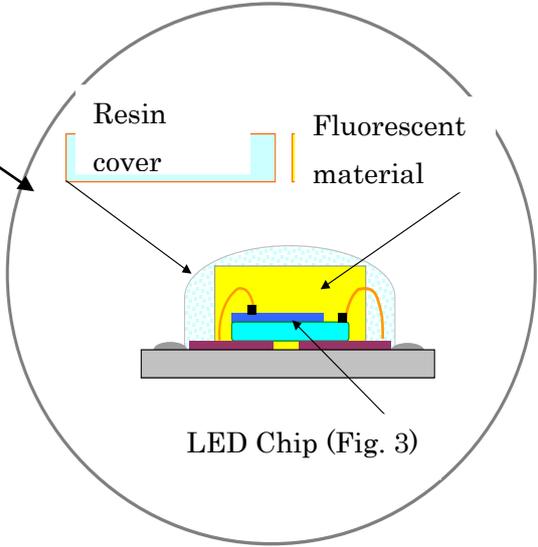
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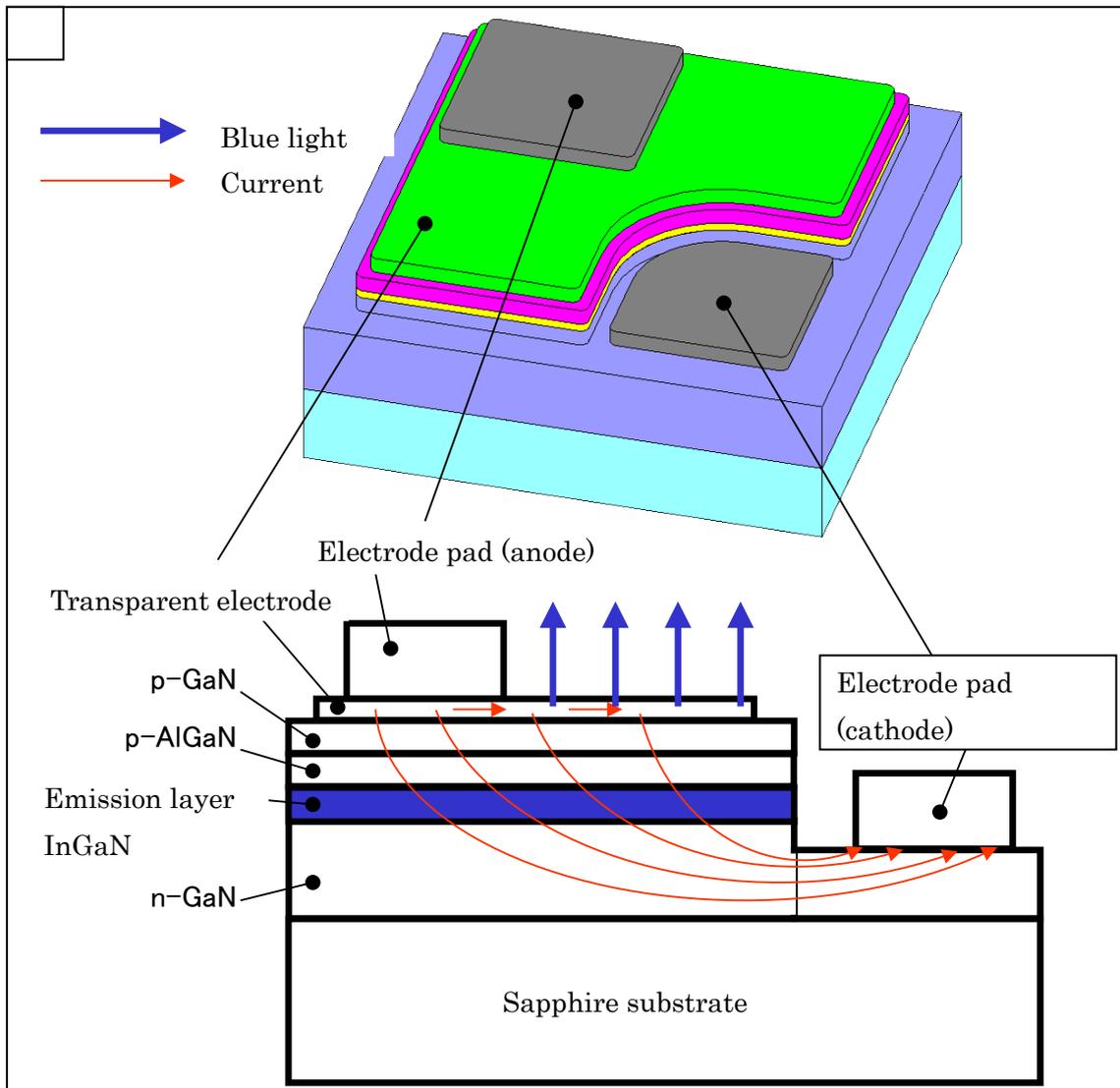
Fig. 3 LED Chip

3. Specific target standard values

Target standard values are set based on the technological improvements at structural area and package performance as described previously from Top Runner value.

In particular, efficacy of the package shall be estimated from Top Runner based on total efficacy (approx. 70 %), and the target standard value shall be set considering total efficacy (approx. 73 %) based on technological improvement of the package (approx. 1 ~ 4 % improvement) from the efficacy and technological improvement of structural area.

(1) Target standard value of Category 1

Target standard value of Category 1 (110.0 lm/W) shall be estimated to be 149.1 lm/W with package efficacy based on total efficacy (approx. 70 %) from top runner value (104.4 lm/W) in basic fiscal year.

The package efficacy of target standard would be 150.0 lm/W with considering package technical improvement (approx. 1 %) from package efficiency (149.1 lm/W).

The target standard values of Category 1 shall be set considering the technological improvements at structural area (approx. 73 %) from package efficacy of target standard value (150.0 lm/W).

(2) Target standard value of Category 2

Target standard value of Category 2 (98.6 lm/W) shall be estimated to be 130.1 lm/W with package efficacy based on total efficacy (approx. 70 %) from top runner value (91.1 lm/W) in basic fiscal year.

The package efficacy of target standard would be 135.0 lm/W with considering package technical improvement (approx. 4 %) from package efficacy (130.1 lm/W).

The target standard values of Category 2 shall be set considering the technological improvements at structural area (approx. 73 %) from package efficacy of target standard value (135.0lm/W).

Table 2 Target standard values of Self-ballasted LED-lamps

Category	Light Source Color	Target Standard Value [lm/W]
1	Daylight, Neutral white, White	110.0
2	Warm white, Lamp color	98.6

Category	Light Source Color	Color Rendering index Ra	[Basic Year] Weighted Average Efficacy	[Basic Year] Top Runner Value (lm/W)	[Target Fiscal Year] Target Standard Value (lm/W9	Improved Ratio from Top Runner Value (%)	Improved Ratio from Weighted Average Efficacy
1	Daylight, Neutral white,	90 or more	-	-	87.8	-	-
2	White	Less than 90	77.1	104.4	110.0	5.4	42.7
3	Warm white,	90 or more	-	-	79.0	-	-
4	Lamp color	Less than 90	61.3	91.1	99.0	8.7	61.5

Energy consumption efficiency
(lm/W)

Target standard value 110.0

Top value 104.4

2011 FY
Weighted average value
(Category 1) 77.1

2011 FY Shipment record (Category 1)

Average color rendering index (Ra)

Fig. 2 Distribution of energy consumption efficiency of Category 1

Energy consumption efficiency
(lm/W)

Target standard value 98.6

Top value 91.1

2011 FY Weighted average value
(Category 2) 61.3

2011 FY Shipment record (Category 2)

Average color rendering index (Ra)
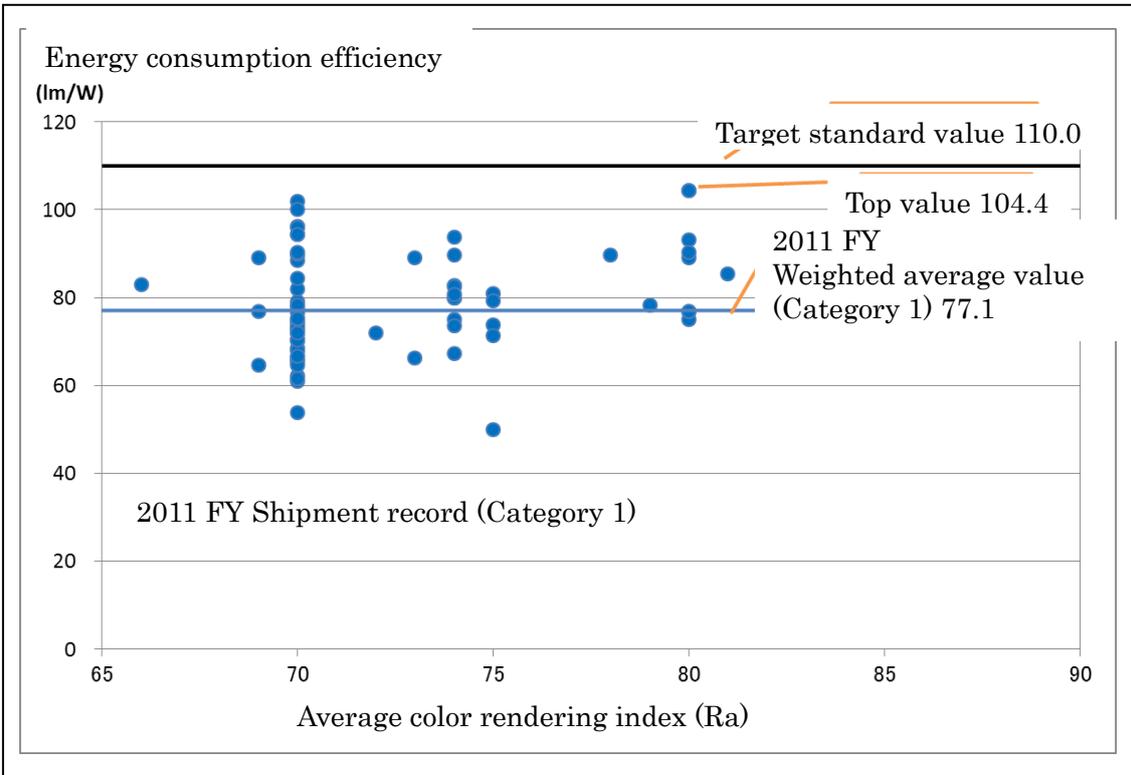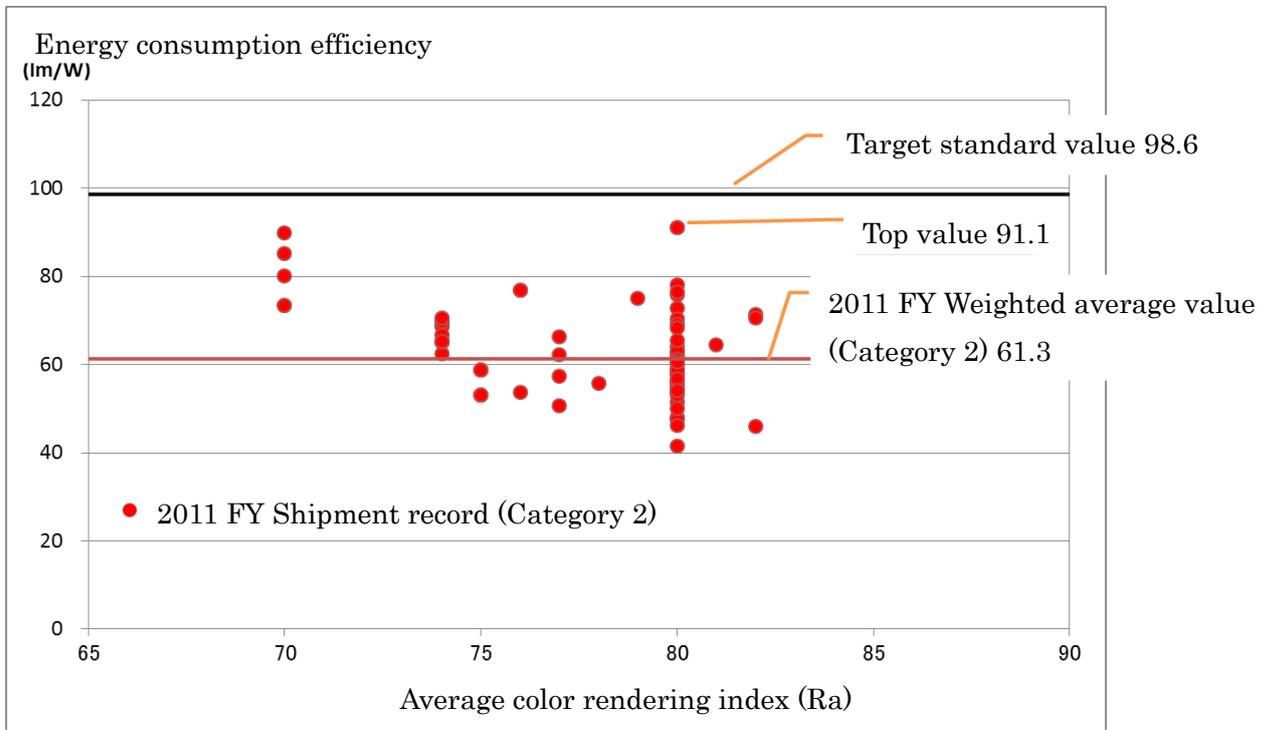
Fig. 3 Distribution of energy consumption efficiency of Category 2

Energy Consumption Efficacy and its Measuring Method
of Self-ballasted LED-lamps

1. Basic idea

The energy consumption efficacy of Self-ballasted LED-lamp shall be the total luminous flux per consumed power [lm/W], since it is reasonable to adopt the brightness quantity of Self-ballasted LED-lamps as index.

The energy consumption efficacy measurement shall be done by reliable testing laboratory qualified by JIS measurement.

2. Specific energy consumption efficacy and its measuring method etc. of Self-ballasted LED-lamps

(1) Energy consumption efficacy

The energy consumption efficacy of self-ballasted LED-lamps shall be calculated by dividing total luminous flux [lm] of self-ballasted LED-lamps by consumed power [W] of self-ballasted LED-lamps.

$$\text{energy consumption efficacy [lm/W]} = \frac{\text{total luminous flux [lm] of self-ballasted LED-lamps}}{\text{consumed power [W] of self-ballasted LED-lamps}}$$

(2) Method for measuring energy consumption efficacy

Total luminous flux measuring method of self-ballasted LED-lamps shall be by measuring method of total luminous flux specified in JIS C 7801. Consumed power measuring method of self-ballasted LED-lamps shall be by measuring method of consumed power specified in JIS C 8157.

(3) Practical use of Accredited Testing Laboratory Operator system
① Discrepancy issue between published value and actual measurement value
According to the investigation by JLMA (Japan Lighting Manufacturers Association) (see separate report), there exist products exceeding acceptable range established by JIS C 8157 between declared value by manufacturer and actual measurement value.

One of the factors is considered to be difficulty of measurement of total luminous flux [lm]. Excellent engineers having sufficient technology and knowledge to find error (uncertainty) caused from measurement are required to implement correct measurement. However, because of increased participation of new entry of organizations which do not have such engineers by market expansion, measurement results with discrepancy are possible to be used as declared value directly. Therefore, products with discrepancy between the published value and the actual measurement value are possible to spread in the market.

②In order to resolve above ① issue, it is necessary to place announcement based on provision of Article 78 paragraph 1 and Article 80 regarding rationalization of energy use ("Standard for judgment, etc. of manufacturers, etc. in regard to performance improvement of self-ballasted LED-lamp" (provisional title)) to JNLA (Japan National Laboratory Accreditation) System based on Japan Industrial Standardization (JIS) Act.

Manufacturers, etc. shall require measurement of total luminous flux and energy consumption to Accredited Testing Laboratory Operator for products selecting from one's own products, and shall indicate the rated value according to JIS C 8157 with own responsibility based on the relevant measurement result.

If the manufacturer, etc. did not indicate the energy consumption efficacy based on the measurement by the Accredited Testing Laboratory Operator, action shall be taken based on provision of Energy Saving Act 81 (Admonishment and order regarding indication).

Result of purchasing investigation regarding Self-ballasted LED-lamps

    JLMA (Japan Lighting Manufacturers Association) had purchased 24 models of 12 companies of Self-ballasted LED lamps during March through July, 2010, and implemented performance measurement after bringing them in the Japan Electrical Safety & Environment Technology Laboratories. There were 12 models which were out of acceptable range (more than 90% of declared value (※)) specified in JIS C 8157(models with boxed companies).

        (※) JIS C 8157 (Self-ballasted LED-lamps for general lighting services > 50 V-Performance requirements) requires that total luminous flux of the Self-ballasted LED-lamp shall be more than 90% of declared value (rated value).

Daylight color, Neutral white color

Total luminous flux (lm)

全光束 [lm]

Published value

Actual measurement value

	A社	B社	C社	D社	F社	G社	H社	I社	J社	K社	L社	M社
Published	520	350	340	560	570	390	400	500	540	520	240	320
Actual	554	372	336	510	509	384	387	386	424	440	188	322
%	103%	106%	99%	91%	89%	99%	97%	77%	79%	85%	78%	101%

Bulb color

Total luminous flux (lm)

全光束 [lm]

Published value

Actual measurement value

	A社	B社	C社	D社	E社	F社	G社	H社	I社	J社	K社	L社
Published	330	270	260	360	350	450	310	250	380	400	430	440
Actual	412	280	225	335	349	458	270	210	296	275	341	207
%	125%	104%	87%	93%	100%	102%	87%	84%	78%	69%	79%	47%
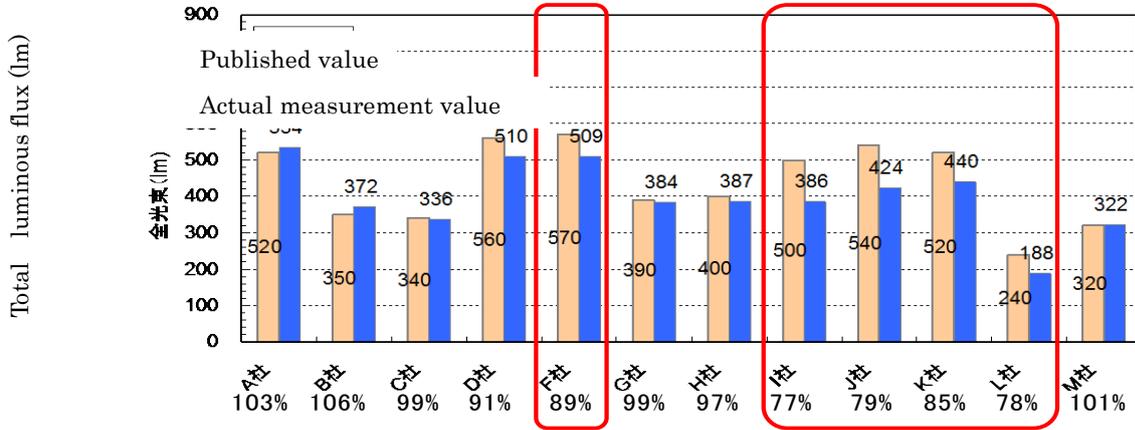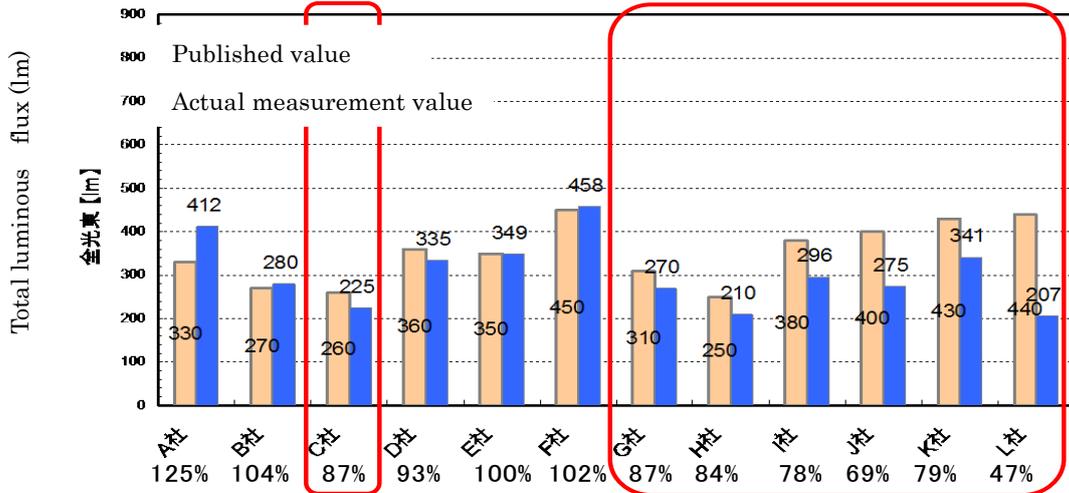
Luminairs, etc. Evaluation Standards Working Group,
Energy Efficiency Standards and New Energy Subcommittee
of the Advisory Committee for Natural Resources and Energy
Meeting History

First Subcommittee Meeting of Energy Saving Standards for Luminairs, etc. Evaluation Standards (November 29, 2012)
- Disclosure of the Luminairs, etc. Evaluation Standards Subcommittee
- Current status around lighting industry
- Scope of Self-ballasted LED-lamp (Draft)
- Energy consumption efficacy of Self-ballasted LED-lamp and its measuring method (Draft)
- Others

First Energy Saving and New Energy Subcommittee, Energy Saving Subcommittee, Luminairs, etc. Evaluation Standards Working Group (July 9, 2013)
- Classification for setting target for Self-ballasted LED-lamp (Draft)
- Target fiscal year and target standard values for Self-ballasted LED-lamp (Draft)
- Interim report (Draft)
- Others

Luminairs, etc. Evaluation Standards Working Group,
Energy Efficiency Standards and New Energy Subcommittee
of the Advisory Committee for Natural Resources and Energy
List of Members

Chairman: Kennchi Akika   Affiliate Professor, The Open University of Japan, Learning Center

Members: Kazuhiro Ookawa   Professor, Applied Physics, Department of Science, Tokyo University of Science

         Katsuo Seda   Executive Advisory Engineer, National Institute of Technology and Evaluation

         Daisuke TanakaSeda

         Yoshiki Nakamura   An Associate Professor, Department of Science and Engineering, Tokyo Institute of Technology

         Masashi Hanagata   Diagnosis・Leading Manager, Energy Conservation Promotion Technology Headquarters, Energy Conservation Center

         Atsushi Honda   Japan Building Mechanical and Electrical Engineers Association (Deputy Representative, Facility Design Department, Nikken Sekkei Ltd.)

         Chiharu Murakoshi   Deputy Director, Jyukankyo Research Institute ink.

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         Tetsuji Takeuchi   Special Advisor, Japan Lighting Manufacturer Association

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