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**Light-exposure and
light-and-water-exposure apparatus
(Enclosed carbon-arc type)**

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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 Testing Machinery Association (JTM)/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 B 7741**:1990 is replaced with this Standard.

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Light-exposure and light-and-water-exposure apparatus (Enclosed carbon-arc type)

1 Scope This Japanese Industrial Standard specifies the light-exposure and light-and-water-exposure apparatus (enclosed carbon-arc type), (hereafter referred to as “testing machines”), to be used for the tests of light resistance⁽¹⁾ and weather resistance⁽²⁾ of various industrial materials and products.

Warning

Because the lights emitted from the emission part of this testing machine contain a large amount of ultraviolet rays, when observing the inside of a testing tank by necessity during the test operation, great care shall be taken to safety by using spectacles of ultraviolet insulating glass etc. (see table 5).

Notes ⁽¹⁾ Properties of resistance to physical and chemical changes of substances that are caused when subjected to light irradiation.

⁽²⁾ Properties of resistance to physical and chemical changes of substances that are caused when subjected to not only light irradiation but also heat, temperature, humidity, wind and rain, etc.

NOTE : The light-exposure apparatus refers to a testing machine capable of irradiating artificial light source which resembles solar light in order to examine properties of a part of light resistance in a short time. The light-and-water-exposure apparatus refers to a testing machine capable of intermittent water spraying as well as irradiation of artificial light source which resembles solar light in order to examine the properties of a part of weather resistance in a short time.

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 1102-2 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 2: Special requirements for ammeters and voltmeters*

JIS G 3442 *Galvanized steel pipes for ordinary piping*

JIS G 3459 *Stainless steel pipes*

JIS G 4305 *Cold-rolled stainless steel plate, sheet and strip*

JIS H 3100 *Copper and copper alloy sheets, plates and strips*

JIS H 4000 *Aluminium and aluminium alloy sheets, strips and plates*

JIS K 6742 *Unplasticized poly (vinyl chloride) (PVC-U) pipes for water supply*

JIS K 6762 *Double wall polyethylene pipes for water supply*

JIS K 7200 *Standard reference test specimens for calibrating a laboratory light exposure apparatus*

JIS K 7363 *Plastics—Instrumental determination of radiant exposure in weathering tests—General guidance and basic test method*

JIS L 0841 *Test methods for colour fastness to daylight*

JIS Z 8703 *Standard atmospheric conditions for testing*

JIS Z 8722 *Methods of colour measurement—Reflecting and transmitting objects*

3 Term and definition For the purpose of this Standard, the following term and definition apply.

- a) **black panel temperature** the temperature which the black panel thermometer attached to a rack or a drum indicates, which represents the surface temperature of a test piece

4 Classification The testing machines are classified into those with the spray device and those without, as shown in the following.

- a) Enclosed carbon-arc type light exposure apparatus (hereafter referred to as “type F”)
- b) Enclosed carbon-arc type light-and-water-exposure apparatus (hereafter referred to as “type W”)

Principle specifications of these two types of testing machines shall be in accordance with table 1.

Table 1 Principle specifications of testing machines

Classification	Number of lamps of emission part	Test piece holding device	Spray device	Blast mechanism	Temperature regulation	Humidity regulation
Type F	1	Rack system	Without	Intermittent or continuous blast type	With	Automatic control type or a moisture absorption cloth type (hereafter referred to as “wick”).
Type W ⁽³⁾	2	Drum system	With	Intermittent or continuous blast type	With	Automatic control type or without

Note ⁽³⁾ There is also a type W machine in which one of the two lamps is removed and the other suspended in the middle, and the drum is replaced with the rack for type F machine. It is capable of conducting the light resistance test without actuating the spray device and drum cooler.

5 Performance

5.1 Light irradiation The light irradiation of the testing machine shall be as follows.

- a) **Spectral characteristics of emission part** The carbon-arc lamp shall emit the light having the specified rising edge by combination with the glass globe given in table 3 under the conditions given in table 2. An example shall be as shown in informative attached figure 1.

Table 2 Conditions of emission part

Item	Condition
Type of emission part	Enclosed type
Number of lights	1 (type F) or 2 (type W)
Voltage and current of arc	A.C. voltage
	Permissible range 125 V to 145 V
	Central value 135 V ($\pm 2\%$)
	A.C. current
	Permissible range 15 A to 17 A
	Central value 16 A ($\pm 2\%$)
	provided that the input voltage is constant.

Table 3 Specification of glass globe

Item	Specification
Spectral transmissivity before use	2 % max. at 275 nm 90 % min. at 400 nm to 700 nm
Expansion ratio	Approx. $3 \times 10^{-6} \text{K}^{-1}$
Total duration	2 000 h

- b) **Irradiance on test piece surface**⁽⁴⁾ The type F machine shall have the irradiance of $500 \text{ W/m}^2 \pm 100 \text{ W/m}^2$ (wavelength range 300 nm to 700 nm) [the value when the central value of voltage and current of arc of table 2 is taken as the reference] at the position of surface of test piece holder of rack or at the position of $254 \text{ mm} \pm 1 \text{ mm}$ from the centre of arc in the horizontal direction. For the type W machine, two carbon arc lamps having this irradiance shall be used. The value of irradiance shall be described in the inspection records etc. at the time of shipment.

In addition, the measurement method shall be as specified in Annex.

Note (4) As given under the conditions of table 2.

5.2 Temperature and humidity

5.2.1 General The temperature and humidity shall be indicated by the reading obtained on the black panel thermometer when the ultraviolet carbon arc lamp is on and the relative humidity near the air outlet of the testing vessel, respectively.

5.2.2 Temperature (black panel temperature) The temperature shall be as follows.

- a) **Setting capable range** 60°C to 70°C or 60°C to 93°C .
- b) **Fluctuation allowable range** The range shall be $\pm 3^\circ\text{C}$ of the set value 63°C , when the ambient air condition is the standard temperature 23°C Class 5 ($23^\circ\text{C} \pm 5^\circ\text{C}$) specified in **JIS Z 8703**, and in the case of type W machine, when the water temperature is 20°C or less.

5.2.3 Humidity The humidity shall be as follows.

- a) For the automatic control type, the relative humidity shall be $(50 \pm 5) \%$.
- b) For the wick type (non-control type), the relative humidity shall be approximately 20 % to 50 %. When the ambient humidity is the standard condition humidity 65 % Class 10 $[(65 \pm 10) \%]$ specified in **JIS Z 8703** and the black panel temperature is $63^\circ\text{C} \pm 3^\circ\text{C}$.

5.3 Spraying to the test piece surface The spraying to the test piece surface shall be as follows.

- a) **Method of irradiation and spraying** At least the following three ways shall be possible.
 - 1) 120 min cycle: 102 min irradiation, followed by 18 min irradiation and spray⁽⁵⁾
 - 2) 60 min cycle: 48 min irradiation, followed by 12 min irradiation and spray⁽⁵⁾
 - 3) Without spray: only irradiation.

Note (5) Cycle which begins with irradiation or spraying and ends with irradiation should also be possible.
- b) **Spray pressure and spray water volume** The spray water volume shall be $0.53 \text{ L} \cdot \text{min}^{-1} \pm 0.10 \text{ L} \cdot \text{min}^{-1}$ per nozzle, under the spray pressure 0.1 MPa. This may be changed upon agreement between the purchaser and the supplier.

6 Construction and materials

6.1 Construction The testing machine shall consist of a testing tank, emission part installed at the centre of the testing tank, arc stabilizer, test piece holding device, spray device for spraying to the test piece surface, drum cooler, thermoregulator, humidity regulator⁽⁶⁾ and instrumentation appliances. An example of testing machine is shown in informative attached figure 2.

Note (6) If equipped.

6.2 Testing tank The testing tank shall be as follows.

- a) **Construction** The testing tank is for irradiating light to, or irradiating light and spraying water to the test piece. It is provided with an emission part, a rack or drum, and is capable of regulating the temperature or temperature and humidity, and in the case of a type W machine, it has a spray nozzle built in.
- b) **Materials** The material of the inner wall of testing tank shall be SUS 304 specified in **JIS G 4305** or any material with at least the equivalent corrosion resistance to this or that which has been given corrosion-resistant treatment.

6.3 Emission part The emission part is a carbon arc lamp of a.c. burning to generate arc in the inside of an enclosed glass globe and consists of a carbon, glass globe, arc current (or voltage) regulator, carbon holder, etc. The summary is shown in informative attached figure 3.

- a) **Carbon** For carbon rods to be used in the testing machine a cored carbon rod and a coreless carbon rod, connected vertically, are used in pair. The ash content shall be 3 % max. for cored carbon rods and 0.5 % max. for coreless carbon rods.

Information : Normally, 48-hour carbons for upper part, with core, and approximately 115 mm in length and 23 mm in outside diameter, and 48-hour carbons for lower part, without core, and approximately 105 mm length and 18.5 mm in outside diameter are used. 20-hour or 24-hour carbons for upper and lower part approximately 305 mm in length and 13 mm in outside diameter are also available.

- b) **Glass globe** A filter made of heat resistant glass having the purpose to enclose the carbon arc.

The specification of glass globe is given in table 3, and the shape of glass globe is shown in informative attached figure 4.

- c) **Arc current (or voltage) regulator** A device to generate arc, to regulate automatically the position of upper part carbon corresponding to variation of the current (or voltage), and to maintain the arc current (or voltage) at the specified value. It shall endure the influence of heat and ash content of the arc.

- d) **Carbon holder** There are carbon holders for upper part carbon and lower part carbon. They shall be capable of fixing the carbons securely, shall be made of metal materials with excellent heat and corrosion resistance, and shall be constructed such that it is free from heat deformation.

6.4 Arc stabilizer An arc stabilizer is a device to hold the arc stable continuously. It consists of a resistor, choke transformer, magnetic leakage transformer, that are installed in the arc circuit. Further, it is equipped with an arc current regulator to enter the arc current consistently in the specified range relative to the variation of input current.

6.5 Thermoregulator The thermoregulator shall be as follows.

- a) **Construction** The thermoregulator is for regulating the air temperature within the testing tank to maintain the black panel thermometer indication constant by means of a blast mechanism which is activated by a thermoregulator and shall be provided with an air deflector or a mechanism having equivalent performance to this. The blast mechanism shall be either of the following.

- 1) **Intermittent blast type** This type of blast mechanism regulates the temperature by activating the blower upon the signal from the thermoregulator, and exhausts air inside the test tank from the upper part of the testing tank. It should be provided with a dust prevention air filter at the outer air inlet, as required.
- 2) **Continuous blast type** This type of blast mechanism regulates the temperature through continuous operation of a blower, its air regulating valve being automatically controlled by the signal from the thermoregulator. It should be provided with a dust prevention air filter at the outer air inlet, as required.