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Series 4
Série des 4

WITHDRAWAL

March 2019

Selected standards in the series Textiles

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Mars 2019

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CAN/CGSB-4.2

Textile test methods

No. 4.5-M86

Retail packages of yarn — Determination of mass (ICS 59.080.20)

No. 5.2-M87

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No. 9.2-M90

Breaking strength of fabrics — Grab method **—** Constant-time-to-break principle (ICS 59.080.30)

No. 9.3-M90

Breaking strength of high-strength fabrics — Constant-time-to-break principle (ICS 59.080.30)

No. 9.4-M91

Breaking strength of yarns — Single strand method (ICS 59.080.20)

No. 9.5-M89

Breaking strength of yarns — Skein method (ICS 59.080.20)

No. 9.6-93

Breaking strength of nonwoven textiles (ICS 59.080.30)

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Bobines de fil vendues au détail — Détermination de la masse (ICS 59.080.20)

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Masse linéique du fil en unités SI (ICS 59.080.20)

Nº 9.2-M90

Résistance à la rupture des tissus — Méthode d'arrachement — Principe de rupture à temps constant (ICS 59.080.30)

Nº 9.3-M90

Résistance à la rupture des tissus de haute résistance — Principe de rupture à temps constant (ICS 59.080.30)

Nº 9.4-M91

Résistance à la rupture des fils — Méthode à fil simple (ICS 59.080.20)

Nº 9.5-M89

Résistance à la rupture des fils — Méthode de l'écheveau (ICS 59.080.20)

Nº 9.6-93

Résistance à la rupture des non-tissés (ICS 59.080.30)

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No. 23-M90

Colourfastness to perspiration (ICS 59.080.01)

No. 25.2-M89

Dimensional change of textile fabrics to open-head steaming (ICS 59.080.30)

No. 26.1-M88

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No. 26.5-M89

Water resistance — High-pressure penetration test (ICS 59.080.30)

No. 28.2-M91

Resistance to micro-organisms — Surface-growing fungus test — Pure culture (ICS 59.080.01)

No. 28.4-M91

Resistance to micro-organisms — Fungus damage test — Pure culture — Qualitative (ICS 59.080.01)

No. 30.1-M89

Effect of solvents on the permanence of textile finishes (ICS 59.080.01)

No. 32.1-98

Resistance of woven fabrics to seam slippage (ICS 59.080.01)

Nº 10-M87

Allongement (ICS 59.080.30)

Nº 23-M90

Solidité de la couleur à la sueur (ICS 59.080.01)

Nº 25.2-M89

Changement dimensionnel des textiles à l'aide d'une presse à plateau inférieur vaporisant (ICS 59.080.30)

Nº 26.1-M88

Résistance à l'eau — Essai de pénétration sous pression constante (ICS 59.080.01)

Nº 26.5-M89

Résistance à l'eau — Essai de pénétration à haute pression (ICS 59.080.30)

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Résistance aux micro-organismes — Essai par fongus se propageant en surface — En culture pure (ICS 59.080.01)

Nº 28.4-M91

Résistance aux micro-organismes — Évaluation des dommages causés par fongus — En culture pure — Qualitative (ICS 59.080.01)

Nº 30.1-M89

Effet des solvants sur la permanence des apprêts textiles (ICS 59.080.01)

Nº 32.1-98

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No. 35.1-M90

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Fabric thickness (ICS 59.080.30)

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No. 60-M89

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Determination of strength of bonds of bonded, laminated and fused fabrics (ICS 59.080.10)

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Étoffes — Détermination de l'auto-défroissabilité d'un spécimen plié horizontalement par mesurage de l'angle rémanent après pliage (ICS 59.080.01)

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Résistance des textiles à la diffusion de vapeur d'eau (ICS 59.080.01)

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Nº 56.1-M87

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No. 66-M91

Dimensional change and appearance after dry cleaning of coated, bonded, laminated and fused fabrics (ICS 59.080.40)

Nº 66-M91

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No. 69-M91

Weather resistance — Xenon arc radiation (ICS 59.080.10)

Nº 69-M91

Résistance aux intempéries — Rayonnement d'une lampe à arc au xénon (ICS 59.080.10)

No. 78.1-2001

Thermal protective performance of materials for clothing (ICS 59.080.01)

Nº 78.1-2001

Évaluation de la protection thermique des matériaux de confection des vêtements (ICS 59.080.01)

CAN/CGSB-4.155-M88

Flammability of soft floor coverings — Sampling plans (ICS 59.080.60)

CAN/CGSB-4.155-M88

Résistance à l'inflammation des revêtements de sol mous — Plans d'échantillonnage (ICS 59.080.60)

CAN/CGSB-4.158-75

Designation of yarns (ICS 59.080.20)

CAN/CGSB-4.158-75

Désignation des fils (ICS 59.080.20)

CAN/CGSB-4.159-75

Universal system for designating linear density (Tex system) (ICS 59.080.20)

CAN/CGSB-4.159-75

Système universel de désignation de la masse linéique (système Tex) (ICS 59.080.20)

CAN/CGSB-4.160-75

Integrated conversion table for replacing traditional yarn numbers by rounded values in the Tex system (ICS 59.080.20)

CAN/CGSB-4.160-75

Table générale de conversion pour le remplacement des titres traditionnels des fils par des valeurs arrondies du système Tex (ICS 59.080.20)

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Textile test methods

Weather resistance — Xenon arc radiation

ICS 59.080.10

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NATIONAL STANDARD OF CANADA

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Textile test methods

Weather resistance — Xenon arc radiation

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE.

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Preface to the National Standard of Canada

This National Standard of Canada has been extended and reaffirmed by the CGSB Committee on Textile Test Methods and Terminology. Editorial changes have been made by the addition and correction of the following paragraphs:

FOREWORD

This method is similar to the exposure procedures described in AATCC Test Method 169-1987 of the American Association of Textile Chemists and Colorists. A new edition of AATCC Test Method 169 was published in 2009.

11.1 **Source of Referenced Publication** — The publication referred to in par. 3.1.1 may be obtained from the Canadian General Standards Board, Sales Centre, Gatineau, Canada K1A 1G6. Telephone 819-956-0425 or 1-800-665-2472. Fax 819-956-5740. E-mail ncr.cgsb-ongc@tpsgc-pwgsc.gc.ca. Web site www.tpsgc-pwgsc.gc.ca/ongc-cgsb.

National Standard of Canada

CGSB Ottawa Canada K1A 1G6	TEXTILE TEST METHODS	CAN/CGSB-4.2
	Weather Resistance — Xenon Arc Radiation	No. 69-M91

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FOREWORD

This method is similar to the exposure procedures described in AATCC Test Method 169-1987 of the American Association of Textile Chemists and Colorists.

1. PURPOSE AND SCOPE

1.1 This method provides a procedure for the exposure of textile materials of all kinds, including coated fabrics and products made thereof, in an artificial weathering apparatus using a xenon arc lamp and controlled conditions of test. This method includes procedures for both controlled wetting and no wetting of the specimen.

1.2 The resistance to weathering of any property of the fabric may be determined by testing the exposed fabric in accordance with the appropriate test method.

1.3 If the degree of change in a property due to weathering is required, fabric must be tested both before and after exposure in the weathering apparatus.

1.4 The method provides the option of four specific weathering cycles with combinations of light, dark and light, and spray. Other cycles may be used if agreed upon by parties concerned.

1.5 The testing and evaluation of a product against this method may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this method has the responsibility to consult the appropriate authorities to establish appropriate health and safety practices in conjunction with any existing applicable regulatory requirements prior to its use.

2. PRINCIPLE

2.1 Samples of the textile material to be tested and the agreed upon standard for comparison are exposed simultaneously to xenon lamp radiation under specified conditions. After exposure, the resistance to weathering of a specific sample property is determined.

3. APPLICABLE PUBLICATION

3.1 The following publication is applicable to this method:

3.1.1 Canadian General Standards Board (CGSB)

CAN/CGSB-4.2-M — Textile Test Methods:

Standard for individual property as required.

3.2 Reference to the above publication is to the latest issue, unless otherwise specified by the authority applying this method. The source for this publication is shown in the Notes section.

4. TERMINOLOGY

4.1 **Irradiance, n.:** radiant power as a function of wavelength.

4.2 **Irradiance, total, n.:** radiant energy integrated over all wavelengths at a point in time, expressed in watts per square meter (W/m^2).

4.3 **Irradiation, n.:** the time integral of irradiance, expressed in joules per square metre (J/m^2).

4.4 **Radiant energy, n.:** energy travelling through space in the form of photons or electromagnetic waves of various lengths.

4.5 **Spectral energy distribution, n.:** the variation of energy due to the source over the wavelength span of the emitted radiation.

4.6 **Weather resistance, n.:** ability of a material to resist degradation of its properties when exposed to climatic conditions.

5. APPARATUS

5.1 **Weathering Chamber** — The exposure apparatus uses a long-arc xenon lamp as the source of irradiance. Different size xenon lamps operate in different wattage ranges in several sizes and types of apparatus. The various models of exposure apparatus, the diameter of the specimen rack, size and wattages of the xenon lamps are varied (Notes 1 and 2).

5.1.1 ***Type 1 — Water-Cooled Test Apparatus (see Appendix A)*** — A water-cooled system, available in three test chamber sizes and various wattage capacities, and found suitable for use with this test method as follows:

5.1.1.1 Test chamber type 1A, a xenon lamp type artificial weathering apparatus, consists of a water-cooled xenon lamp (long arc) radiant energy source positioned at the central axis of a 96 cm diameter vertical specimen rack.

5.1.1.2 Test chamber type 1B, a xenon lamp type artificial weathering apparatus, consists of a water-cooled xenon lamp (long arc) radiant energy source positioned at the central axis of a 64.8 ± 0.3 cm diameter inclined specimen rack.

5.1.1.3 Test chamber type 1C, a xenon lamp type artificial weathering apparatus, consists of a water-cooled xenon lamp (long arc) radiant energy source positioned at the central axis of a 51 ± 0.3 cm diameter vertical specimen rack.

5.1.2 ***Type 2 — Air-Cooled Test Apparatus (see Appendix A)*** — An air-cooled system, available in two test chamber sizes and various wattage capacities.

5.1.2.1 Test chamber type 2A, a xenon lamp type artificial weathering apparatus, consists of three air-cooled xenon lamps (long arc) as a radiant energy source positioned within a 61 ± 0.3 cm diameter vertical specimen rack to provide a specified spectral energy distribution.

5.1.2.2 Test chamber type 2B, a xenon lamp type artificial weathering apparatus, consists of an air-cooled xenon lamp (long arc) as a radiant energy source positioned at the central axis of a 15.7 ± 0.3 cm diameter vertical specimen rack to simulate a specified spectral energy distribution.

5.2 **Black panel thermometer** (See Appendix A and Note 1).

5.3 **Standards for Comparison** — Standards for comparison must be determined and agreed upon by the concerned parties. The standards can be any suitable textile material where a history of the rates of strength degradation or colour change is known. Standards must be exposed simultaneously with the test specimen. The standard used with water spray options must not show any character change as a result of the water spray.

5.3.1 The use of the standard is to determine time-to-time equipment and test procedure variations. If test results of the exposed standards differ by more than 10% from the known standard data, thoroughly review the test machine operating conditions, and correct any malfunctions or defective parts. Then, repeat the test. If the data still differ by

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Note 1: Test apparatus is available from J.B. Atlas Co., 9 Canso Drive, Rexdale, Ontario, Canada M9W 4L9; Suga Test Instrument Co., 4-14 Shinjuku 5-chome, Tokyo 160, Japan; and Heraeus Inc., 24 Union Hill Industrial Park, West Conshohocken, PA 19428, U.S.A.

Note 2: The decision as to which machine type to use should be agreed upon by the parties concerned based on their historical data and experience. There may be distinct differences in spectral distribution, water spray application, air and humidity sensor location, and test chamber size between weathering test machines supplied by different manufacturers that can result in differences in reported test results. Consequently, data obtained from machines supplied by different manufacturers and different size test chambers and xenon lamps cannot be used interchangeably unless a mathematical correlation has been established and agreed upon by the parties concerned.

more than 10% from the known data and there is no evidence of machine malfunction, then the standard should be questioned and re-evaluated.

6. TEST SPECIMENS

6.1 Specimens of both the sample under test and the standard for comparison shall be of a size adequate to perform the required tests and shall be representative of the sample as a whole.

7. WEATHERING CYCLES

7.1 The nature of the test material contributes to the selection of the appropriate test cycle with respect to ultraviolet exposure, wetting, wet time and temperature. The following weathering cycle options are acceptable.

7.1.1 ***Option 1*** — This cycle has been used to approximate a semi tropical climate such as found in South Florida: 120 min cycle, 90 min light only, alternating with 30 min light and water spray, black panel temperature 77 ± 3°C, relative humidity 70 ± 5% in the light only portion of the cycle.

7.1.2 ***Option 2*** — This cycle has been used to approximate a semi tropical climate such as found in South Florida when appropriate machine water supply is restricted: 120 min cycle, 60 min light only, alternating with 60 min dark, black panel temperature 77 ± 3°C, relative humidity 70 ± 5% in the light only portion of the cycle, no water spray.

7.1.3 ***Option 3*** — This cycle has been used to approximate a semi-arid climate such as found in Phoenix, Arizona: light on cycle, continuous light only, no water spray, black panel temperature 77 ± 3°C, relative humidity 27 ± 3%.

7.1.4 ***Option 4*** — This cycle has been used to approximate a temperate climate such as found in Columbus, Ohio: 120 min cycle, 102 min light only, alternating with 18 min of light and water spray, black panel temperature 63 ± 3°C, relative humidity 50 ± 5% in the light only portion of the cycle.

7.2 The use of these cycles does not imply, expressly or otherwise, an accelerated weathering test. This test method is not restricted to the use of these cycles. Other cycles may be agreed upon by the concerned parties.

8. PREPARATION OF TEST APPARATUS

8.1 The following safety precautions should be observed at all times.

8.1.1 Do not operate the test equipment until the manufacturer's operating instructions have been read and understood. It is the responsibility of whomever operates the test equipment to conform to the manufacturer's directions for safe operation.

8.1.2 The test equipment contains high intensity lamps. The door of the test machine must be kept closed whenever it is running.

8.1.3 Before servicing xenon lamps, allow 30 min cool-down after test machine is shut down.

8.1.4 When servicing the test machine, shut off both the off switch on the front panel and the main power disconnect switch. Insure that the main power indicator light on the machine front panel goes out.

8.2 If possible, install the test apparatus in a room where temperature and relative humidity are controlled to minimize the effects of air supply variations.

8.3 Be sure that the test apparatus is calibrated at the start of each test, that filters are clean and that the wattage is within the limits specified by the manufacturer.

8.3.1 For type 1 apparatus, discard outer filters after 2000 h of use and inner filters after 400 h of use. If no automatic light monitoring equipment is available, discard xenon lamp tubes at the manufacturer's recommended time intervals. For type 2A apparatus, discard lamp tubes according to the manufacturer's instructions. For type 2B apparatus, discard filters and lamp tubes according to the manufacturer's instructions.

8.3.2 For type 1 apparatus equipped with automatic light monitor equipment, provision is included to progressively increase wattage of the xenon lamp to minimize changes in the intensity that result with use. When the type 1 apparatus are not equipped with a means to progressively increase wattage with use, increase wattage in steps

according to the manufacturer's instructions for respective wattage rated xenon lamp tubes and the use of borosilicate filters. When wattage is controlled manually, pre-age the xenon lamp and optical filters for 20 h.

8.4 When the apparatus is equipped to monitor specific portions of a continuous spectrum, control the level of irradiance of 0.35 ± 0.01 W/m²/nm band-pass at 340 nm, unless otherwise specified.

8.5 For type 1 apparatus, unless otherwise specified, use borosilicate glass filters that simulate the spectral power distribution of daylight throughout the actinic region. The filter used shall have a transmission of at least 90% between 380 and 750 nm, falling to 0% between 290 and 300 nm.

8.6 For type 2 apparatus, unless otherwise specified, use filter systems recommended by the manufacturer that simulate the spectral power distribution of daylight throughout the actinic region. The filter used shall have a transmission of at least 90% between 380 and 750 nm, falling to 0% between 290 and 300 nm.

8.7 Control irradiation, wetting, relative humidity, air temperature, and black panel temperature, when applicable.

8.8 The black panel sensor unit indicates the absorbed irradiance minus the heat dissipated by conduction and convection. Keep the face of the black panel in good condition. Although it is coated with a high quality finish, when exposed in the weathering apparatus it is subject to deterioration. Therefore, periodically clean and polish it with a high grade automobile wax. Maintain a control black panel unit to periodically check the operating black panel unit for conformance. When an operating black panel unit falls outside the limits established for the test procedure, compared to the control unit, refinish or replace the unit.

8.9 Install a light-on-only program cam, card or other mechanism in the test apparatus. Fill the specimen rack with framed material and the black panel thermometer. The material is used to simulate air flow in the test chamber during the test exposure and should not include the actual test samples. Support the black panel thermometer in the specimen drum or rack in the same manner as the material. When exterior indicators are not available, read the black panel temperature through the window in the test chamber door. Operate and control the test apparatus as defined by the manufacturer. Operate the test apparatus in this mode and adjust the chamber dry and wet bulb temperatures, or chamber thermometer and hygrometer, to provide the required black panel temperature and relative humidity.

8.10 Shut down the test apparatus after operating at the controlled conditions for 60 min. Remove the material from the specimen rack.

9. PROCEDURE

9.1 Install the appropriate program cam, card or other mechanism, for the agreed upon operating cycle (see section 7).

9.2 Mount the test specimens on the specimen rack vertically both above and below the horizontal centre line of the source of radiation. Make sure that all materials are adequately supported and in proper vertical alignment. Any displacement of the material toward or away from the source, even by a small distance, may lead to variation in degradation between specimens. The specimen rack must be filled; extra material is used when the number of specimens being tested is insufficient to fill the specimen rack.

9.2.1 For single strand tests when material length exceeds 23 cm, mount the test specimens on the specimen rack vertically in the horizontal centre line of the source of radiation.

9.3 In the case of woven, knitted, and nonwoven fabrics, ensure that the side directly exposed to the radiant source is that normally used as the face. If for any reason, the face of the material is not exposed, report this fact with the data.

9.4 For test program cycles with water spray, ensure that the water spray strikes the test samples as a fine spray equally distributed over the surface exposed to the radiation. Use F-80 water spray nozzles, or equivalent unless otherwise agreed upon between concerned parties. Use of other water spray nozzle types can result in differences in reported test results. For type 1 instruments, maintain the water pressure at the spray nozzle at 83 to 124 kPa. For type 2 instruments, maintain the water flow rate at each spray nozzle to provide 12 to 18 L/h. Only one side of the specimens shall be exposed to weathering and light. Use deionized, demineralized or distilled water that contains less than 17 ppm of total solids and preferably water of 6 to 8 ppm to reduce deposits on the test specimen. Use water having a pH maintained at 7 ± 1. Use stainless steel or other acceptable water transport lines that will not contaminate the water. Maintain water temperature entering the test chamber at 16 ± 5°C.

9.5 Be sure the wattage and water supply during the test are as specified in the detailed description of the apparatus furnished by the manufacturer. Be sure the program cam, card or other mechanism provides the designated black panel temperature and relative humidity. Monitor exposure test chamber conditions with suitable recorders (optional).

9.6 Operate the test apparatus continually until the selected exposure has been completed. Avoid unnecessary delays when filters or lamps are changed and the exposure period continued, as such delays may contribute to variations in results or lead to errors.

9.7 To ensure uniform total irradiation over the specimen surface, reposition specimens vertically in a sequence which will provide each specimen equivalent exposure periods in each location. Rotate the test samples after each 250 h of exposure. When the exposure interval does not exceed 24 h, locate each sample equidistant from the horizontal axis of the xenon lamp arc. Other test methods of achieving uniform total irradiation may be employed if mutually agreed upon by the concerned parties.

9.8 Replace filters according to manufacturer's instructions, or when pronounced discolouration or milkiness develops, whichever occurs first.

9.9 When applicable, operate the test apparatus on a time cycle of at least a seven day exposure. Some laboratories employ a rest cycle between exposure cycles. In any event, the operating schedule must be reported.

9.10 When the exposure cycle is completed, remove the replicate standard and test specimens from the exposure rack.

9.10.1 If upon removal from the racks, the specimens are wet, dry them without tension at ambient laboratory conditions or at a temperature not exceeding 70°C.

9.11 If the exposure cycle has included a water spray, wet-out the unexposed reference standard (comparison standard) and the retained unexposed original. Treat them under the same conditions of drying and conditioning as the exposed test specimens before property evaluation.

9.12 Conduct the property test, on the exposed fabric in accordance with the agreed upon test method. If the change in the property is to be determined, also conduct the test on the unexposed fabric.

9.13 If required, calculate the change in the property.

9.14 Test the standards for comparison (par 5.3) before and after exposure and determine that the change in property is within 10% of the established norm for these standards.

10. REPORT

Report the following information:

10.1 The average of the property test results after exposure.

10.2 If required, the percent change in property results.

10.3 Whether property degradation of standards for comparison is within 10% of norm for these standards.

10.4 The type of test apparatus.

10.5 The cycle option used.

10.6 The total exposure time.

10.7 The type of water used in spray.

10.8 The number of this method: CAN/CGSB-4.2 No. 69-M91.

11. NOTES

11.1 **Source of Referenced Publication** — The publication referred to in par. 3.1.1 may be obtained from the Canadian General Standards Board, Ottawa, Canada K1A 1G6. Telephone (819) 956-0425 or 956-0426. Fax (819) 956-5644.

DESCRIPTION OF TYPES OF WEATHERING EQUIPMENT

A1. WATER-COOLED LAMPS

A1.1 **Type 1 Instruments** — The xenon lamp has cylindrical inner and outer optical filters to provide a flow of cooling water and to provide a specified spectral energy distribution. The apparatus has the means to progressively increase the wattage of the xenon lamp, either automatically or manually, to minimize the changes in the intensity of the radiation as a result of continued xenon lamp use. The apparatus has a means to recirculate distilled or deionized water past the xenon lamp tube at a flow rate sufficient to remove excess heat. A cartridge demineralizer is installed in the recirculating water line just prior to the xenon lamp. The recirculated water is cooled by means of a heat exchange unit. The apparatus is equipped with water spray nozzles to provide uniform wetting of the specimens. Vaporizing units for adding moisture to the air as it passes through the conditioning chamber prior to its entry into the test chamber are provided. Relative humidity of the air in the test chamber is determined from readings of wet and dry bulb thermometers, either indicating or recording. A fan blows conditioned air over the specimens and through the test chamber. Testing temperature is measured and regulated by a black panel thermometer unit. It consists of a 1.0 mm thick, black stainless steel panel 70 x 150 mm to which is mechanically fastened a stainless steel bimetallic dial-type thermometer or resistance temperature device (RTD). The thermometer has a stem 1.4 mm in diameter with a 44 mm dial. The sensitive portion extending 38 mm from the end of the stem is located in the centre of the panel 64 mm from the top and 48 mm from the bottom of the panel. The face of the panel with the thermometer stem attached should be finished with two coats of baked-on black enamel selected for its resistance to light and water. The exact exposure cycle is controlled by a program cam or mechanism. The specimen rack rotates at one revolution per minute.

A1.2 **Type 2A Instruments** — Unless otherwise specified, the xenon lamps consist of quartz glass burner tubes with an optical filter system consisting of special quartz glass inner and outer cylinders combined with a three section cover of special ultraviolet glass to simulate the spectral power distribution of global radiation (daylight). Excess heat is removed from the xenon lamps by recirculating distilled or deionized water between thinner and outer filter cylinders in conjunction with an air flow along the xenon lamp. The recirculated water is cooled by means of a heat exchange unit. Xenon lamp tubes are changed in a cyclic pattern according to the manufacturer's recommendations to minimize changes in the intensity of the radiation during the test period.

A1.3 **Type 2B Instruments** — Unless otherwise specified, the xenon lamp has a quartz glass burner tube, having an optical filter system consisting of a lantern with a combination of six infrared absorbing glasses plus one dark ultraviolet filter surrounded by an outer cylinder of a special ultraviolet glass to simulate the spectral power distribution of global radiation (daylight). Excess heat is removed from the xenon lamps by air flow. Xenon lamp tubes are changed according to their life span as recommended by the manufacturer to minimize changes in the intensity of the radiation during the test period.

A2. AIR-COOLED LAMPS

A2.1 Type 2A and type 2B instruments are both equipped with a water spray nozzle to provide uniform wetting of the specimens. Atomizing units for adding moisture to the air of the test chamber are provided. Percent relative humidity of the air in the test chamber is determined with either an indicating or recording hygrometer. Testing temperature is measured by a black panel thermometer unit. It consists of a black stainless steel panel to which is mechanically fastened a stainless steel bimetallic dial-type thermometer. The black panel temperature is controlled by regulating the test chamber air temperature. For type 2A apparatus, the black stainless steel panel is 68 x 200 mm. For type 2B apparatus, the black stainless steel panel is 45 x 100 mm. The exact cycle is controlled by a program card or other mechanism. For type 2A apparatus, the specimen rack and specimen holders rotate clockwise at 2 ± 0.1 revolutions per minute. For type 2B apparatus, the specimen rack and specimen holders rotate clockwise at 5.2 ± 0.1 revolutions per minute. After one revolution, the specimen holders can turn on their own axis to provide light and dark cycles.