



# ICBO Evaluation Service, Inc.

A subsidiary corporation of the International Conference of Building Officials

5360 WORKMAN MILL ROAD

• WHITTIER, CALIFORNIA 90601-2299

• (310) 699-0543  
FAX (310) 695-4694

## ACCEPTANCE CRITERIA FOR SKYLIGHTS WITH PLASTIC FRAMES

April, 1994  
AC79

Previously Approved January, 1994

### PREFACE

Evaluation reports issued by the ICBO Evaluation Service, Inc. (ICBO ES), are based upon performance features of the *Uniform Building Code™*, *Uniform Mechanical Code™*, *Uniform Plumbing Code™* and related codes. Section 105 of the Uniform Building Code is the primary charging section upon which evaluation reports are issued. Section 105 reads as follows:

The provisions of this code are not intended to prevent the use of any material or method of construction not specifically prescribed by this code, provided any alternate has been approved and its use authorized by the building official.

The building official may approve any such alternate, provided he finds that the proposed design is satisfactory and complies with the provisions of this code and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation.

The building official shall require that sufficient evidence or proof be submitted to substantiate any claims that may be made regarding its use. The details of any action granting approval of an alternate shall be recorded and entered in the files of the code enforcement agency.

The attached acceptance criteria for the general code sections noted have been issued to provide all interested parties with guidelines on implementing performance features of the codes. The attached acceptance criteria were developed and adopted following public hearings conducted by the Evaluation Committee. These criteria may be revised from time to time as the need dictates.

ICBO ES may consider alternate criteria, provided the proponent submits valid data demonstrating that the alternate criteria are at least equivalent to the attached criteria and otherwise meet the applicable performance requirements of the codes. Notwithstanding that a material, type or method of construction, or equipment, meets the attached acceptance criteria, or it can be demonstrated that valid alternate criteria are equivalent and otherwise meet the applicable performance requirements of the codes, if the material, product, system or equipment is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use thereof, ICBO ES retains the right to refuse to issue or renew an evaluation report.

Published by the

**International Conference of Building Officials**

5360 WORKMAN MILL ROAD • WHITTIER, CALIFORNIA 90601-2298

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PRINTED IN THE U.S.A.

# ACCEPTANCE CRITERIA FOR SKYLIGHTS WITH PLASTIC FRAMES

## 1. INTRODUCTION

**Scope:** The purpose of these criteria is to specify the conditions under which plastic-framed skylights can be recognized in ICBO Evaluation Service, Inc. (ICBO ES), evaluation reports under Chapter 34 and Section 5207, as applicable, of the Uniform Building Code.

## 2. DEFINITIONS

**2.1 SKYLIGHT** is a prefabricated unit consisting of glass or translucent or transparent plastic glazing and a frame and retainer cap to glaze a roof or ceiling opening for admitting light. The skylight may be fixed or openable. Skylights with glass glazing must also comply with the Acceptance Criteria for Sloped Glass Glazing in Solariums, Patio Covers and Prefabricated Skylights and Chapter 34 of the Uniform Building Code. Skylights with plastic glazing must also comply with the Acceptance Criteria for Plastic Skylights and Chapters 34 and 52 of the Uniform Building Code.

**2.2 PLASTIC FRAME** is a supporting and restraining component attached to the roof that supports glazing.

**2.3 RETAINER CAP** is a cap that retains and supports glazing. The cap is also known as the sash.

**2.4 APPROVED TESTING AGENCY** is an independent testing agency, recognized by ICBO ES as having the personnel, expertise, equipment and facilities for testing in accordance with these criteria.

## 3. BASIC INFORMATION AND REPORT OF TESTS

**3.1 Test specimens** must be of standard manufacture and representative (as to dimensional specifications, materials, finish, etc.) of the product on which recognition is sought. The test specimens must be mounted in a manner consistent with intended field installation. Tests are to be conducted by approved testing agencies.

**3.2 Frames** must be described in accordance with the Acceptance Criteria for Sloped Glass Glazing in Solariums, Patio Covers and Prefabricated Skylights or the Acceptance Criteria for Plastic Skylights, whichever is appropriate, to:

**3.2.1 Frame materials** including physical properties.

**3.2.2 Scaled drawings** on mounting details, including profiles, clearances, seals, drainage, adjacent components, frame connections, etc.

**3.2.3 Manufacturer's installation instructions.**

## 4. REQUIRED DATA

**4.1 All required data** in the Acceptance Criteria for Plastic Skylights or the Acceptance Criteria for Sloped Glass Glazing in Solariums, Patio Covers and Prefabricated Skylights, as appropriate, must be provided.

**4.2 Plastic frame material(s)** must comply with the following:

**4.2.1** A self-ignition temperature of 650°F. or greater when tested in accordance with ASTM D 1929-68 (1975).

**4.2.2** The plastics shall be classified as either CC1 or CC2 plastic when tested in accordance with ASTM D 635-74.

**4.2.3 Installation** is limited to nonrated roof coverings unless frames are protected by metal or other noncombustible materials or are tested to show equivalent fire protection.

**4.3 Weathering (Outdoor or Weatherometer) and Strength Tests:** See Section 5.1 for test procedures. Weathering tests are not required when the plastic frame is protected from exposure by a metal cladding or equivalent method.

**4.4 Temperature Cycling Tests:** See Section 5.2 for test procedures.

**4.5 Deformation/Creep Tests:** Plastic frames that do not directly transfer loads axially to the supporting sash are beyond the scope of these criteria. When plastic frames transfer loads eccentrically to the supporting sash flexural deflection of the frame can occur. The proponent must investigate and determine the effect of deformation under long-term loads or creep on product performance. The proponent must submit a proposed test program to ICBO ES for review prior to testing.

**4.6 In-house Quality Control Program:** As a minimum, incoming materials must be verified as being the same as materials used in the qualifying test specimens. Classification of defects, inspection methods for glazing surfaces, installation of gasketing and proper setting of glazing must be addressed. Details of the quality control program must be submitted.

## 5. TEST PROCEDURES

**5.1 Weathering (Outdoor or Weatherometer) and Strength Tests:**

**5.1.1 Ten 1-inch by 6-to-10-inch samples** are cut from the plastic frame or from a sample representative of the materials. Cut edges may be protected. Half of the samples will be treated as control.

**5.1.2 Five of the samples** must be subjected to one of the following weathering conditions. The surface exposed in the test must represent the surface exposed in the end use:

**5.1.2.1** Accelerated weathering tests for 2,000 hours in accordance with ASTM Specification D 1499 "Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics" using Type D or DH twin-enclosed carbon arcs.

**5.1.2.2** Accelerated weathering tests, in accordance with ASTM Specification D 2565 "Practice for Operating Xenon Arc-Type Light Exposure Apparatus With and Without Water for Exposure of Plastics." The exposure apparatus shall be 6,000 or 6,500 watts, Type B or BH as specified in ASTM G 26. Exposure shall be for 2,900 hours with 102 minutes of light only exposure and 18 minutes of water spray and light exposure.

**5.1.2.3** Exposure to 36,805 Langley's of ultraviolet (UV) irradiance in accordance with Procedure B of ASTM Specification D 4364, "Practice for Performing Accelerated Outdoor Weathering of Plastics Using Concentrated Natural Sunlight" using Spray Cycle 1.

**5.1.2.4** Outdoor weathering per ASTM D 1435 with exposure for five years in a hot humid, hot arid and a northern industrial climate with a southern exposure at a 45-degree angle.

**5.1.2.5** Accelerated weathering tests in accordance with ASTM Specification D 4329 "Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Plastics." Exposure shall be for 2,000 hours with cycles of 8 hours UV at 158°F. (70°C.) followed by four hours condensation of 104°F. (40°C.).

**5.1.3 Both the control and weathered samples** shall be evaluated to assess retention of mechanical properties of the plastic after weathering by one of the following two methods:

**5.1.3.1 Rigid PVC plastics** shall be evaluated as described in Procedure B of ASTM Designation D 4226-85, "Test Method for Impact Resistance of Rigid Poly(Vinyl Chloride) (PVC) Building Products."

For acceptance, the minimum impact strength after two years of outdoor weathering shall be not less than 0.60 in.-lb./mil. In addition, there shall be no visible signs of cracking or chipping after five years.

Alternatively, the plastics may be evaluated as described in Section 5.1.3.2.

**5.1.3.2 Other plastics**, such as fiberglass shall be evaluated as described in ASTM D 638 “Tensile Properties of Plastics” and ASTM D 790 “Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.” Any loss in mechanical properties must be accounted for in the design of the plastic frame. The allowable design load is determined in accordance with the Acceptance Criteria for Plastic Skylights or the Acceptance Criteria for Sloped Glass Glazing in Solariums, Patio Covers and Prefabricated Skylights as appropriate, less the percentage of loss in mechanical properties.

**5.2 Temperature Cycling Tests:** A representative sample skylight frame with glazing shall be subjected to 24 consecutive cycles of this test. The specimens must be applied to a rigid wood frame simulating the field installation procedure recommended by the manufacturer. The test decks must be installed at the minimum horizontal slope recommended for evaluation. Test specimens must be mounted in a compartment in such a way that one side of the specimens can be maintained at 23°C. (73.4°F.) throughout testing. The apparatus must allow variable temperatures to the other side (weather side) of the specimen.

**Each cycle consists of:** During the first hour the weather side tem-

perature is decreased from 23°C. (73.4°F.) to -30°C. (-22°F.) and then maintained at -30°C. (-22°F.) for one hour. During the third hour the weather side temperature is increased to 23°C. (73.4°F.). In the next hour the weather side temperature is raised to 49°C. (122°F.) and then maintained for an additional hour. During this two-hour period, radiant heat is applied to the weather side of the specimens. The radiant heat must impose and maintain for one hour, a body temperature on the frame equivalent to the sum of the maximum heat build-up plus the ambient test temperature of 49°C. (122°F.).

Maximum heat build-up is determined in accordance with ASTM D 4803 using horizontal samples and the darkest colors being evaluated.

During the sixth hour the radiant heat source is turned off and the temperature of the weather side compartment is lowered to 23°C. (73.4°F.). At the conclusion of 24 cycles, the specimen shall be examined between cycles, such as on weekends, holidays, etc., the samples may be maintained at 23°C. (73.4°F.)

**Conditions of Acceptance:** The product shall have no crazing, cracking or other deleterious surface or joint changes at the end of test. Additionally, there shall be no sign of failure or distress at fastener locations and at skylight frame corners.