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ACCEPTANCE CRITERIA FOR CLASS 5 DUCTS CONVEYING NONFLAMMABLE CORROSIVE FUMES AND VAPORS

AC28

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PREFACE

Evaluation reports issued by the ICBO Evaluation Service, Inc. (ICBO ES), are based upon performance features of the *Uniform Building Code*™, ICBO *Uniform Mechanical Code*™ and related codes. Section 104.2.8 of the *Uniform Building Code* is the primary charging section upon which evaluation reports are issued. Section 104.2.8 reads as follows:

> The provisions of this code are not intended to prevent the use of any material, alternate design 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 the building official 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 has been issued to provide all interested parties with guidelines on implementing performance features of the codes. The attached acceptance criteria was developed and adopted following public hearings conducted by the Evaluation Committee. If the criteria is an updated version from a previous edition, solid vertical lines (▌) in the outer margin within the criteria indicate a technical change or addition from the previous edition. Deletion indicators (⏵) are provided in the outer margins where a paragraph or item has been deleted if the deletion resulted from a technical change. This 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 that 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 in 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.

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1.0 INTRODUCTION

The purpose of this document is to establish the basis of recognition in ICBO ES evaluation reports of Class 5 thermoset reinforced plastic ducts conveying nonflammable corrosive fumes and vapors under Section 506 of the ICBO *Uniform Mechanical Code*™.

2.0 BASIC INFORMATION

The following information is necessary:

2.1 General information on the manufacturing process.

2.1.1 Type and description of resins and manufacturer's product designation.

2.1.2 Percentage and identity and additives and fillers (manufacturer's name and generic name).

2.1.3 Percentage and type of reinforcing glass by weight, etc., for each type and thickness of duct.

2.1.4 Other pertinent data showing duct suitability for intended use.

2.2 Dimensioned drawings with details showing duct thicknesses, sizes, configurations, transition and lateral entry components, elbows, duct terminations and other accessories.

2.3 Product identification, including the evaluation report number and the designation "Class 5."

2.4 Installation instructions and drawings, including method of field cutting, treatment of cut edges, field-joints, etc.

3.0 PERFORMANCE REQUIREMENTS

3.1 General:

Sampling, preparation of test specimens and tests must be done by an ICBO ES recognized independent testing agency. As an alternative, specimen preparation and tests may be conducted in the proponent's facility, provided an approved testing agency or independent consultant, specifically recognized by ICBO ES, certifies that sampling, preparation of specimens, testing, and calibration of instruments comply with accepted procedures. The agency must prepare and sign the test report.

Verification that test specimens are consistent with details in Section 2.1 and as described in the quality control manual, must be provided by the testing agency.

3.2 Surface-burning Characteristics:

3.2.1 Tests, in accordance with UBC Standard 8-1 (ASTM E 84), are necessary and results must be reported (also see Section 3.2.2 of this criteria). Testing must be conducted in a tunnel previously recognized on the basis of inspections by the ICBO ES staff and correlation testing in a round robin test program. Tests must be conducted on the minimum and maximum thicknesses of each type of plastic used. If a fire-retardant coating is used, the thinnest and thickest, coated and uncoated material must be tested.

Exception: Provided the testing agency can state, in writing, that the most critical conditions have been tested, the following conditions can be used:

1. Thinnest material with no coating.
2. Thickest material with coating.

Conditions of Acceptance: The materials shall have a flame-spread index not exceeding 25 and a smoke-developed rating not exceeding 50.

Exception: Materials with a smoke-developed rating exceeding 50 may be used if the duct system is protected internally by an approved automatic sprinkler system.

3.2.2 In lieu of meeting the flame-spread index requirement of 25, tests in accordance with Section 5.1 and Appendix E of the Factory Mutual Research Corporation Approval Standard No. 4922 Approval Standard for Fume and/or Smoke Exhaust Ducts, may be conducted.

Conditions of Acceptance: 1. No flaming beyond 23 feet (7010 mm) from the fire exposure end on the interior of the duct and;

2. The temperature at 23 feet (7010 mm) from the exposure end shall not exceed 1,000°F (537°C) and;

3. Flaming on the exterior of the duct on horizontal sections is unacceptable.

The smoke-density rating requirements noted above must be met.

3.3 Structural Data:

3.3.1 Plastic laminates used in construction of Class 5 ducts shall comply with the requirements of ASTM C 582-87. Tests shall be conducted on minimum and maximum thickness specimens of each type of plastic. Results must show compliance with Table 1. If the product material is directional, testing in both longitudinal and transverse directions is necessary. The test result averages from a minimum of five samples per test must attain minimum values noted in the table.

3.3.2 Structural data must be submitted for the allowable vacuum and pressure values for which recognition is desired. Data may consist of pressure and vacuum test results or structural calculations in accordance with ASTM D 3982-92. Structural calculations must be based on data generated from tests described in Section 3.3.1.

3.3.3 Duct supports and connections to structural elements are not a part of this criteria.

3.4 Pressure and Vacuum Tests for Joints:

Two-joint specimens, each involving ducts 10 and 24 inches (254 and 610 mm) in diameter are subjected to at least five times the pressure and vacuum indicated by calculations performed in Section 3.3.2. The pressure and vacuum must be held for two minutes at the prescribed level. The joint specimens must be at least two duct-diameters in length, with the joint in the middle.

3.5 Weatherability and Wind Pressures:

Ducts are limited to interior installations unless data is furnished verifying durability under environmental conditions and ability of the duct system to resist minimum wind pressures under Section 1613 of the *Uniform Building Code*™.

3.6 Testing Laboratories and Reports of Tests:

3.6.1 Testing laboratories shall comply with the ICBO ES Acceptance Criteria for Laboratory Accreditation (AC89).

3.6.2 Test reports and test specimen sampling shall comply with the ICBO ES Acceptance Criteria for Test Reports and Product Sampling (AC85).

4.0 INSTALLATION

Installation of ducts must comply with ASTM D 3982-92, manufacturer's instructions, Chapter 5 of the ICBO *Uniform Mechanical Code* and listing requirements. Conditions of acceptance in an ICBO ES report will include the following information:

Ducts must lead directly to the outside and have no openings other than those required for proper operation and maintenance of the system. Ducts must be thoroughly braced and supported by metal hangers or brackets designed for strength, rigidity and anchorage. In case of bell and spigot joints, duct laps must be made in the direction of the airflow. The system must slope at

least $^1/_4$ inch per linear foot (2.1% slope) toward the hood or an approved condensate collector.

The duct systems must have a clearance of at least 6 inches (152 mm) from stored combustible materials and at least $^1/_2$-inch (12.7 mm) clearance from combustible construction regardless of protective material (e.g. gypsum wallboard, etc.). Manifold systems are limited to 50,000 cfm (23 600 L/s).

An approved automatic fire-extinguishing system must be installed at the duct intake, hood, and canopy. Ducts installed in environmental plenums are limited to a maximum flame-spread rating of 25 and a maximum smoke-developed rating of 50.

Incompatible fumes and vapors must have separate ventilation systems as required under Section 505 of the ICBO *Uniform Mechanical Code*.

Shaft enclosures are required as noted in Section 711 of the *Uniform Building Code*.

Sprinklers must be installed in accordance with Appendix A of Factory Mutual Loss Prevention Data Sheet 7-78.

The duct system must comply with Section 5104 of the *Uniform Fire Code*™ if the exhaust system serves a semiconductor fabrication facility classified as Group H, Division 6 Occupancy.

Details of installation including type and spacing of hangers, and attachment to the building framing must be approved by the building official prior to installation. Forces and loads such as those generated by earthquake or sprinkler systems must be considered.

5.0 QUALITY CONTROL

The ducts must be manufactured under a quality control program with inspections by a quality control agency accredited by ICBO ES or by a compliance assurance/inspection agency recognized by the National Evaluation Service (NES). A quality control manual, jointly developed by the applicant and the agency, complying with the ICBO ES Acceptance Criteria for Quality Control Manuals (AC10) must be submitted.

TABLE 1—REQUIREMENTS FOR PROPERTIES OF REINFORCED PLASTIC DUCTS

PROPERTY AT 73.4°F	THICKNESS (inch)			
	$^1/_8$ to $^3/_{16}$	$^1/_4$	$^5/_{16}$	$^3/_8$ and up
Ultimate tensile strength, minimum (psi)	9,000	12,000	13,500	15,000
Flexural strength, minimum (psi)	16,000	19,000	20,000	22,000
Flexural modulus of elasticity (tangent), minimum (psi)	700,000	800,000	900,000	1,000,000

For **SI**: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1°C = $^5/_9$ (F° – 32).