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A subsidiary corporation of the International Conference of Building Officials

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ACCEPTANCE CRITERIA FOR GREASE DUCT SYSTEMS, SELF-ENCLOSED (Proprietary)

AC121

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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

Scope: This criteria establishes the basis of recognition in ICBO ES evaluation reports of self-enclosed grease duct systems as alternates to ducts and enclosures serving Type I kitchen hoods as discussed in Section 507 of the ICBO *Uniform Mechanical Code*[™] (UMC).

2.0 DEFINITIONS

2.1 Grease Ducts:

Grease ducts are assemblies for moving grease and smoke from a Type I hood to the exterior of the structure in which they are located.

2.2 Self-enclosed Grease Duct System:

A self-enclosed grease duct system is a factory-fabricated grease duct that provides its own enclosure to achieve a fire-resistive rating as required by Section 507.6 of the UMC. The duct system consists of the duct and the support fastening system. Duct sections are composed of two concentric pipes with a layer of proprietary blanket insulation material in the intervening space.

2.3 Fire-resistive Enclosure:

An assembly that is assigned a fire-resistive rating when tested in accordance with UBC Standard 7-1 with the least fire-resistive side exposed to the furnace.

3.0 BASIC DATA

3.1 The applicant for an evaluation report concerning a grease duct system shall submit the following product information:

3.2 Information on the manufacturing process of the grease duct materials.

3.3 Method of packaging.

3.4 Product identification, including evaluation report number and name of the quality control agency.

3.5 Installation instructions. The instructions shall reflect the limitations of the evaluation report where the duct system is recognized only for vertical applications.

3.6 Description of fasteners and method of application.

4.0 TEST REQUIREMENTS

4.1 Testing:

An ICBO ES accredited or NES recognized independent testing agency shall randomly select samples from manufacturer's production or inventory, prepare or witness preparation of test assemblies, conduct tests, and prepare test reports. Testing laboratories shall comply with the ICBO ES Acceptance Criteria for Laboratory Accreditation (AC89).

4.2 Test Reports:

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

5.0 PERFORMANCE TESTS

5.1 Grease Duct:

The duct system and components shall be tested in accordance with and meet the requirements of UL Standard 1978, except Sections 12 and 13. See Section 5.5 of this criteria for requirements for grease duct fire test.

5.2 Noncombustibility Tests:

Materials comprising the duct system shall be classified as noncombustible in accordance with Section 215 of the *Uniform Building Code*[™] (UBC).

5.3 Fire-resistance Tests:

The duct system shall be fire-resistive and shall be tested in accordance with UBC Standard 7-1 in a horizontal furnace, with the least fire-resistive side exposed to the furnace.

5.3.1 The test specimen configuration shall consist of a proprietary duct system longitudinally bisected to form a channel section. The least fire-resistive side of the bisected duct shall be exposed to the furnace, and the other side of the duct system shall be unexposed. The duct enclosure test sample shall be a minimum of 12 feet (3658 mm) long and as wide as the duct width sought for recognition in the evaluation report. The test specimen shall include joints and openings representative of end-use conditions.

5.3.2 Type, location and installation of thermocouples shall meet the intent of UBC Standard 7-1.

5.3.3 The fire-endurance test on the sample shall be continued until failure occurs, or until the sample has withstood the test conditions for a period equal to that specified in the conditions of acceptance in UBC Standard 7-1, Section 7.114.

5.3.4 The duct system test specimen shall sustain the hose stream test specified in Section 7.108 of UBC Standard 7-1.

5.3.5 Where assemblies are tested in a vertical furnace, recognition in ICBO ES evaluation reports will be limited to vertical applications. Specimen configuration shall be as noted in Section 5.3.1 except the specimen size shall be minimum 9 feet (2743 mm) long.

5.4 Durability Tests:

Aging-effects tests simulate long-term exposure to typical in-service conditions to determine effects on the thermal transmission qualities of the duct insulation materials.

5.4.1 A total of eight samples of the duct insulation material is needed in the thickness intended for use, and the length and width of the test specimen must comply with ASTM C 518-85. All specimens are conditioned at 75°F ± 5°F (23.8°C ± 2.8°C) with a relative humidity of 50 ± 5 percent. Specimens are conditioned for 24 hours prior to testing.

5.4.2 Four samples are exposed to the effect of temperature aging to determine changes, if any, in thermal transmission properties. An additional four samples are used as a base reference for comparison.

The temperature aging samples are placed on a rack in a vertical position, with a clearance of from $\frac{3}{8}$ to $\frac{3}{4}$ inch (9.5 to 19.1 mm) between samples. The rack is placed into an oven that has been preheated to a temperature of 300°F (149°C). After 12 hours, the oven is shut off and the specimens are allowed to cool for another 12-hour period. This cycle is repeated 10 times.

On completion of the final cycle, the specimens are removed from the oven and allowed to cool for a period of two hours at standard atmospheric conditions.

5.4.3 Thermal conductivity properties of temperature-aged samples and control samples are determined in accordance with ASTM C 518-85, "Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus." Change in the average thermal conductivity of

the heat-treated samples shall be reported as a percentage of the average thermal conductivity of untreated samples.

5.4.4 Thermal conductivity shall not increase by more than 10 percent.

5.5 Grease Duct Fire Test:

The grease duct fire test is to simulate the effects of a grease fire occurring inside the metal duct, and to establish allowable clearances of the system to combustibles.

5.5.1 Test specimens must be installed in accordance with manufacturer's instructions on a duct having the largest cross-sectional dimension for which recognition is desired. The duct must have at least two joints, and the horizontal portion of the duct shall be at least 8 feet (2438 mm) in length. Access openings or other fittings shall be a part of the assembly. Conditions of recognition will be set by the tested conditions. See Figure 1 for thermocouple locations.

Tests must be conducted indoors. Environmental conditions, such as air temperature and air velocity at time of test, must comply with UBC Standard 7-1. Unexposed thermocouples and thermocouple pads on the unexposed side of the specimen must comply with UBC Standard 7-1. Thermocouples on the exposed side of the assembly must be No. 20 gage Type S or No. 18 gage Type K, protruding $\frac{1}{2}$ inch (12.7 mm) from inner ends of support tubes.

5.5.2 Test Procedure: The temperature inside the metal duct must be raised from room temperature to at least 500°F (260°C) as an average of readings from Thermocouples 1 through 4. This average temperature is maintained for at least four hours. Data must be recorded at maximum 5-minute intervals. The temperature is then increased to 2,000°F (1093°C) within 15 minutes as an average of readings from the thermocouples inside the metal duct. The average temperature recorded by thermocouples inside the metal duct must be at least 2,000°F (1093°C) at each recording interval for the remaining 30-minute duration of the test. Temperatures must be recorded at intervals not exceeding 30 seconds.

5.5.3 Conditions of Acceptance:

- (1) The system must maintain its structural integrity.
- (2) Transmission of heat shall not raise the temperature of any thermocouple on the unexposed surface of the duct enclosure more than 117°F (47°C) above ambient when the temperature inside the metal duct is 500°F (260°C).
- (3) At no time during the test shall transmission of heat through the duct enclosure raise the temperature of any thermocouple on the unexposed surface more than 250°F (121°C) above ambient or 325°F (162°C), maximum, whichever is less.

5.6 Through-penetration Fire-stops:

Tests of assemblies with through-penetration fire-stops shall be conducted on duct systems where recognition is sought for installation of the self-enclosed duct through the floors or ceilings of buildings more than one story in height or where the floor or ceiling assembly is required to be of fire-resistant construction.

5.6.1 Testing shall be conducted in accordance with UBC Standard 7-5. Test assemblies shall be installed in accordance with the manufacturer's instructions on a duct having the largest cross-sectional dimension for which recognition is desired.

5.6.2 Conditions of acceptance are that the F- and T-ratings shall not be less than the fire-resistance rating of the grease duct assembly as determined in Section 5.3 of this criteria.

5.7 Fire Engulfment Test:

The fire engulfment test is to simulate fire exposure occurring from an outside source to the duct system, and establish structural integrity of the duct system and supports under fire exposure conditions.

5.7.1 The test specimen shall consist of complete sections of the grease duct system, including an elbow and all of the necessary supports assembled in an L-shape in accordance with the manufacturer's instructions. The sample shall be a minimum of 10 feet (3048 mm) long and 4 feet (1219 mm) high. The assembly shall be capped at the horizontal end of the sample, and the vertical termination extending a minimum of 2 feet (610 mm) above the slab shall be open to the atmosphere. See Figure 2.

5.7.2 The assembly shall be installed in a horizontal furnace capable of creating the conditions required by UBC Standard 7-1. The assembly shall be centered in the furnace with a minimum distance of 12 inches (305 mm) between the sample and the furnace wall.

5.7.3 The assembly shall be suspended from a floor/ceiling assembly having a fire-resistance greater than the intended rating of the duct system. The penetration between the vertical duct section and the test slab shall be sealed with a through-penetration fire-stop system specified by the manufacturer.

5.7.4 The assembly shall be exposed to fire-exposure conditions in accordance with UBC Standard 7-1. The fire-endurance test shall be continued until failure occurs or until the assembly has withstood the test conditions for a period equal to that specified in the conditions of acceptance in UBC Standard 7-1, Section 7.114. Environmental conditions at the start of the test shall comply with UBC Standard 7-1, Section 7.109.

5.7.5 The assembly shall sustain the hose stream test specified in Section 7.108 of UBC Standard 7-1.

5.7.6 Conditions of Acceptance:

There shall be no structural collapse, failure or opening of the duct cavity or through-penetration fire-stop during the fire engulfment test or the hose stream test.

6.0 QUALITY CONTROL

The duct system must be manufactured under a quality control program with inspections by a quality control agency accredited by ICBO ES or 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.

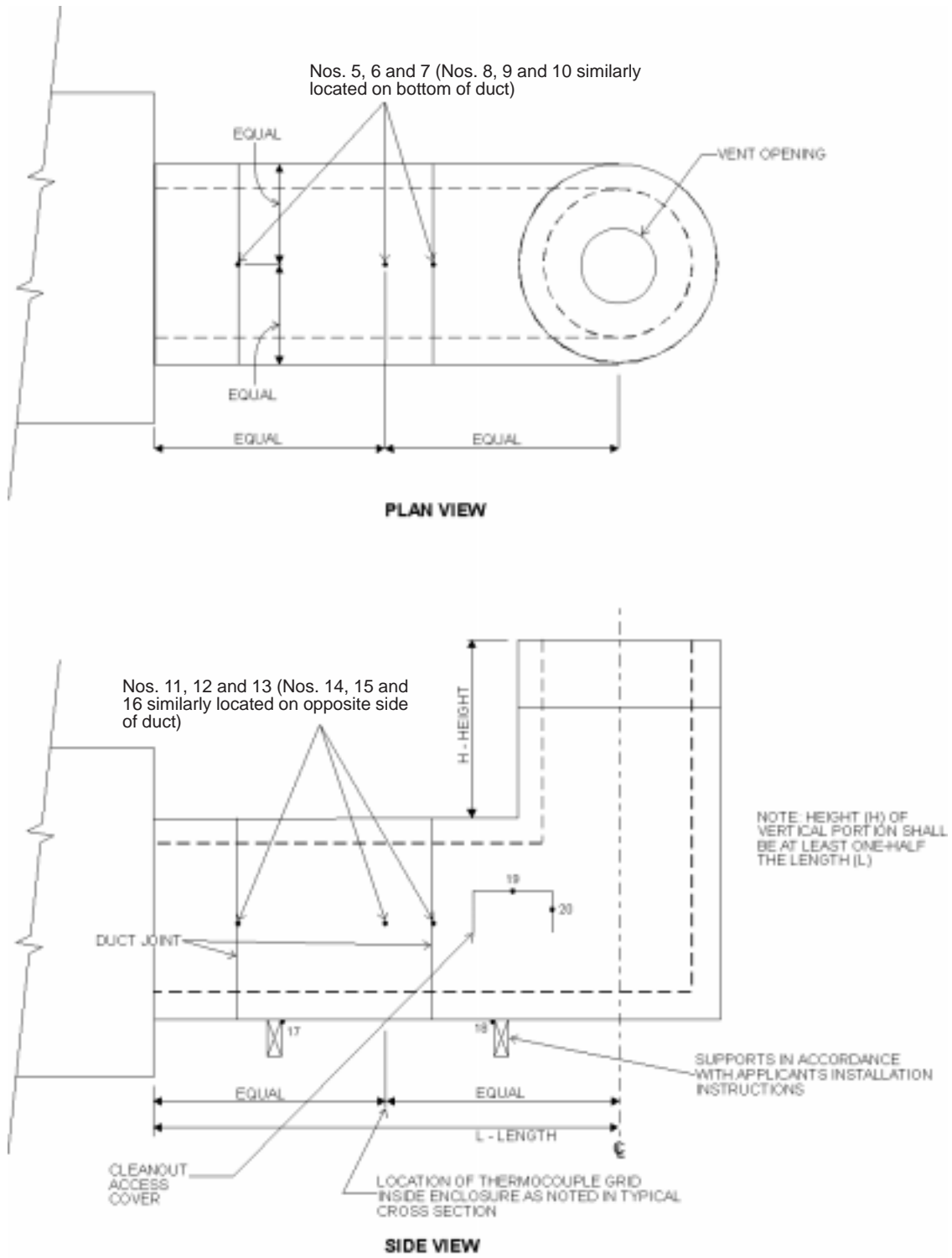
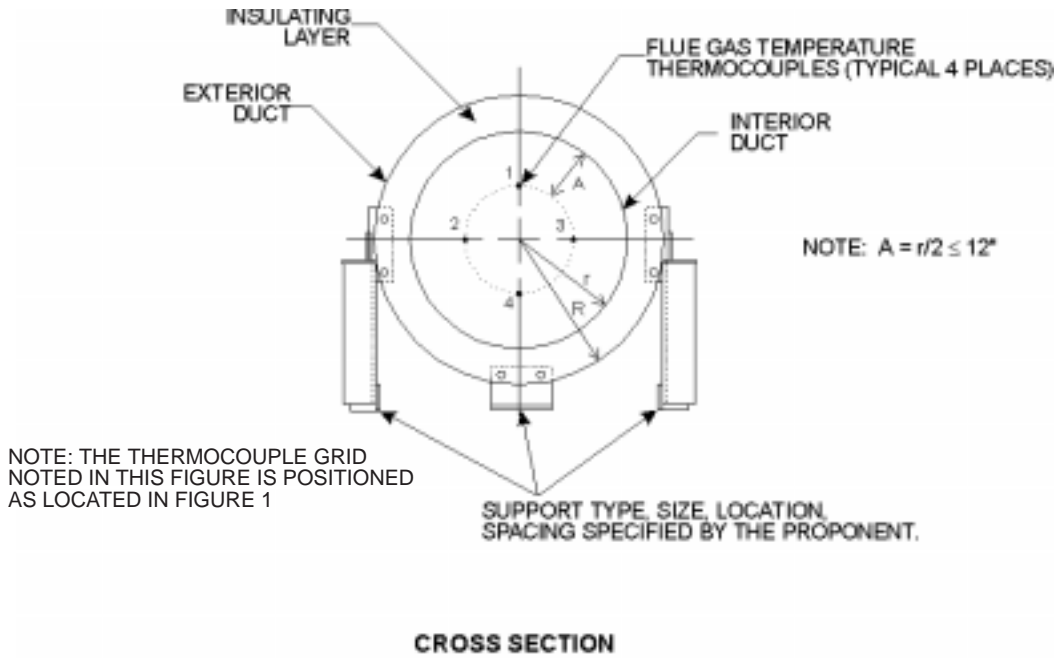


FIGURE 1—THERMOCOUPLE LOCATIONS FOR GREASE DUCT FIRE TEST



NOTE: THE THERMOCOUPLE GRID NOTED IN THIS FIGURE IS POSITIONED AS LOCATED IN FIGURE 1

Thermocouple Locations:

Four (4) thermocouples located inside the duct to measure the furnace temperature mid-length of duct enclosure and located on the four principal axes at a distance of $r/2$ to a maximum of 12 inches from the inner face of the interior duct. Thermocouples 1 through 4.

Four (4) thermocouples located at 0, 90, 180 and 270 degrees from the top vertical at the exterior of the duct at each joint and at mid-length of the horizontal duct section. Thermocouples 5 through 16.

Two (2) thermocouples between the test duct and the support system, for information purposes only. Thermocouples 17 and 18.

Two (2) thermocouples around edges of cleanout access covers: one top, one side, at joints between cover and duct. Thermocouples 19 and 20.

FIGURE 1—THERMOCOUPLE LOCATIONS FOR GREASE DUCT FIRE TEST—(Continued)