



ICBO Evaluation Service, Inc.

A subsidiary corporation of the International Conference of Building Officials

5360 SOUTH WORKMAN MILL ROAD

• WHITTIER, CALIFORNIA 90601

• (213) 699-0543, 4 or 5
FAX (213) 695-4694

ACCEPTANCE CRITERIA FOR GREASE DUCT ENCLOSURE SYSTEMS

January, 1991

PREFACE

Evaluation reports issued by the ICBO Evaluation Service, Inc. (ICBO ES), are based upon performance features of the Uniform Building Code,TM 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

International Conference of Building Officials

5360 SOUTH WORKMAN MILL ROAD • WHITTIER, CALIFORNIA 90601

PRINTED IN THE U.S.A.

Copyright © 1991 ICBO Evaluation Service, Inc.

ACCEPTANCE CRITERIA FOR GREASE DUCT ENCLOSURE SYSTEMS

I. SCOPE

The purpose of these criteria is to establish the basis of recognition, in ICBO Evaluation Service, Inc. (ICBO ES) evaluation reports, for grease duct enclosure systems as alternates to shaft enclosure requirements in Section 2002 (d) of the 1988 Uniform Mechanical Code (U.M.C.) and 1989 Supplement.

II. DEFINITIONS

A. A grease duct enclosure system under this criteria is defined as a self-supporting interior shaft enclosure around a metal grease exhaust duct which penetrates a ceiling, wall or floor and serves Type I kitchen hoods. The outer face of the enclosure may be placed in direct contact with combustibles. The system consists of rigid duct enclosure material and a fastening method. It also includes access openings for cleaning the metal duct. The specified air space between the metal duct and enclosure is vented to the building exterior. The system shall include provision for supporting the enclosure at each floor level. Additionally, the metal duct must be supported inside the enclosure without duct supports penetrating the enclosure.

B. Fastening method is the manner in which insulation boards are connected to form the enclosure. It may involve adhesives, mechanical fasteners or a combination thereof.

C. The proponent is the applicant for an evaluation report concerning a grease duct enclosure system.

III. BASIC DATA

A. General information on the manufacturing process of the duct enclosure material.

B. Method of packaging and product identification.

C. Installation instructions and drawings including method of field cutting, treatment of cut edges, field joints, duct and enclosure support, etc.

D. Mechanical fasteners must be specifically described including type, shank diameter, length, head diameter and application method.

E. Adhesives must be specifically described including manufacturer, type, use, application method and application rate.

IV. PERFORMANCE REQUIREMENTS

A. **General:** Sampling, preparation of test specimens, conduct of tests and preparation of test report must be by an ICBO ES recognized independent testing agency. As an alternate, specimen preparation and tests may be conducted in the proponent's facility, provided an approved independent testing agency or qualified independent consultant specifically recognized by the ICBO ES, certifies that sampling, preparation of test specimens, testing and calibration of instruments, comply with accepted procedures. The test facility must, in all cases, be recognized by ICBO ES.

B. **Noncombustibility Tests:** The duct enclosure material must be classified as noncombustible. See U.B.C. Standard No. 4-1 for test method.

C. **Fire-resistance Test:** Tests must be conducted as required by Section 4302 (b) of the Uniform Building Code and results reported to demonstrate compliance with fire-resistive construction requirements of Section 2002 (d) of the U.M.C. Nonsymmetrical construction must be tested with each face exposed to the furnace and the assigned fire-resistance rating based on the shortest duration obtained from the two tests. Reports of tests of only one face exposed to the furnace may be considered, provided it can be demonstrated that the exposed face is the least fire resistive.

D. **Grease Duct Fire Test:** 1. **General:** The grease duct fire test is to simulate the effects of a grease fire occurring inside the metal duct and is required for systems having less than 3-inch clearance between

the metal duct and the inside face of the enclosure material. A minimum 1 inch clearance is required except the metal duct may rest on the floor of horizontal enclosures when tested in this arrangement. Test specimens must be installed in accordance with manufacturer's instructions with the enclosure material surrounding a metal duct having the largest cross-sectional dimension on which recognition is desired. The metal duct must have at least two joints and comply with minimum requirements of Section 2002 (a) 1 of the U.M.C. Specimens must have sufficient length to enclose the metal duct with the horizontal portion of the duct enclosure at least 8 feet in length. The enclosure must be supported in accordance with manufacturer's recommendations. Access openings in the enclosure system must be aligned with metal duct access openings. Conditions of recognition will be set by the tested conditions such as minimum air space, enclosure size, enclosure support spacings, etc. See Figures Nos. 1 and 2 for typical test set-up and thermocouple locations.

Tests must be conducted indoors. Environmental conditions, such as air temperature and air velocity at time of test, must comply with U.B.C. Standard No. 43-1. Unexposed thermocouples and thermocouple pads on the unexposed side of the specimen, must comply with U.B.C. Standard No. 43-1. Thermocouples on the exposed side of the assembly shall not be heavier than No. 18 Types S or K and shall provide $\frac{1}{2}$ inch from inner ends of support tubes.

2. **Test Procedure:** The temperature inside the metal duct must be raised from room temperature to at least 500°F. as an average of readings from Thermocouples Nos. 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 2000°F. within 15 minutes as an average of the thermocouples inside the metal duct. The average temperature recorded by thermocouples inside the metal duct must be at least 2000°F. at each recording interval for the remaining 30 minute duration of the test. Temperatures must be recorded at intervals not exceeding 30 seconds.

Conditions of Acceptance: (a) The metal duct may deform or collapse, but the grease duct enclosure must maintain its structural integrity with no passage of flame or gases to the unexposed side hot enough to ignite cotton waste for the duration of the fire tests.

(b) Transmission of heat shall not raise the temperature of any thermocouple on the unexposed surface of the duct enclosure more than 117°F. above ambient when the temperature inside the metal duct is 500°F.

(c) 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. above ambient or 325°F. maximum, whichever is less.

E. **Aging Effects:** The aging effects test simulates long-term exposure to typical in-service conditions on the structural and thermal conductivity qualities of the duct enclosure materials:

1. **Specimen Size:** A total of sixteen (16) samples of the duct enclosure material are needed in the thickness to be utilized. Structural test specimens must be 6 inches wide and 12 inches in length. The length and width of the thermal conductivity test specimens must comply with ASTM C 518-85. All specimens must be conditioned at 75°F. plus or minus 5°F. with a relative humidity of 50 percent plus or minus 5 percent. Specimens are conditioned for 24 hours prior to testing.

2. **Temperature Aging:** A total of eight samples are exposed to the effects of temperature aging to determine the reduction in structural and thermal conductivity properties. The remaining eight samples are used as a base reference for comparison.

The eight temperature aging samples are placed on a rack in a vertical position with a $\frac{3}{8}$ to $\frac{3}{4}$ inch clearance between samples. The rack is placed into an oven which has been preheated to a temperature of 300°F. After 12 hours, the oven is shut off and the specimens allowed to cool for another 12 hour period. This cycle is repeated ten (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 noted in Section IV-E-1.

3. **Structural Test:** The modulus of rupture and modulus of elasticity of four of the temperature aged samples and four of the control samples shall be determined in accordance with Method II, Procedure A of ASTM C 203-85 "Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation". Reduction of physical properties shall be reported as a percentage of the average value for the untreated samples.

4. **Thermal Conductivity Test:** Thermal conductivity properties of four temperature aged samples and four 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." Reduction in the average thermal conductivity of the heat-treated samples shall be reported as a percentage of the average thermal conductivity of untreated samples.

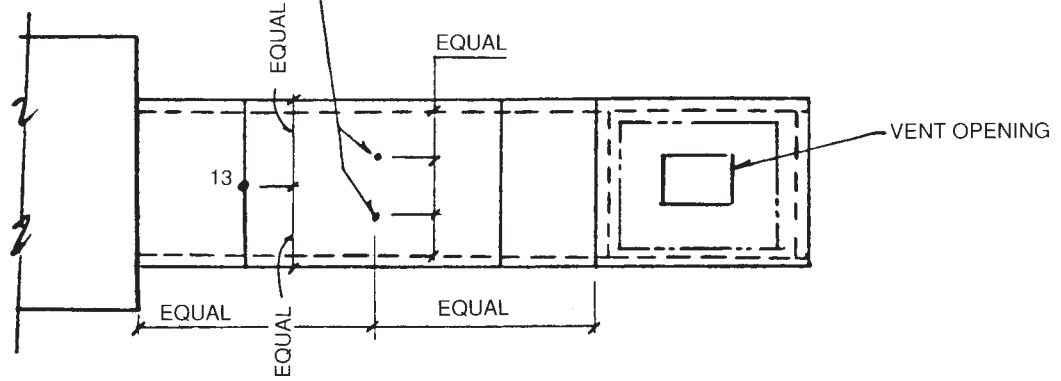
5. **Conditions of Acceptance:** Physical properties shall not be reduced in value greater than 25 percent and the thermal conductivity shall not be increased greater than 10 percent.

V. TEST REPORTS

Test reports must include the following:

1. Verification that the test specimens are consistent with details provided in Section III.
2. Verification that the sampling and preparation of the test specimens are consistent with Section IV A.
3. Description of test procedure.
4. Test observations including description of specimen condition before, during and after completion of tests.
5. Statement on passing or failing, where applicable.
6. Photographic record of tests.
7. Small sample of duct enclosure material.

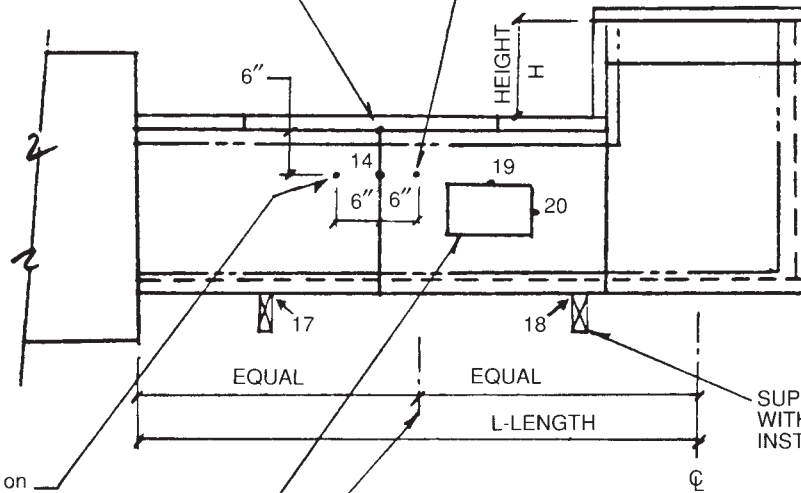
NOS. 9 AND 10 (Nos. 11 and 12 similarly located on bottom of enclosure)



PLAN VIEW

NO. 15 (No. 16 similarly located on opposite side of enclosure)

NO. 6 (No. 8 similarly located on opposite side of enclosure)



NOTE: HEIGHT (H) OF VERTICAL PORTION SHALL BE AT LEAST ONE-HALF THE LENGTH (L).

SUPPORTS IN ACCORDANCE WITH APPLICANTS INSTALLATION INSTRUCTIONS.

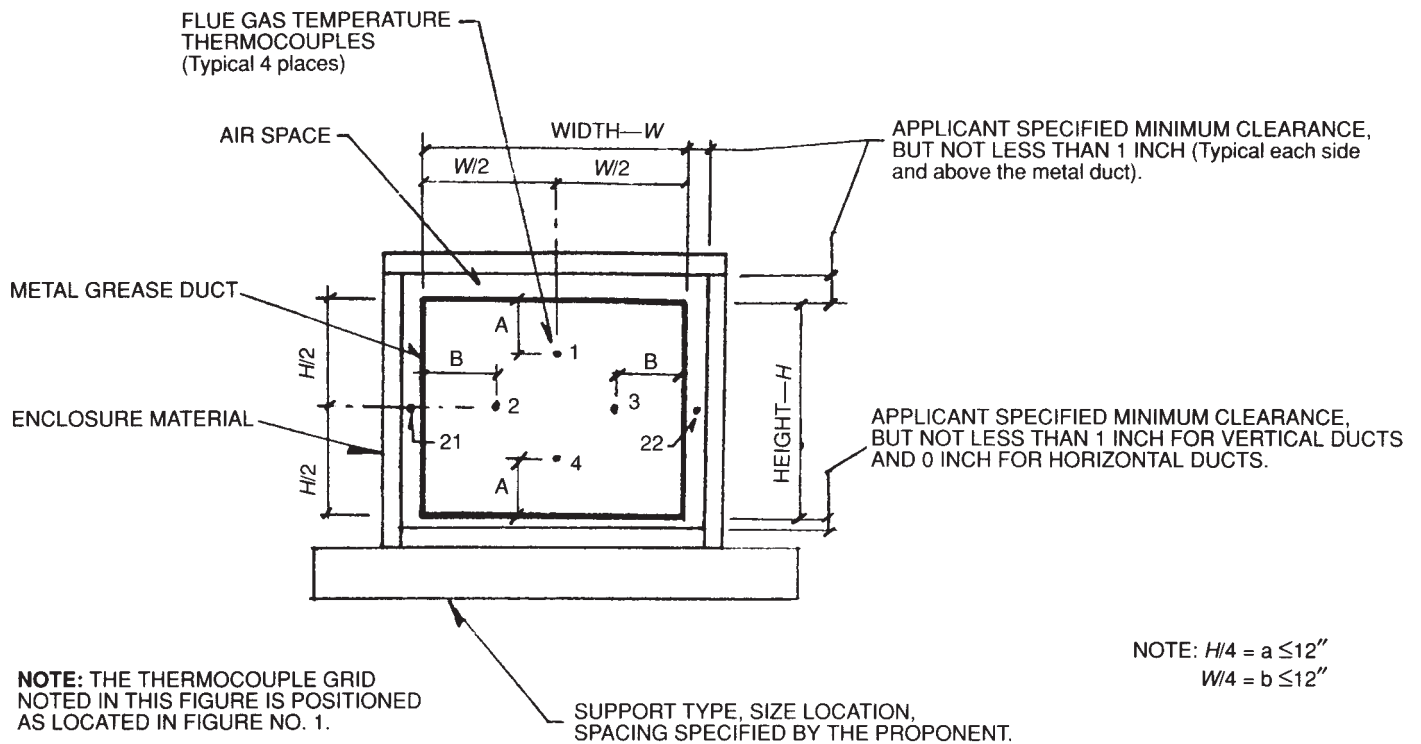
NO. 5 (No. 7 similarly located on opposite side of enclosure)

CLEANOUT ACCESS COVER

LOCATION OF THERMOCOUPLE GRID INSIDE ENCLOSURE AS NOTED IN TYPICAL CROSS SECTION OF FIGURE NO. 2.

SIDE VIEW

FIGURE NO. 1—GREASE DUCT ENCLOSURE



GREASE DUCT ENCLOSURE TYPICAL CROSS SECTION—FIGURE NO. 2

THERMOCOUPLE LOCATIONS

Four (4) thermocouples located inside the duct to measure the furnace temperature mid length of duct enclosure and immersed 12 inches into each face of the heated metal duct or one-fourth of the distance between the face of the metal duct and its parallel, opposing face, whichever is the least. Thermocouples Nos. 1 through 4.

Two (2) thermocouples mounted on each face for a total of 8 (top, bottom, side, side). Thermocouples Nos. 5 through 12.

Two (2) thermocouples mounted over double joints. Thermocouples Nos. 13 and 14.

Two (2) thermocouples mounted over triple joints. Thermocouples Nos. 15 and 16.

Two (2) thermocouples between the test duct enclosure and enclosure support system, for informational purposes only. Thermocouples Nos. 17 and 18. See Figure No. 1.

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

Two (2) thermocouples between the sides of metal duct and inside face of test duct enclosure. Thermocouples Nos. 21 and 22.