This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: E2816 – 20a

An American National Standard

Standard Test Methods for Fire Resistive Metallic HVAC Duct Systems[1]

This standard is issued under the fixed designation E2816; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

Heating, Ventilation, Air Conditioning (HVAC) duct systems may be subjected to fire- exposure conditions. ISO 6944 is a standard test method used to evaluate ventilation ducts. However, ISO 6944 does not address all of the fire resistive attributes deemed necessary by some authorities having jurisdiction, for example, *(1)* the transition from the horizontal to a vertical HVAC duct, *(2)* the attachment of the HVAC duct's supports to the fire-separating elements, *(3)* the termination of an HVAC duct system and the protection of its ends, *(4)* the effects of rapid cooling and erosion upon the HVAC duct system, *(5)* the use of fire dampers and *(6)* the effect of the HVAC duct system on its supporting construction. Many types of fire-resistive materials are used to protect HVAC ducts. These fire-resistive materials are either applied to HVAC ducts in the field or are fabricated as an integral part of the HVAC duct system when shipped from the factory. Evaluating fire-resistive materials used to protect a HVAC duct from fire is an aid for predicting their fire performance and helps to establish uniformity in requirements of various authorities. To do this it is necessary that the fire-resistance properties of HVAC ducts protected with fire-resistive materials be measured and specified according to a common standard expressed in terms that are applicable alike to a wide variety of materials, situations, and conditions of exposure.

1. Scope*

NOTE 1—Use of the standard designation ISO 6944 refers to both ISO 6944:1985 and ISO 6944-1:2008.

1.1 These test methods evaluate the fire-resistive metallic HVAC duct system's fire resistance and fire-engulfment with horizontal and vertical through-penetration firestops.

NOTE 2—The intent of these test methods is to provide authorities having jurisdiction a means to evaluate the fire performance of HVAC duct systems to enable their application and use.

1.2 These test methods evaluate the fire performance of HVAC ducts, including both supply (pressurized: Condition A – Horizontal and Condition B – Vertical) and return (exhaust: Condition C – Horizontal and Condition D – Vertical).

1.3 These test methods evaluate the ability of a HVAC duct system to resist the spread of fire from one compartment to other compartments separated by a fire resistance rated construction when the HVAC duct system is exposed to fire under one or more of the following conditions:

1.3.1 *Condition A*—Fire exposure from the outside of the horizontal HVAC duct system without openings,

1.3.2 *Condition B*—Fire exposure from the outside of the vertical HVAC duct system without openings,

1.3.3 *Condition C*—Fire exposure from the outside with hot gases entering the inside of the horizontal HVAC duct system with unprotected openings,

NOTE 3—Unprotected openings are openings that are not protected by fire dampers.

1.3.4 *Condition D*—Fire exposure from the outside with hot gases entering the inside of the vertical HVAC duct system with unprotected openings.

1.4 These test methods provide a means for determining the fire-resistance of vertical and horizontal HVAC duct systems, when subjected to the standard time-temperature curve of Test Methods E119.

1.4.1 *Condition A*—These test methods provide a means for evaluating a horizontal HVAC duct system, without openings exposed to fire, passing through a vertical fire-separating element.

1.4.2 *Condition B*—These test methods provide a means for evaluating a vertical HVAC duct system, without openings exposed to fire and outfitted with a horizontal connection, passing through a horizontal fire-separating element.

[1] These test methods are under the jurisdiction of ASTM Committee E05 on Fire Standards and are the direct responsibility of Subcommittee E05.11 on Fire Resistance.

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*A Summary of Changes section appears at the end of this standard

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1.4.3 *Condition C*—These test methods provide a means for evaluating a horizontal HVAC duct system, with unprotected openings exposed to fire, passing through a vertical fire-separating element.

1.4.4 *Condition D*—These test methods provide a means for evaluating a vertical HVAC duct system with a horizontal connection, and with unprotected openings exposed to fire, passing through a horizontal fire-separating element.

1.5 These test methods prescribe a standardized fire exposure for comparing the test results of the fire resistive materials and HVAC duct systems. The results of these tests are one factor in assessing predicted fire performance of HVAC duct systems. Using these test results to predict the performance of actual HVAC duct systems requires the evaluation of test conditions.

1.6 The values stated in inch-pound units are to be regarded as the standard. The SI values given in parentheses are for information only, unless the SI units are used consistently to perform all of the test methods referenced herein. In this case, the SI units will be regarded as the standard and will be used in Section 13, Report.

1.7 The text of these test methods references notes and footnotes which provide explanatory material and (excluding those in tables and figures) shall not be considered as requirements of the fire-test-response standard.

1.8 This document specifically excludes evaluating ducts that carry combustibles, flammable vapors, combustible gases, and commercial kitchen ventilation systems commonly called grease ducts or hazardous exhaust ducts, which are tested in compliance with Test Methods E2336.

1.9 This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment of the materials, products, or assemblies under actual fire conditions.

1.10 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.11 Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests.

1.12 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E119 Test Methods for Fire Tests of Building Construction and Materials

E176 Terminology of Fire Standards

E631 Terminology of Building Constructions

E814 Test Method for Fire Tests of Penetration Firestop Systems

E2226 Practice for Application of Hose Stream

E2307 Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus

E2336 Test Methods for Fire Resistive Grease Duct Enclosure Systems

2.2 *Other Standards:*

UL 385 Standard for Play Pipes for Water Supply Testing in Fire-Protection Service[3]

ISO 6944:1985 Fire Resistance Tests – Ventilation Ducts [4]

ISO 6944-1:2008 Fire Containment – Elements of Building Construction – Part 1: Ventilation ducts[4]

SMACNA HVAC Duct Construction Standards[5]

DW/144 Specification for Sheet Metal Ductwork[6]

3. Terminology

3.1 For definitions of terms used in these test methods and associated with fire issues, refer to the definitions contained in Terminology E176.

3.2 For definitions of terms used in these test methods and associated with building issues, refer to the definitions contained in Terminology E631.

3.3 When there is a conflict between Terminology E176 and Terminology E631 definitions, Terminology E176 definitions shall apply.

3.4 *Definitions of Terms Specific to This Standard:*

3.4.1 *fire resistive material, n*—the product applied to or a part of the HVAC duct to provide fire resistance.

3.4.2 *fire-separating element, n*—floors, walls, and partitions having a period of fire resistance determined in accordance with fire resistance test methods such as Test Methods E119.

3.4.3 *fire side, adj*—the surface of the test assembly or test specimen exposed to the heat or flame, or both, of the test apparatus.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Underwriters Laboratories (UL), 2600 N.W. Lake Rd., Camas, WA 98607-8542, http://www.ul.com.

[4] Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

[5] Available from Sheet Metal and Air Conditioning Contractors' National Association, 4201 Lafayette Center Drive Chantilly, Virginia 20151-1219, www.s-macna.org.

[6] Available from BESA, Building Engineering Services Association, www.besa-publications.com.

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3.4.4 *integrity, n*—the absence of cracks, holes or openings that appear outside the furnace on the fire-resistive material or firestop, or both, or through which flames or hot gases pass as determined by the cotton pad test.

3.4.5 *orifice, n*—the continuous hollow area or opening within the HVAC duct.

3.4.6 *stability, n*—the ability of the HVAC duct, support and fastening system to fulfill their intended function.

3.4.7 *supporting construction, n*—the arrangement of building sections forming the fire-separating elements into which the HVAC duct system is installed.

3.4.8 *support system, n*—the vertical or horizontal devices used to sustain the HVAC duct and its fire-resistive materials and their fastening means.

3.4.9 *test assembly, n*—the complete construction composed of a test specimen(s) together with its supporting construction.

3.4.10 *test specimen, n*—a material, product, or assemblage of a specific design, composition, density, and dimension, for example, a HVAC duct protected with a fire-resistive material(s) that is secured by fastening system, which is suspended by a support system, and protected by a firestop(s).

3.4.10.1 *Discussion*—The fire-resistive material or the HVAC duct system are examples of test specimens.

3.4.11 *unexposed side, n*—the surface not directly exposed to the heat or flame, or both, of the test apparatus.

3.4.12 *unexposed surface thermocouple, n*—temperature-measuring device placed on the unexposed surface.

3.4.13 *HVAC duct, n*—a tube or conduit utilized for conveying air without combustible materials, flammable vapors, and combustible gases.

3.4.14 *HVAC duct system, n*—consists of the HVAC duct, a fire-resistive material(s), a support system, the through-penetration firestop(s) and fastening system(s).

4. Summary of Test Method

4.1 Representative test specimens of the fire-resistive material or the HVAC duct system are subjected to the selected tests for the purposes of assisting the authority having jurisdiction in qualifying an HVAC duct system to a an explicit set of their requirements. These test methods describe the following test sequence and procedures:

4.1.1 A fire-engulfment test uses a standardized fire exposure to simulate a fire occurring on the outside of the HVAC duct system in Conditions A and B, or a fire occurring on the inside and outside of the HVAC duct system in Conditions C and D, and demonstrates the ability of the HVAC duct system to remain intact without a through opening appearing in supporting construction or the HVAC duct system outside the furnace or raising the temperature on its unexposed surface above the limitations of these test methods or conveying hot gases into other compartments. The fire-engulfment test also tests the fastening methods used to secure the fire-resistive material to the HVAC duct and the support system. The fire-engulfment test also provides a means to test a through-penetration firestop to determine its compatibility with the HVAC duct when mounted in a horizontal or vertical fire-separating element. A hose stream test is also performed on the test assembly in accordance with the provisions in Practice E2226.

5. Significance and Use

5.1 These test methods are intended to evaluate the ability of the HVAC duct system and its supporting construction to do the following:

5.1.1 Resist the effects of a standardized fire exposure, and

5.1.2 Retain its integrity.

5.2 These test methods provide for the following measurements and evaluations where applicable:

5.2.1 Ability of the tested support system to carry the load of the HVAC duct and its fire-resistive material(s) during the entire duration of the standardized fire-engulfment test.

5.2.2 Ability of the firestops to meet the requirements of Test Method E814 when used as part of a HVAC duct system.

5.2.3 Ability of the HVAC duct system to resist the passage of flames and hot gases onto its unexposed surface during a standardized fire-resistance test.

5.2.4 Transmission of heat through the HVAC duct system during a standardized fire-resistance test.

5.2.5 Ability of the firestop to resist the passage of water during a standardized hose stream test.

5.3 These test methods do not provide the following:

5.3.1 Full information as to performance of the fire-resistive material, supporting construction, or the HVAC duct system constructed with components, densities, or dimensions other than those tested.

5.3.2 Evaluation of the degree by which the fire-resistive material or HVAC duct system contributes to the fire hazard by generation of toxic gases, or other products of combustion.

5.3.3 Measurement of the degree of control or limitation of the passage of smoke or products of combustion through the HVAC duct system.

5.4 The test specimens are subjected to one or more specific tests under laboratory conditions. When different test conditions are substituted or the end-use conditions are changed, it is not always possible by, or from, these test methods to predict changes to the characteristics measured. Therefore, the results of these laboratory tests are valid only for the exposure conditions described in these test methods.

5.5 These test methods require a test specimen to be exposed to a standard fire that is controlled to achieve specified temperatures throughout a specified time period. The engulfment test is followed by the application of a standardized hose stream test. These test methods provide a relative measure of the fire-test-response of comparable fire-resistive materials and HVAC duct systems under these exposure conditions. The fire exposure is not representative of all fire conditions because conditions vary with changes in the amount, nature and distribution of fire loading, ventilation, compartment size and configuration, and heat sink characteristics of the compartment. Variation from the test conditions or test specimen construction, such as size, materials, method of assembly, also

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affects the fire-test-response. For these reasons, evaluation of the variation is required for application to construction in the field.

NOTE 4—When the size of the HVAC duct exceeds the capability of the test furnace to test it, the authority having jurisdiction (AHJ) should be consulted to determine what test and evaluation of the variation is required for application to construction in the field.

6. Apparatus

6.1 *Furnace*—An enclosure capable of containing a fire being controlled to the time-temperature curve as required by the test method being conducted, for example, Test Methods E119, and meeting the dimensional requirements to contain the test assembly.

6.2 *Furnace Thermocouples:*

6.2.1 The furnace thermocouples shall comply with the time constant, dimensional and physical requirements of those specified in the fire resistance test method being conducted: Test Methods E119 and E814.

NOTE 5—A typical furnace thermocouple assembly meeting the time constant requirements of Test Methods E119 and E814 is fabricated by fusion-welding the twisted ends of No. 18 gage Chromel-Alumel wires, mounting the leads in porcelain insulators and inserting the assembly so the thermocouple bead is approximately 0.5 in. (12.7 mm) from the sealed end of the standard weight nominal 0.5-in. (12.7-mm) iron, steel, or Inconel[7] pipe. The time constant for this and for several other thermocouple assemblies was measured in 1976. Another option is to calculate the time constant from knowledge of its physical and thermal properties.[8]

6.3 *Pressure-sensing Probes:*

6.3.1 The pressure-sensing probes shall meet the requirements specified in the fire resistance test method being conducted: Test Methods E119 and E814.

6.4 *Unexposed Surface Thermocouples:*

6.4.1 The unexposed surface thermocouples, which shall be covered by the thermocouple pads described in 6.5 during testing, shall meet the requirements specified in the fire resistance Test Method E2307.

6.5 *Thermocouple Pads:*

6.5.1 The thermocouple pads used to cover each thermocouple on the unexposed side of the test specimen or test assembly shall be made of materials that meet the requirements specified in the fire resistance Test Method E2307.

6.6 *Differential Pressure Measurement Instruments:*

6.6.1 The differential pressure measurement instrument shall be:

6.6.2 A manometer or equivalent transducer meeting the requirements specified in the fire resistance test method being conducted: Test Methods E119 and E814.

6.6.3 Capable of reading in graduated increments of no greater than 0.01 in. H_2O (2.5 Pa) with a precision of not less than ±0.005 in. H_2O (±1.25 Pa).

6.7 *Hose Stream Delivery System:*

6.7.1 The hose stream delivery system shall consist of the same apparatus used in Practice E2226.

6.7.2 Maintain the hose stream on the test assembly for the duration of application in accordance with Practice E2226.

6.8 *Air Flow Systems:*

6.8.1 For Conditions A and B, a fan or similar apparatus capable of producing a negative pressure of 1.20 ± 0.06 in. H_2O (300 ± 15 Pa) within HVAC duct as compared to the fire-exposure environment during the fire-engulfment test. The fan is connected, either directly or by a suitable length of flexible ducting, to the measuring device.

6.8.2 For Conditions C and D, a fan or similar apparatus capable of producing an air velocity when extracting gas from the HVAC duct of at least 3 m/s (10 ft/s) measured at ambient temperature in the HVAC duct before the fire-engulfment test. The fan is connected, either directly or by a suitable length of flexible ducting, to the measuring device. Maintain the air velocity at 3 ± 0.45 m/s (9.8 ± 1.5 ft/s) during the test, except for the 5-min period each 30 min. During this 5-min period, the fan either *(1)* remains on but the air flow is not drawn through the HVAC duct, or *(2)* the fan is shut off at the beginning of the 5-min period and restarted after the 5-min period. The integrity of the HVAC duct is determined during this 5-min period. The 5-min period begins at 25 min and is repeated every 30 min.

7. Sampling, Test Specimens, and Test Assemblies

7.1 *Sampling:*

7.1.1 Document the origin of the materials being tested.

7.1.1.1 Document the materials' lot number, batch number, product name, packaging and other relevant information on the packaging, for example, third-party marks, test method references, etc.

7.1.1.2 Document whether samples were submitted by test sponsor.

7.1.1.3 Document whether samples were randomly selected from test sponsor's inventory by an independent third-party. Include the date of the sampling, the sample method, the location of the sampling, the person performing the sampling.

7.1.1.4 Document whether production of the samples was witnessed and their quality, manufacturing procedures, and composition were documented by an independent third-party. Include the date of the sampling, the sample method, the location of the sampling, the person performing the sampling.

NOTE 6—Some evaluation services require an approved inspection agency or certification body to witness the fire-resistive material production to establish traceability to the test specimens and that the fire-resistive material be representative of the product as applied in the field.

7.2 *Fire-Engulfment Test Specimen:*

7.2.1 The test specimen shall be representative of the construction for which Interpretation of Results is desired, as to materials, workmanship, and details, such as dimensions of parts, joints, and expansion joints, and shall be built under conditions representative of those in building construction and operation. The test specimen sections passing through the fire separating element shall be symmetrical. Alternatively, when asymmetrical test specimen sections pass through the fire separating element, testing from each side of the fire separating element shall be performed unless it is documented that the side with the lower fire resistance rating is being tested. The

[7] Inconel is a registered trade name of INCO Alloys, Inc., 3800 Riverside Dr., Huntingdon, WV 25720.

[8] Supporting data is available from ASTM International Headquarters. Request RR:E05-1001.

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physical properties of the materials and ingredients used in the test specimen shall be determined and documented.

7.2.1.1 Construct the HVAC duct using the maximum dimensions and minimum metal thickness (gage) for which approval is sought. Document the HVAC duct material, dimensions, thickness of material, the type of any internal and external reinforcement, and the connection (joint) type.

NOTE 7—A successful test on the HVAC duct in 7.2.1.1 normally qualifies the fire-resistive material for use on rectangular ducts with equal or less widths and equal or less cross-sectional areas, and round ducts with equal or less cross-sectional areas.

7.2.1.2 Document the support system used to carry the load of the HVAC duct and its fire-resistive materials and their fastening means, for example, metal angle size and length, hole size and location on metal angle, threaded rod diameter and length, location and spacing relationship (distance) between HVAC duct and threaded rods, location and spacing between support systems, anchoring means and installation method used to secure the support system, etc.

7.2.2 The test specimen shall be constructed or assembled, or both, in accordance with the manufacturer's instructions. All construction methods shall be documented.

7.2.3 All sections of the HVAC duct shall have joints. The type of joint tested shall be documented. When a specific type of joint or support is designated by industry nomenclature, for example, SMACNA, that particular nomenclature shall be used to describe the joint or support. The HVAC duct system conditions (A and B) shall have a branch connection.

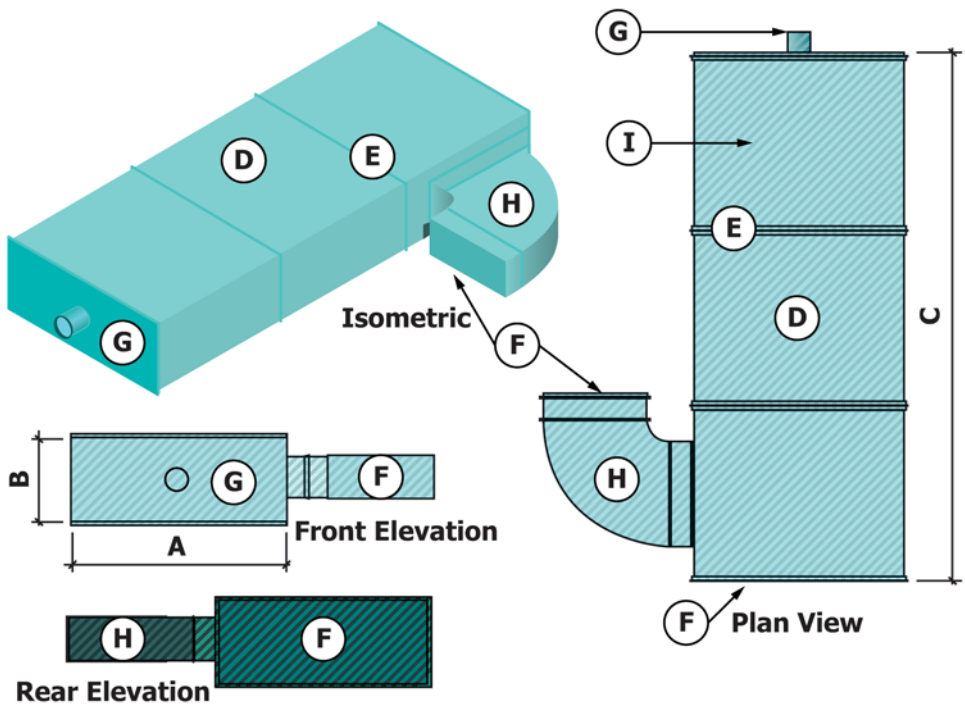
NOTE 8—SMACNA HVAC Duct Construction Standards and DW/144, Specification for Sheet Metal Ductwork are two examples of industry publications that provide guidance for HVAC duct design.

7.2.4 The opening area shall be 50 ± 5 % of the cross sectional area of the HVAC duct made from one or more openings. The interior area of the branch, 'T' or elbow, shall be 25 ± 5 % of the interior area of the HVAC duct.

7.2.5 Testing qualifies the performance of HVAC ducts, either supply (pressurization: Condition A – Horizontal and Condition B – Vertical) or return (exhaust: Condition C – Horizontal and Condition D – Vertical) or both (test all Conditions). The HVAC duct shall be one or more of the following:

7.2.5.1 *Condition A*—Fire from the outside of the horizontal HVAC duct system without openings, shall consist of the following minimum components assembled to meet the layout and the dimensional requirements in Fig. 1 that has at least: one joint on the fire side, one joint located on the unexposed side, one straight section, one "T" section, and one 90-degree elbow with an end cap.

7.2.5.2 *Condition B*—Fire from the outside of the vertical HVAC duct system without openings, shall consist of the following minimum components assembled to meet the layout



A = Width of HVAC Duct
B = Depth of HVAC Duct
C = Length of HVAC Duct
D = Straight HVAC Duct

E = HVAC Duct Joints

F = HVAC End Cap
G = Test Cap with Fan Connection
H = HVAC Duct 90° Elbow
I = Optional HVAC Duct Internal Reinforcement

FIG. 1 Condition A – Horizontal HVAC without Openings

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and the dimensional requirements in Fig. 2 that has at least: one joint on the fire side, one joint located on the unexposed side, one straight section, one 'T' section with an end cap at both openings.

7.2.5.3 *Condition C*—Fire exposure from the outside with hot gases entering the horizontal HVAC duct system through unprotected openings, shall consist of the following minimum components assembled to meet the layout and the dimensional requirements in Fig. 3 that has at least: one joint on the fire side, one joint located on the unexposed side, one straight section having an end cap, and one of the sections in the furnace with two unprotected openings. The unprotected opening area shall total 50 % of the cross sectional area of the HVAC duct with the depth of the unprotected opening one half the depth of the HVAC duct, and shall be located at least 20 in. (508 mm) from the fire-separating element through which the HVAC duct passes.

7.2.5.4 *Condition D*—Fire exposure from the outside with hot gases entering the inside of the vertical HVAC duct system through unprotected openings, shall consist of the following minimum components assembled to meet the layout and the dimensional requirements in Fig. 4 that has at least: one joint on the fire side, one joint located on the unexposed side, one straight section having an end cap, and one of the sections in the furnace with two unprotected openings. The unprotected opening area shall total 50 % of the cross sectional area of the HVAC duct with the width of the opening one half the width of the HVAC duct, and shall be located at least 20 in. (508 mm) from the fire-separating element through which the HVAC duct passes.

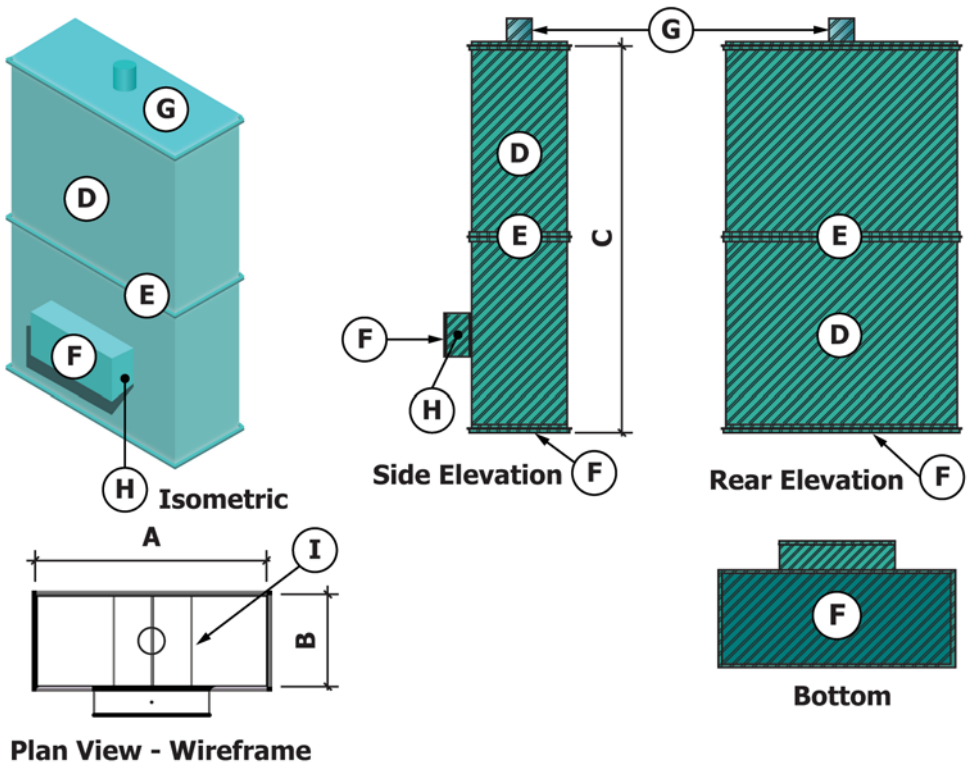
7.2.6 All vertical sections of the HVAC duct not within the furnace shall be supported as in practice at the horizontal separating element. The vertical section of an HVAC duct within the furnace shall have at least one joint. When equipped with a horizontal transition of the HVAC duct inside the furnace, support the horizontal transition as in practice with a support system.

7.2.7 All HVAC ducts shall have a least one joint within the furnace located a minimum of 12 in. (305 mm) from the supporting construction.

7.2.8 All fire-resistive materials used shall also have at least one joint within the furnace located a minimum of 12 in. (305 mm) from the supporting construction.

7.2.9 Properties of the materials, such as density and dimensions, used in the test specimen shall be determined, documented, and recorded. Document the description of the test specimens. Include such information as the lot number, trade name, and all recorded information.

7.2.10 *Test Assemblies:*



A = Width of HVAC Duct
B = Depth of HVAC Duct
C = Length of HVAC Duct
D = Straight HVAC Duct

E = HVAC Duct Joints

F = HVAC End Cap
G = Test Cap with Fan Connection
H = "T" Connection
I = Optional HVAC Duct Internal Reinforcement

FIG. 2 Condition B – Vertical HVAC Duct without Openings

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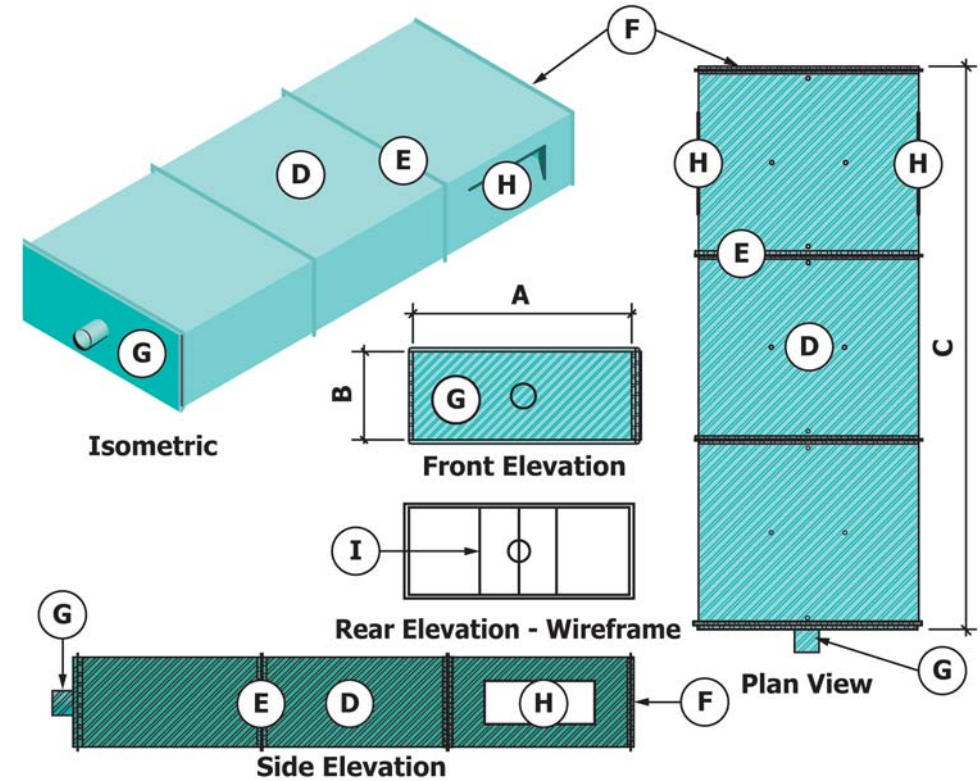

A = Width of HVAC Duct
B = Depth of HVAC Duct
C = Length of HVAC Duct
D = Straight HVAC Duct

E = HVAC Duct Joints

F = HVAC End Cap
G = Test Cap with Fan Connection
H = Unprotected Opening
I = Optional HVAC Duct Internal Reinforcement

FIG. 3 Condition C – Horizontal HVAC Duct with Openings

7.2.10.1 Construct a test assembly to house one or more HVAC duct system conditions. When two or more HVAC ducts are tested simultaneously provide a minimum separation distance of 12 in. (305 mm) between the HVAC ducts and a minimum distance of 12 in. (305 mm) from the furnace walls. Construct the test assembly using the following:

7.2.10.2 Create a horizontal fire-separating element, a vertical fire-separating element, or a combination of both fire-separating elements sized to meet the requirements needed to test the desired HVAC duct system condition or conditions.

(1) Create an opening through the fire-separating element, which is sized in accordance with the test sponsor's specification, for the penetration of the HVAC duct through the fire-separating element and application of a through-penetration firestop system. Document and report the size of the opening and its location in the fire-separating element.

(2) For a solid horizontal homogeneous fire-separating element, for example, concrete, the fire-resistance rating of the fire-separating element surrounding the opening for a minimum distance of 12 in. (305 mm) shall be equal to the intended fire-resistance of the HVAC duct system.

(3) For a vertical fire-separating element containing cavities, for example, stud wall or CMU, the fire-resistance rating of the fire-separating element surrounding the opening for a minimum distance of at least one vertical course or stud cavity adjacent to the opening shall be equal to the intended fire-resistance of the HVAC duct system.

NOTE 9—Spans of thin concrete floors require substantial structural reinforcement. Solid concrete resists lateral heat transfer. Concrete is thermally stable at locations 6 in. (152 mm) away from openings.

NOTE 10—At least one full stud cavity in gypsum wall assemblies should bound each side of the HVAC duct system. The effect of the HVAC duct system's radiation may enter the cavity of the gypsum wall assembly and increase the unexposed surface temperature at a rate greater than the rest of the wall assembly.

7.2.10.3 Extend one end of the HVAC duct at least 36 in. (914 mm) beyond the unexposed side of the surface fire-separating element and project the other end of the HVAC duct a minimum of 72 in. (1829 mm) beyond the exposed side of the surface fire-separating element and support HVAC duct as in practice. Suspend the HVAC duct from the fire-separating element using a support system specified by the test sponsor and intended to carry the load of the HVAC duct system being tested. Install the support system in accordance with the test sponsor's installation instructions. Document and report the support system components and the installation method.

7.2.10.4 The orifice at the end of the HVAC duct unexposed to fire shall be capped, sealed, and equipped with the apparatus

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