NFPA 285

Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus

1998 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 285

Standard Method of Test for the

Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus

1998 Edition

This edition of NFPA 285, *Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus*, was prepared by the Technical Committee on Fire Tests and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 18–21, 1998, in Cincinnati, OH. It was issued by the Standards Council on July 16, 1998, with an effective date of August 5, 1998, and supersedes all previous editions.

This edition of NFPA 285 was approved as an American National Standard on August 6, 1998.

Origin and Development of NFPA 285

This 1998 edition is the first for this standard. It establishes a test method, developed through a consensus process, for determining the flammability characteristics of exterior non-load-bearing wall assemblies or panels. The Committee's intention was to establish a standard that could be adopted or referenced by other applicable documents such as the model building codes. The standard was introduced to regulate and address the introduction of combustible materials into exterior walls of all construction types.

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Contents

NFPA 285

Standard Method of Test for the

Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus

1998 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

Information on referenced publications can be found in Appendix B.

Chapter 1 General

1-1 Scope. This test provides a method of determining the flammability characteristics of exterior, non-load-bearing wall assemblies/panels. The test method described is intended to evaluate the inclusion of combustible components within wall assembled/panels of buildings that are required to be of noncombustible construction. It is intended to simulate the tested wall assemblies' fire performance.

1-2 Purpose.

1-2.1 The primary performance characteristics that shall be evaluated in this test are as follows:

(a) The capability of the test wall assembly to resist flame propagation over the exterior face of the system

(b) The capability of the test wall assembly to resist vertical spread of flame within the combustible core/component of the panel from one story to the next

(c) The capability of the test wall assembly to resist vertical spread of flame over the interior (room side) surface of the panels from one story to the next

(d) The capability of the test wall assembly to resist lateral spread of flame from the compartment of fire origin to adjacent spaces

1-2.2 The ability of the test wall assembly to meet these performance characteristics shall be determined by visual observations along with temperature data obtained during the test.

1-2.3 This test shall not be an evaluation of the methods used to seal voids at the floor–wall intersection per se. While this test requires the use of materials to seal voids at the floor–wall intersection, the results of the test shall not be restricted to the sealing method used but rather shall encompass any approved sealing method suitable for the type of wall assembly tested.

1-3 Definitions.

Approved.* Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Chapter 2 Test Facility and Apparatus

2-1 Test Facility. The test apparatus described in Section 2-2 shall be located inside a test facility. The facility shall be a minimum of 30 ft × 30 ft × 23 ft (9.14 m × 9.14 m × 7.01 m) high. The facility shall have provisions for supplying fresh combustion make-up air during the test. The facility shall also be constructed so as to allow for the exhaust of the combustion byproducts during the test while not inducing an air flow on the exterior face of the test panels. The test facility shall protect the test apparatus and test samples from weather conditions such as wind and rain.

2-2 Test Apparatus.

2-2.1 The intermediate-scale, multistory test apparatus (ISMA) shall consist of a two-story test structure having minimum floor-to-top dimensions of 15 ft 2 in. ± 1 in. (4.62 m ± 25 mm). Each room shall have inside dimensions (unfinished or unprotected) of 10 ft ± 0.5 in. × 10 ft ± 0.5 in. (3.05 m ± 13 mm × 3.05 m ± 13 mm) with a floor-to-ceiling height (unfinished or unprotected) of 7 ft ± 0.5 in. (2.13 m ± 13 mm). See Figures 2-2.1(a) through 2-2.1(d) for diagrams of the test structure.

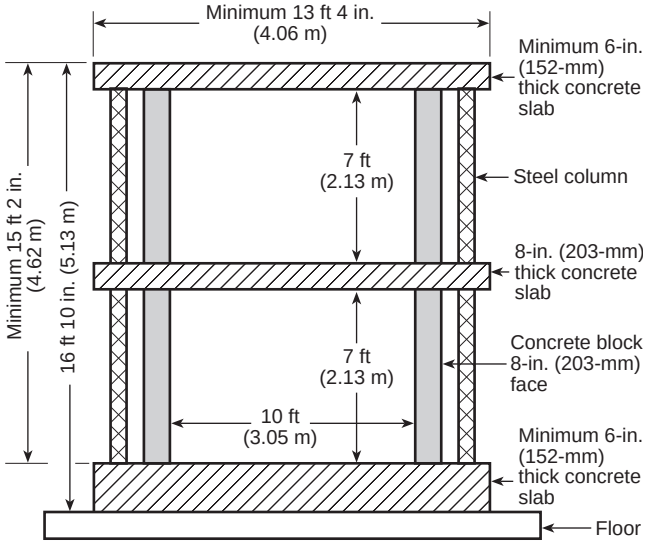


Figure 2-2.1(a) Front view of test structure (not to scale).

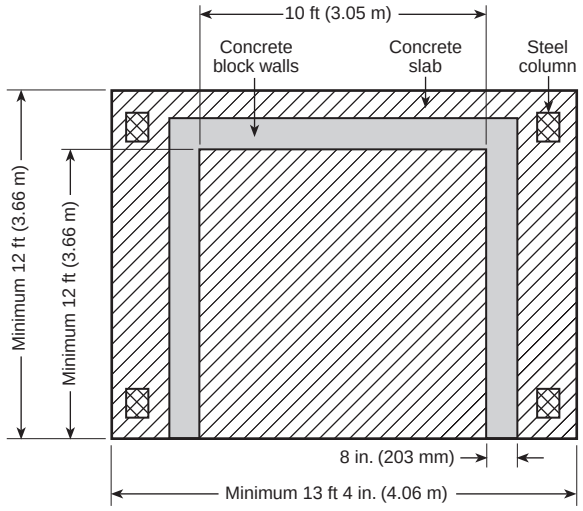


Figure 2-2.1(b) Plan view of test structure — both floors (not to scale).

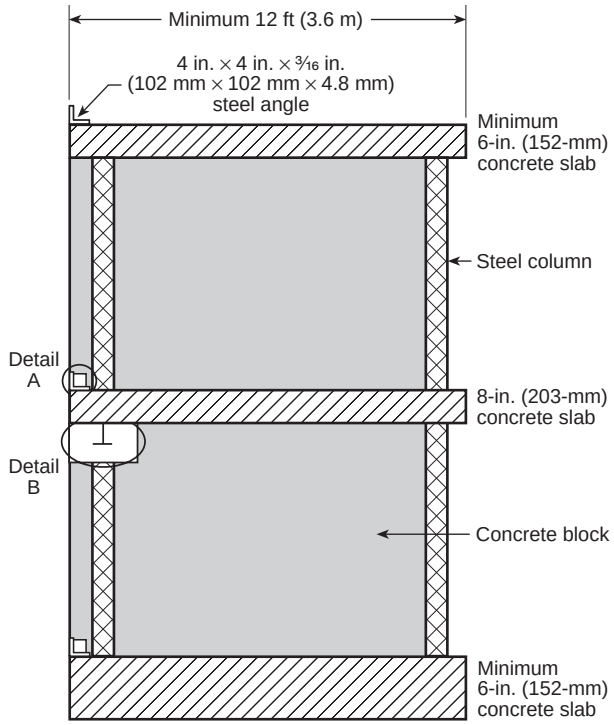


Figure 2-2.1(c) Side view of test structure (not to scale).

2-2.2 The floors shall be constructed of reinforced concrete and shall be supported by steel columns of an appropriate size. The columns shall not be inside either the first- or second-story test rooms. The first floor slab shall be a minimum of 6 in. (152 mm) thick, the second floor slab shall be 8 in. ± 0.5 in. (203 mm ± 13 mm) thick, and the third floor slab shall be a minimum of 6 in. ± 0.5 in. (152 mm ± 13 mm) thick.

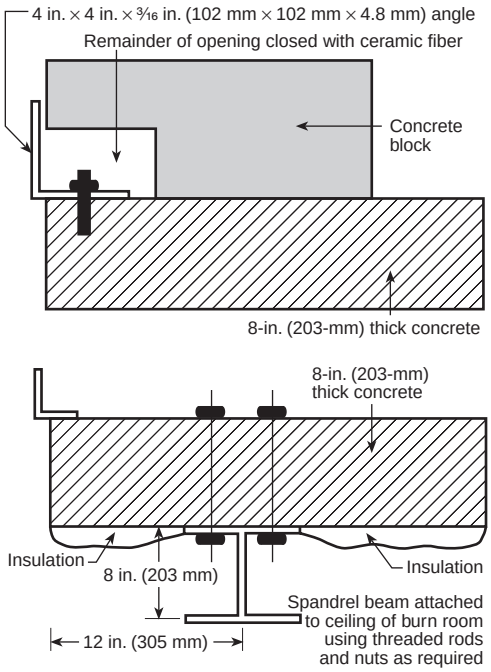


Figure 2-2.1(d) Detail B of test structure (not to scale).

2-2.3 The three permanent walls that form each room shall be constructed of 8 in. ± 0.5 in. (203 mm ± 13 mm) concrete block or similar construction.

2-2.4 The interior surfaces of the first floor burn room shall be insulated as follows:

(a) Walls and ceiling shall be one layer of $^{5}/_{8}$-in. (15.9-mm) thick, type X gypsum wallboard and one layer of 1.5-in. (38-mm) thick, 8-lb/ft^3 (128-kg/m^3) ceramic fiber insulation on the interior face. The insulation thickness on each individual wall or on the ceiling shall not exceed 2.5 in. (64 mm).

(b) Floor shall be two layers of $^{5}/_{8}$-in. (15.9-mm) thick, gypsum wallboard.

2-2.5 No insulation shall be required in the second floor area.

2-2.6 Each floor level shall have one access opening approximately 3.5 ft wide × 6.75 ft high (1.07 m × 2.06 m). The first floor access opening shall be in one of the sidewalls, and the second floor access opening shall be in the back wall. The access door opening on the first floor shall be capable of being closed during tests, while the access opening on the second floor shall remain open during tests.

2-2.7 Additional access openings shall be permitted to be made in the second floor area for instrumentation and video; however, they shall be closed during test.

2-2.8 Test wall assemblies shall be permitted to be built directly onto the test apparatus or they shall be permitted to be built into a movable frame system that is in turn fastened to the test apparatus.

2-3 Movable Test Frame.

2-3.1 Figure 2-3.1 provides a sketch of the movable test frame. The frame shall be designed such that the 4 in. × 4 in. × $^{3}/_{16}$ in. (102 mm × 102 mm × 4.8 mm) angles will meet at the top of the respective floor lines on the test apparatus. The frame

shall be sufficiently rugged so that no racking or movement will occur in the test wall assembly during movement and/or fastening. The frame system shown in Figure 2-3.1 shall serve the minimum size test wall assembly. Larger frame assemblies shall be permitted.

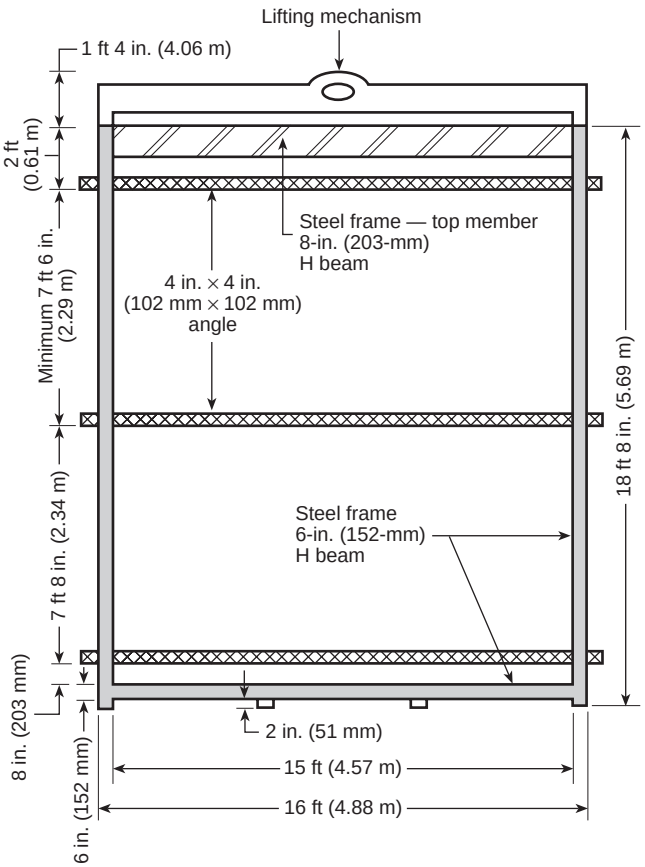


Figure 2-3.1 Front view of wall frame (not to scale).

2-4 Burners.

2-4.1 The burner arrangement shall consist of two gas-fired burners. The first burner shall be positioned inside the first floor burn room, and the second burner shall be positioned inside the window opening of the test wall assembly .

2-4.2 The burn room burner shall be constructed of 2-in. (51-mm) O.D. steel pipe with $^1/_8$-in. (3.2-mm) diameter holes placed 1-in. (25-mm) on center. The holes shall be positioned such that they face upward. The holes shall start at 3.5 ft (1.06 m) from the back wall on both sides of the gas supply pipes and continue across the front gas supply pipe. The entire gas supply pipe system located within the burn room shall be wrapped with a single layer of nominally 1-in. (25-mm) thick, 8-lb/ft^3 (128-kg/m^3) ceramic fiber blanket. The burner shall be supported such that its centerline is 2.5 ft ± 1.0 in. (0.76 m ± 25 mm) above the floor. Figures 2-4.2(a) and 2-4.2(b) provide sketches of the burn room burner.

2-4.3* The window gas burner shall consist of a 60 in. ± 0.5 in. (1524 mm ± 13 mm) length of nominal 2-in. (51-mm) O.D. pipe having a 0.5 in. ± 0.06 in. (13 mm ± 1.5 mm) wide by 44 in. ± 0.5 in. (1118 mm ± 13 mm) long slot. The burner shall be supplied with gas at both ends through nominal 1-in. (25-mm) O.D. pipe to provide uniform gas pressure at the burner slot. Figure 2-4.3 provides a sketch of the window burner.

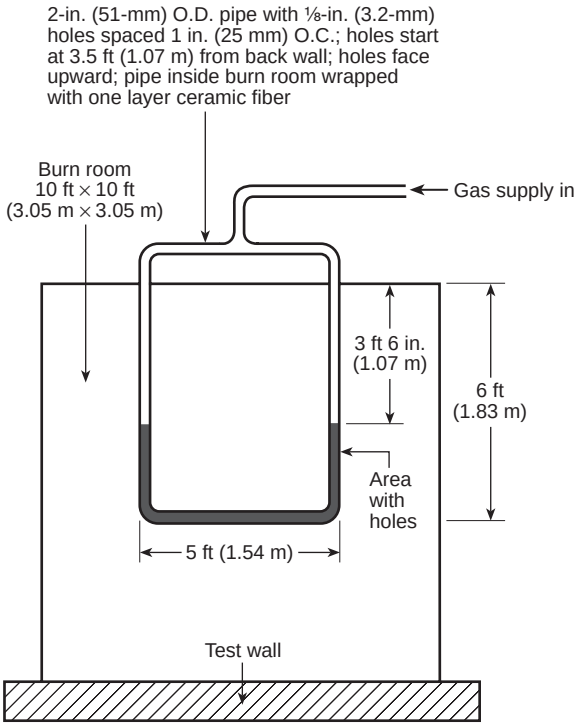


Figure 2-4.2(a) Burn room burner — plan view (not to scale).

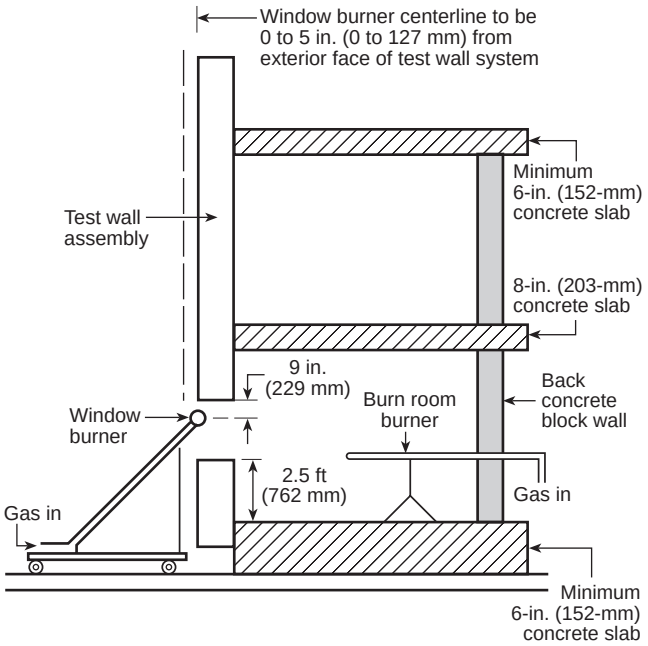


Figure 2-4.2(b) Side view of burner placement in burn room (not to scale).

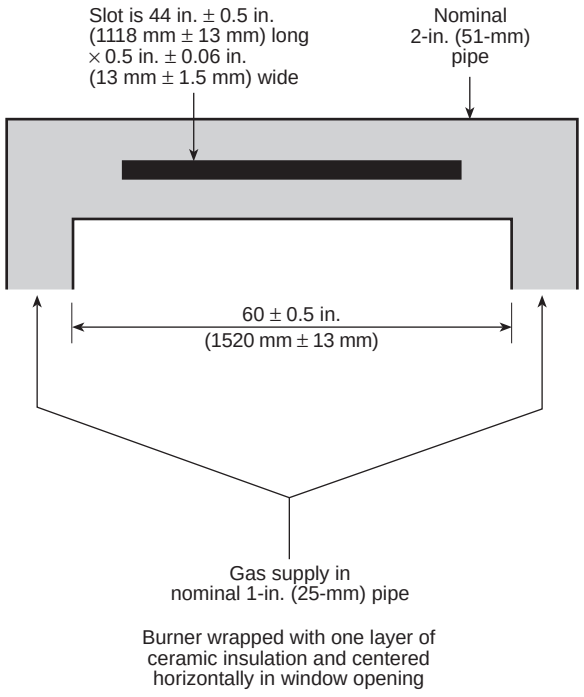


Figure 2-4.3 Plan view of window burner (not to scale).

2-4.4 The window burner shall be wrapped with a layer of nominally 1-in. (25-mm) thick, 8-lb/ft^3 (128-kg/m^3) ceramic fiber insulation. The burner shall be permitted to be mounted on a movable trolley. The burner shall be positioned such that the slot is facing upward, and it shall be centered horizontally in the window opening. The horizontal centerline of the burner shall be 9 in. ± 0.5 in. (229 mm ± 13 mm) below the window header. The vertical centerline of the burner shall be placed such that it is 0–5 in. (0–127 mm) from the exterior face of the test wall assembly. The exact placement [inches (millimeters) from the exterior face] shall be based on information developed during the calibration procedure.

2-4.5 The burners shall be fired during the test according to the burner regimen shown in Table 2-4.5 in order to achieve the temperature shown in Table 7-1.8 *(see 7-1.11)*. Each burner shall attain its assigned flow rate within 15 seconds of each change. If during the calibration procedure it is demonstrated that the burners need to follow slightly different flow rates in order to attain the prescribed burn room and/or exterior temperatures and heat fluxes, then the flows derived from the calibration tests shall be used.

Chapter 3 Test Wall Assemblies

3-1 Assemblies.

3-1.1 The test wall assemblies shall be built either on the test apparatus or in a movable test frame. Figures 3-1.1(a) through (c) provide sketches of the test wall assembly mounting methods.

3-1.2 As a minimum, the test wall assembly shall be 17.5 ft high × 13.33 ft wide (5.33 m × 4.06 m). Larger wall assemblies shall be permitted.

3-1.3 The test wall assembly shall extend as follows:

(a) Below the first floor a minimum of 2 in. (51 mm)

(b) Above the top of the test apparatus a minimum of 2 ft (0.61 m)

(c) Past the outside edges of both concrete block sidewalls a minimum of 1 ft (0.305 m)

3-1.4 The test wall assembly shall completely close the front face of the test apparatus except for a simulated window opening in the first floor area. The window shall be 30 in. ± 0.5 in. high by 78 in. ± 0.5 in. wide (76 mm ± 13 mm high by 1981 mm ± 13 mm wide) with a sill height of 30 in. ± 0.5 in. (76 mm ± 13 mm). It shall be centered horizontally with respect to the burn room. The window opening shall be the only opening in the first-story burn room area during the test.

3-1.5 The test wall assembly shall be secured to the test apparatus using a girth system of replaceable nominal 4 in. × 4 in. × $^3/_{16}$ in. (102 mm × 102 mm × 8 mm) steel angles.

Table 2-4.5 Calibration Flow Rates (Based on Natural Gas)

Time Interval	Room Burner SCFM	Room Burner (m^3/min)	Room Burner kW	Room Burner (Btu/min)	Window Burner SCFM	Window Burner (m^3/min)	Window Burner kW	Window Burner (Btu/min)
0:00 – 5:00	38.0	1.08	687	39,064	0.0	0.00	0	0
5:00 – 10:00	38.0	1.08	687	39,064	9.0	0.25	163	9,252
10:00 – 15:00	43.0	1.22	777	44,204	12.0	0.34	217	12,336
15:00 – 20:00	46.0	1.30	831	47,288	16.0	0.45	289	16,448
20:00 – 25:00	46.0	1.30	831	47,288	19.0	0.54	343	19,532
25:00 – 30:00	50.0	1.42	904	51,400	22.0	0.62	398	22,616

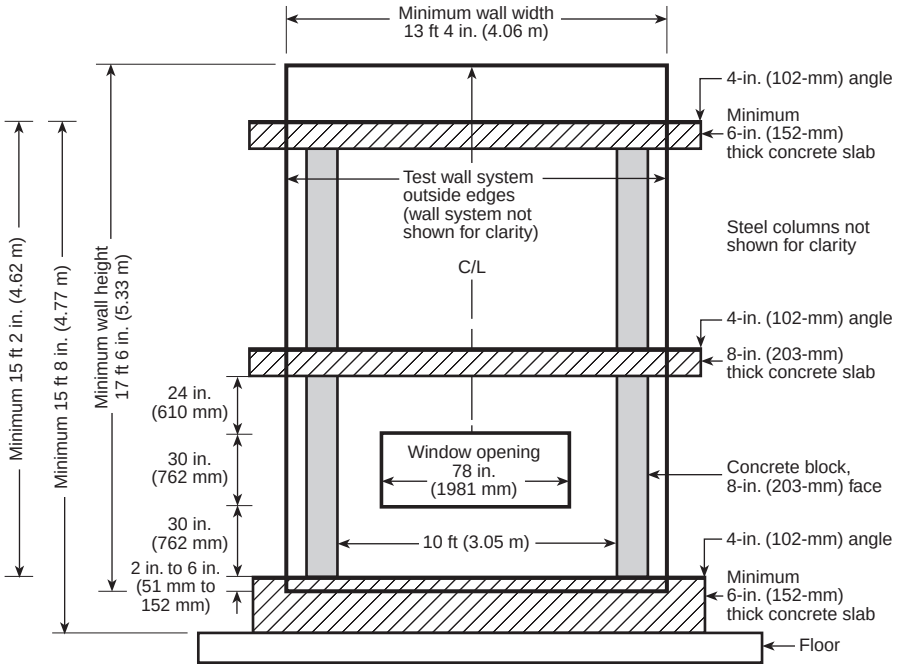


Figure 3-1.1(a) Front view of wall system built in place on test structure (not to scale).

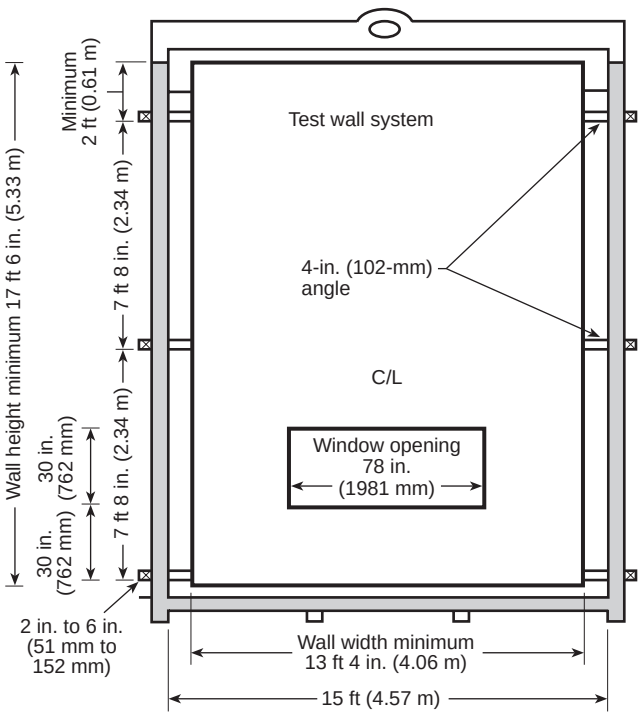


Figure 3-1.1(b) Front fiew of wall system in frame (not to scale).

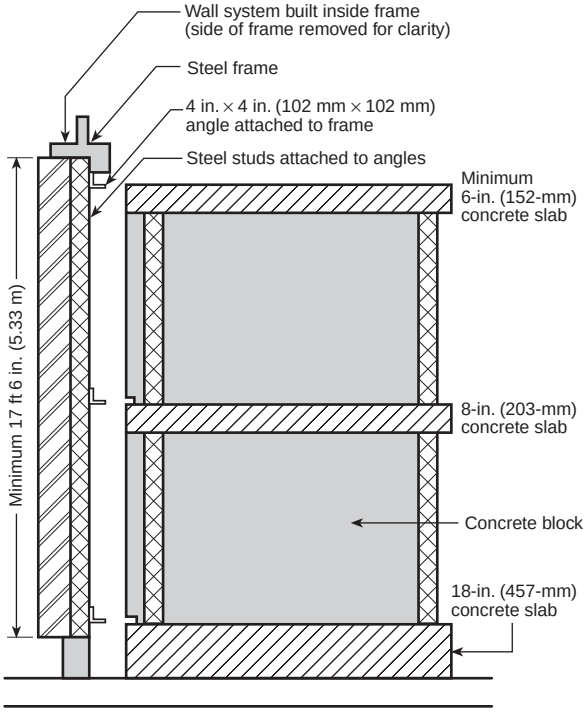


Figure 3-1.1(c) Side view of wall system in frame (not to scale).

3-1.6 A replaceable spandrel beam shall be mounted on the underside of the second floor when the attachment of the test wall assembly requires that it be present. The spandrel beam shall be W8 × 21 (W200 × 31) and shall be installed as shown in Figures 2-2.1(c) and 2-2.1(d). The spandrel beam shall extend across the burn room compartment from one protected interior wall surface to the opposite protected interior wall surface.

3-1.7 Where used, the spandrel beam shall be permitted to be either protected or unprotected, at the discretion of the test laboratory or the client. If the spandrel beam is to be protected, then one layer of nominal 1-in. (25-mm) thick, 6-lb/ft^3 (96-kg/m^3) ceramic fiber shall be used. All outriggers and additional connections shall not be protected.

3-1.8 The test wall assembly shall be constructed and secured to the test apparatus using fastening and construction details representative of actual field conditions. Details of the erection shall follow the manufacturer's instructions and shall be typical of actual product use. When a product has vertical or horizontal joints or seams, joints or seams typical of normal construction including caulking, backing, and other details as appropriate shall be incorporated into the test assembly.

3-1.9 Prior to test, the test wall assembly and its components shall be cured as required by the manufacturer. In the case of cementitious coatings or materials, a minimum of 28 days shall elapse from completion of construction to testing. During cure time, the wall assemblies shall be protected from weather.

Chapter 4 Instrumentation

4-1 General.

4-1.1 The test instrumentation shall be as provided in 4-1.2 and 4-1.3.

4-1.2 Temperature measurements shall be taken at the following locations:

(a) Exterior face of test wall assembly, as shown in Figure 4-1.2(a)

(b) Core of the test wall assembly, as shown in Figures 4-1.2(a) and 4-1.2(b

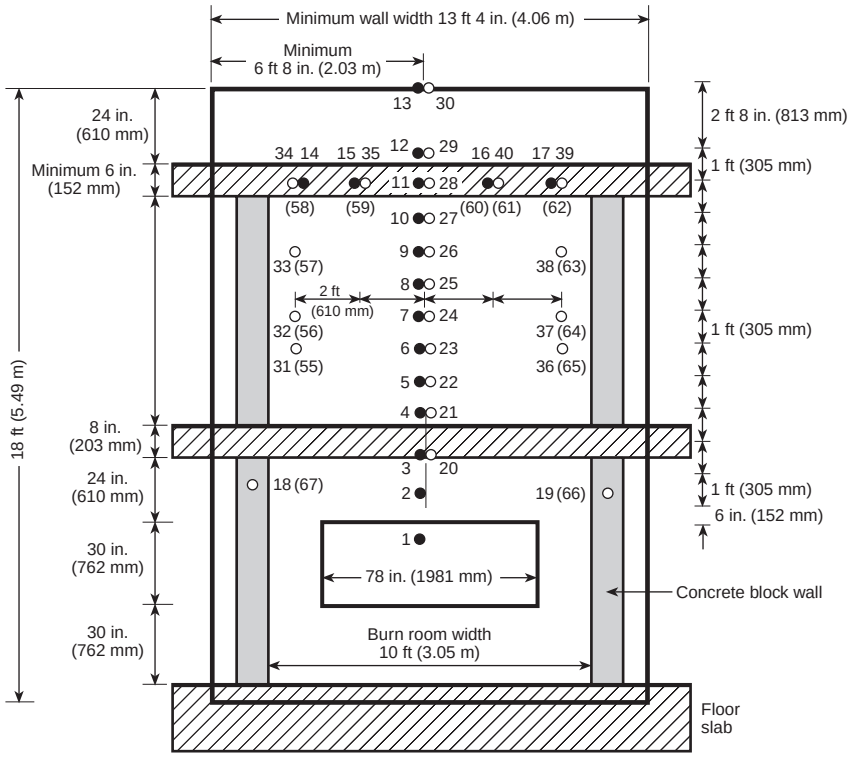
(c) Interior surface of test wall system, as shown in Figure 4-1.2(c)

(d) Burn room ceiling area as shown in Figure 4-1.2(d)

4-1.3 Instrumentation to measure the flow rate of gas to each of the burners shall be provided.

4-2 Thermocouples. Temperature measurements shall be made using 20-gauge, Type K thermocouples except that those used to measure the temperatures shown in Figure 4-1.2(d) shall be 18-gauge, Type K thermocouples.

4-3 Recording. All data shall be recorded at intervals not to exceed 15 seconds.



● Thermocouples — 1 in. (25 mm) from exterior wall surface

○ Thermocouples — In core/air space [see Figure 4-1.2(b)]
(Thermocouples) — Additional thermocouples [see Figure 4-1.2(b), part C]

Figure 4-1.2(a) Exterior view of exterior wall. Instrumentation arrangement.

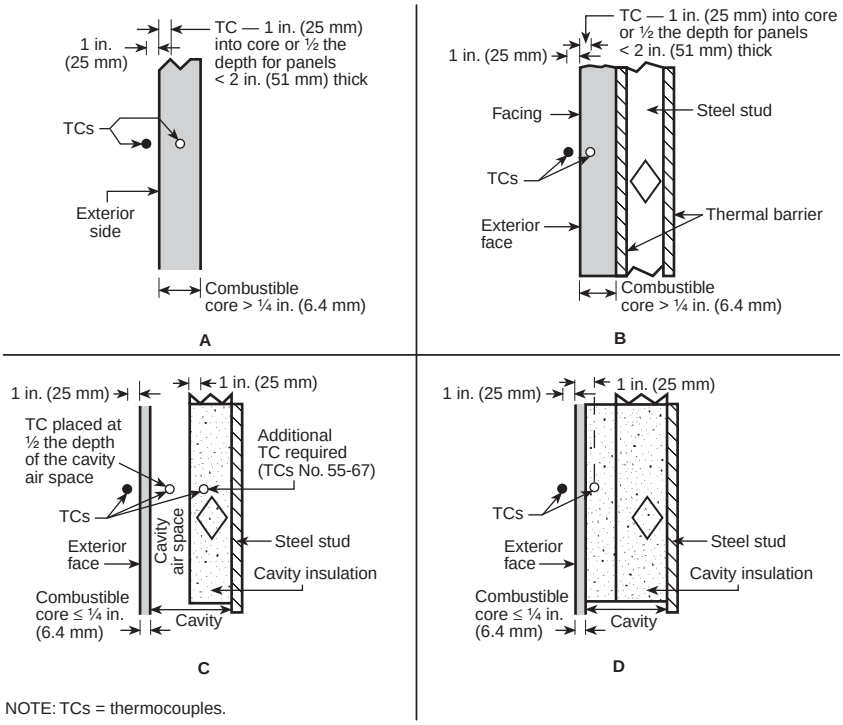


Figure 4-1.2(b) Instrumentation arrangement.

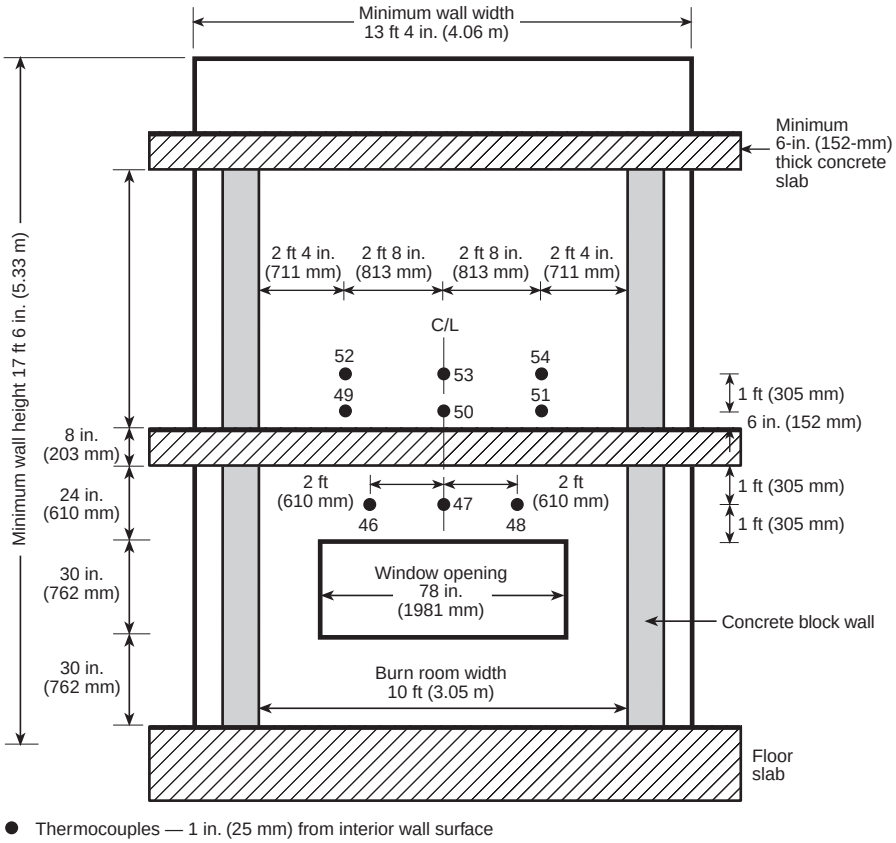


Figure 4-1.2(c) Interior view of exterior wall. Instrumentation arrangement.

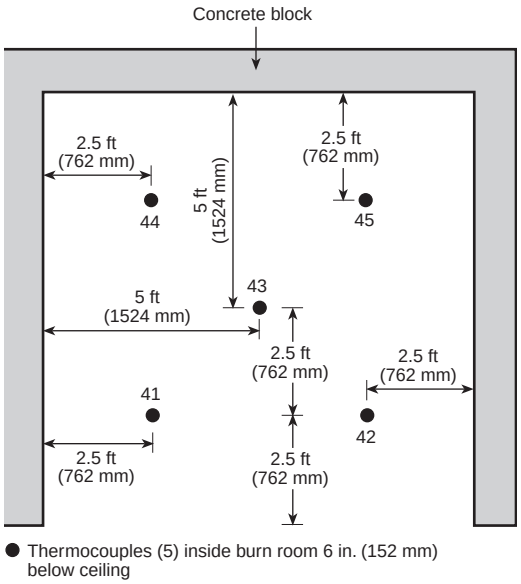


Figure 4-1.2(d) Plan view looking down — burn room. Instrumentation arrangement.

Chapter 5 Documentation

5-1 Data Recording. Documentation shall consist of the following:

(a) 35-mm color slides or photographs taken during construction of the test wall assembly, during actual test (at least once every minute) of the exterior face, and post-test to include dissection of the test assembly

(b) Color videotape of the exterior face of the test wall assembly prior to, during, and post-test

(c) Film, taken immediately prior to the start of the test, of the exterior face of the assembly, the laboratory test report identification number, and test date

(d) Color videotape of the test wall–floor intersection in the second floor level during the test period (This camera is used to assist in determination of flame penetration and/or smoke development.)

(e) Videos including a clock or a timer depicting "real time" (The timer shall be permitted to be integral to the video camera, or a clock or timer shall be permitted to be used provided it is clearly viewed throughout the test.)

Chapter 6 Test

6-1 Test Procedure. The following test procedure shall be used:

(a) Instrumentation on the completed test wall assembly shall be verified for operation.

(b) The placement of the window burner shall be verified.

(c) Ambient conditions prior to the test shall be as follows:

1. The temperature shall be 50°F – 90°F (10°C – 32°C).
2. The relative humidity shall be 20 percent to 80 percent.
3. Airflow across the exterior face of the test assembly shall be less than 4.4 ft/sec (1.3 m/sec), as determined by an anemometer placed at right angles to the exterior face.

(d) Video and data collection shall be started 1 minute prior to ignition of the room burner.

(e) The burn room burner shall be ignited.

(f) The flow regimen shall be followed for burners to achieve temperatures or heat fluxes as shown in Table 7-1.8 *(see 7-1.11)*.

(g) At 5 minutes after ignition of the room burner, the window burner shall be ignited.

(h) Visual observation of the performance of the wall assembly during the test period shall be recorded.

(i) At 30 minutes after ignition of the room burner, the gas supply to both burners shall be shut off.

(j) Data collection shall be continued until residual burning has stopped or 10 minutes has elapsed after gas flow was shut off.

(k) Any residual burning on the wall assembly shall be permitted to continue until extinguishment or until 10 minutes has elapsed after the gas flow was shut off.

(l) The interior and exterior walls shall be photographed and visual observations taken. The test wall assembly shall be dismantled and dissected to determine the height and depth of damage within the combustible core and the condition of the panel facings.

Chapter 7 Calibration Procedure

7-1 Procedure. Prior to product testing, an initial calibration test shall be performed to evaluate the flow rates of the gas burners.

7-1.1 The test wall assembly for the calibration test shall be constructed of two layers of $^{5}/_{8}$-in. (15.9-mm) thick, Type X gypsum wallboard applied to both sides of 18-gauge steel studs that are 24 in. (610 mm) on center. All joints shall be taped or caulked. Figure 7-1.1 provides a sketch of this construction. The test wall assembly shall extend 18 ft (5.49 m) above the first-floor level and shall be a minimum of 14 ft (4.27 m) wide.

7-1.2 The interior enclosing boundary surface of the window opening shall be gypsum wallboard.

7-1.3 No spandrel beam shall be used.

7-1.4 Calibration instrumentation shall consist of the following:

(a) As a minimum, temperature measurements at the locations shown in Figures 7-1.4(a) through (c). The temperature measurements shall be made using 20-gauge, Type K thermocouples, except that those used to measure the temperatures shown in Figure 7-1.4(c) shall be 18-gauge, Type K thermocouples.

(b) A minimum of three 0–5 W/cm^2 circular foil total heat flux gauges. Figure 7-1.4(a) provides the locations for these instruments.

(c) Flow rate measurement equipment for each of the burners.

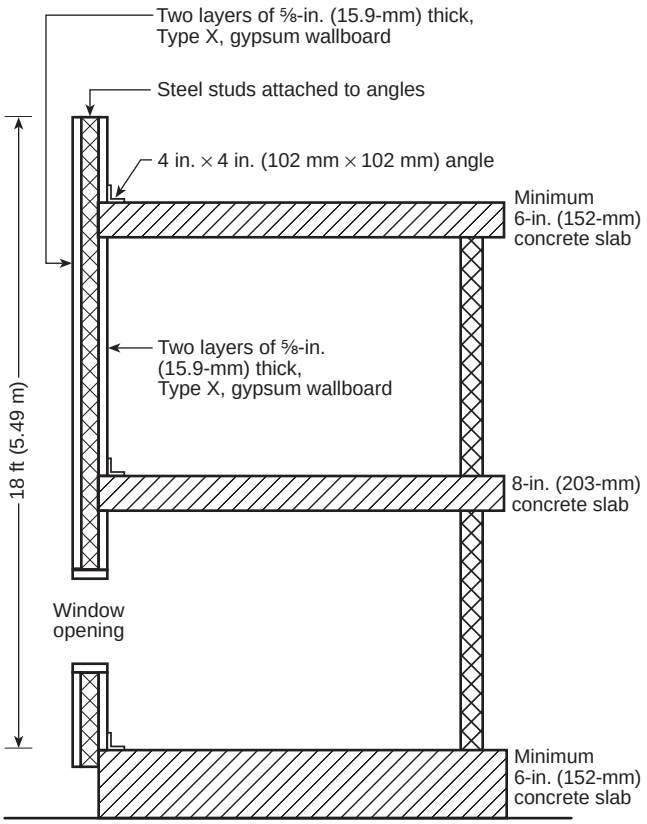


Figure 7-1.1 Side view of calibration wall system (not to scale).

7-1.5 Prior to the conduct of the calibration test, the paper facing of the gypsum wallboard on the exterior face of the calibration wall assembly shall be burned away. This shall be accomplished by igniting both the room burner and the window burner and immediately adjusting the burners to their maximum flow rates as prescribed in Table 2-4.5. The burners shall be run for 5 minutes at these flows.

7-1.6 The calibration test shall be conducted such that the burners are fired during the test according to the burner regimen shown in Table 2-4.5. Each burner shall be at its assigned flow rate within 15 seconds of each change.

7-1.7 The initial calibration test shall be conducted with the window burner positioned such that the vertical centerline of the burner is flush with the exterior face of the wall assembly.

7-1.8* At the conclusion of the test, the data obtained shall be compared to the values specified in Table 7-1.8. To prevent burner changes from affecting the data, the average values for each time period shall be determined using data from 15 seconds into the period through 15 seconds short of the end of the period.

7-1.9 The allowable tolerances for the comparison of determined average values to the specified average values shall be 10 percent for temperatures and as shown in Table 7-1.8 for the heat flux measurements. All of the determined average values for the locations shown in Table 7-1.8 shall fall within the tolerances of those specified in Table 7-1.8. The values for Thermocouples 1 and 8 – 14, as shown in Figure 7-1.4(a), shall be reported, but they shall not be used in the calibration determination.

7-1-10 If the actual test values are not within the allowable tolerances, then the calibration shall be repeated and the gas flows or window burner position adjusted until the determined values are within the allowable tolerances.

7-1.11 If it is demonstrated that the burners must follow different flow rates in order to attain the prescribed burn room and/or exterior temperatures and heat fluxes, then the flows derived from the calibration test shall be used.

7-1.12 If it is demonstrated that the window burner must be repositioned within 0–5 in. (127 mm) of the exterior face of the calibration wall to attain the prescribed exterior temperatures and heat fluxes, then the position derived from the calibration shall be used in all subsequent testing.

7-2 Calibration. Calibration shall be performed in the following circumstances:

(a) Initially, prior to the first wall assembly test

(b) When significant changes (e.g., flowmeters are new) to the gas flow systems are made

(c) Within one year prior to the test of an actual product wall assembly

(d) Whenever ceramic blanket covering more than 50 percent of the wall or ceiling surface in the burn room is replaced

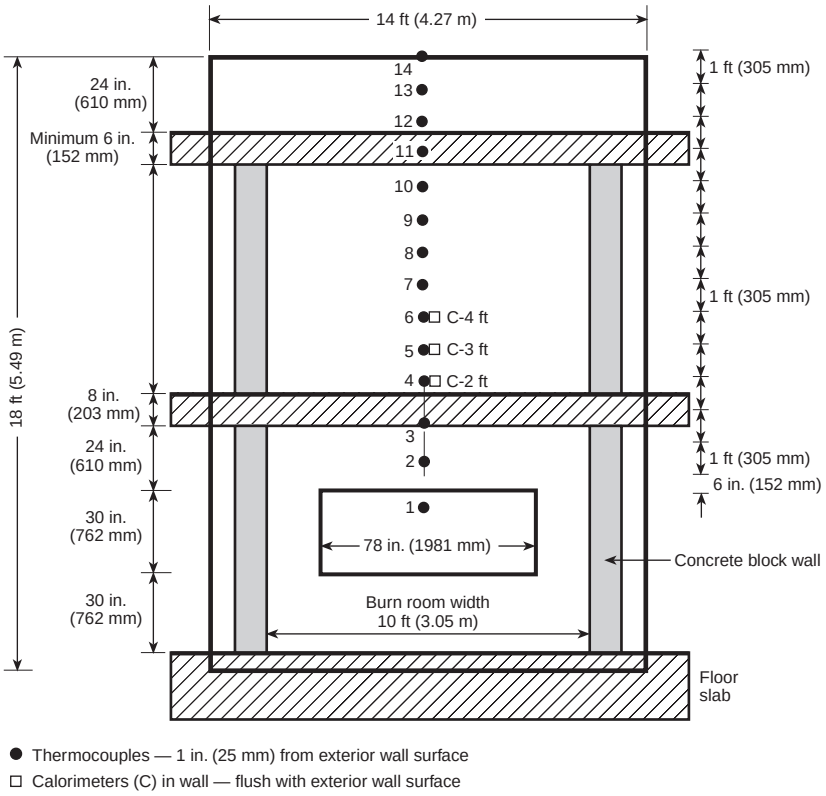


Figure 7-1.4(a) Front view of exterior wall. Calibration instrumentation (not to scale).

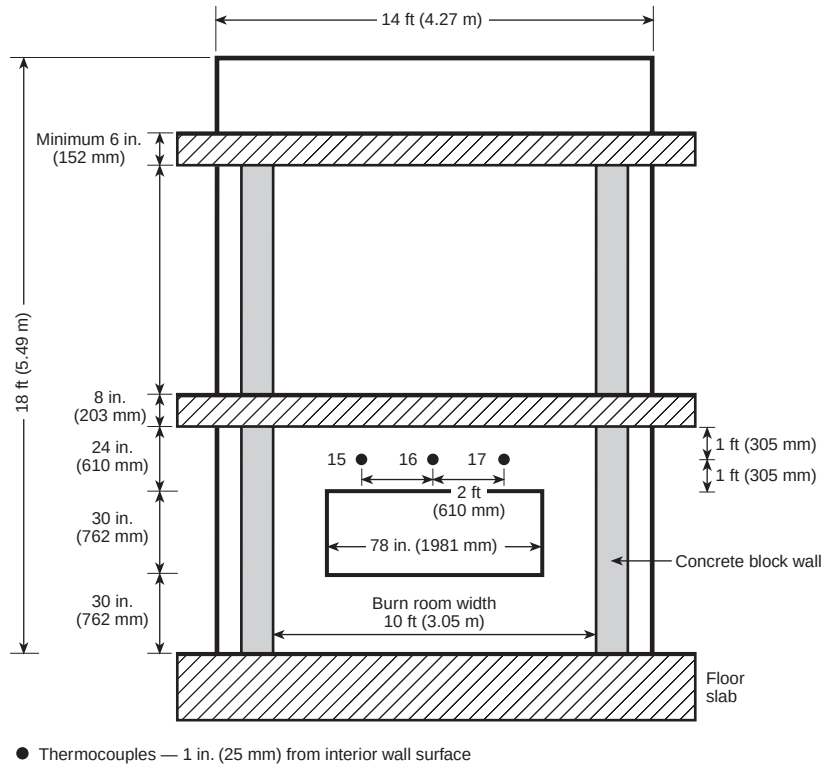


Figure 7-1.4(b) Interior view of exterior wall. Calibration instrumentation (not to scale).