RESOURCE A

GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

Introduction

The *International Existing Building Code* (IEBC) is a comprehensive code with the goal of addressing all aspects of work taking place in existing buildings and providing user friendly methods and tools for regulation and improvement of such buildings. This resource document is included within the cover of the IEBC with that goal in mind and as a step towards accomplishing that goal.

In the process of repair and alteration of existing buildings, based on the nature and the extent of the work, the IEBC might require certain upgrades in the fire resistance rating of building elements, at which time it becomes critical for the designers and the code officials to be able to determine the fire resistance rating of the existing building elements as part of the overall evaluation for the assessment of the need for improvements. This resource document provides a guideline for such an evaluation for fire resistance rating of archaic materials that is not typically found in the modern model building codes.

Resource A is only a guideline and is not intended to be a document for specific adoption as it is not written in the format or language of ICC's *International Codes* and is not subject to the code development process.

PURPOSE

The *Guideline on Fire Ratings of Archaic Materials and Assemblies* focuses upon the fire-related performance of archaic construction. "Archaic" encompasses construction typical of an earlier time, generally prior to 1950. "Fire-related performance" includes fire resistance, flame spread, smoke production, and degree of combustibility.

The purpose of this guideline is to update the information which was available at the time of original construction, for use by architects, engineers, and code officials when evaluating the fire safety of a rehabilitation project. In addition, information relevant to the evaluation of general classes of materials and types of construction is presented for those cases when documentation of the fire performance of a particular archaic material or assembly cannot be found.

It has been assumed that the building materials and their fastening, joining, and incorporation into the building structure are sound mechanically. Therefore, some determination must be made that the original manufacture, the original construction practice, and the rigors of aging and use have not weakened the building. This assessment can often be difficult because process and quality control was not good in many industries, and variations among locally available raw materials and manufacturing techniques often resulted in a product which varied widely in its strength and durability. The properties of iron and steel, for example, varied widely, depending on the mill and the process used.

There is nothing inherently inferior about archaic materials or construction techniques. The pressures that promote fundamental change are most often economic or technological—matters not necessarily related to concerns for safety. The high cost of labor made wood lath and plaster uneconomical. The high cost of land and the congestion of the cities provided the impetus for high-rise construction. Improved technology made it possible. The difficulty with archaic materials is not a question of suitability, but familiarity.

Code requirements for the fire performance of key building elements (e.g., walls, floor/ceiling assemblies, doors, shaft enclosures) are stated in performance terms: hours of fire resistance. It matters not whether these elements were built in 1908 or 1980, only that they provide the required degree of fire resistance. The level of performance will be defined by the local community, primarily through the enactment of a building or rehabilitation code. This guideline is only a tool to help evaluate the various building elements, regardless of what the level of performance is required to be.

The problem with archaic materials is simply that documentation of their fire performance is not readily available. The application of engineering judgment is more difficult because building officials may not be familiar with the materials or construction method involved. As a result, either a full-scale fire test is required or the archaic construction in question removed and replaced. Both alternatives are time consuming and wasteful.

This guideline and the accompanying Appendix are designed to help fill this information void. By providing the necessary documentation, there will be a firm basis for the continued acceptance of archaic materials and assemblies.

1
FIRE-RELATED PERFORMANCE OF ARCHAIC MATERIALS AND ASSEMBLIES

1.1
FIRE PERFORMANCE MEASURES

This guideline does not specify the level of performance required for the various building components. These requirements are controlled by the building occupancy and use and are set forth in the local building or rehabilitation code.

The fire resistance of a given building element is established by subjecting a sample of the assembly to a "standard" fire test which follows a "standard" time-temperature curve. This test method has changed little since the 1920s. The test results tabulated in the Appendix have been adjusted to reflect current test methods.

The current model building codes cite other fire-related properties not always tested for in earlier years: flame spread, smoke production, and degree of combustibility. However, they can generally be assumed to fall within well defined values because the principal combustible component of archaic materials is cellulose. Smoke production is more important today because of the increased use of plastics. However, the early flame spread tests, developed in the early 1940s, also included a test for smoke production.

"Plastics," one of the most important classes of contemporary materials, were not found in the review of archaic materials. If plastics are to be used in a rehabilitated building, they should be evaluated by contemporary standards. Information and documentation of their fire-related properties and performance is widely available.

Flame spread, smoke production and degree of combustibility are discussed in detail below. Test results for eight common species of lumber, published in an Underwriter's Laboratories' report (104), are noted in the following table:

TUNNEL TEST RESULTS FOR EIGHT SPECIES OF LUMBER

SPECIES OF LUMBER	FLAME SPREAD	FUEL CONTRIBUTED	SMOKE DEVELOPED
Western White Pine	75	50-60	50
Northern White Pine	120-215	120-140	60-65
Ponderosa Pine	80-215	120-135	100-110
Yellow Pine	180-190	130-145	275-305
Red Gum	140-155	125-175	40-60
Yellow Birch	105-110	100-105	45-65
Douglas Fir	65-100	50-80	10-100

Flame Spread

The flame spread of interior finishes is most often measured by the ASTM E 84 "tunnel test." This test measures how far and how fast the flames spread across the surface of the test sample. The resulting flame spread rating (FSR) is expressed as a number on a continuous scale where cement-asbestos board is 0 and red oak is 100. (Materials with a flame spread greater than red

oak have an FSR greater than 100.) The scale is divided into distinct groups or classes. The most commonly used flame spread classifications are: Class I or A*, with a 0-25 FSR; Class II or B, with a 26-75 FSR; and Class III or C, with a 76-200 FSR. The *NFPA Life Safety Code* also has a Class D (201-500 FSR) and Class E (over 500 FSR) interior finish.

These classifications are typically used in modern building codes to restrict the rate of fire spread. Only the first three classifications are normally permitted, though not all classes of materials can be used in all places throughout a building. For example, the interior finish of building materials used in exits or in corridors leading to exits is more strictly regulated than materials used within private dwelling units.

In general, inorganic archaic materials (e.g., bricks or tile) can be expected to be in Class I. Materials of whole wood are mostly Class II. Whole wood is defined as wood used in the same form as sawn from the tree. This is in contrast to the contemporary reconstituted wood products such as plywood, fiberboard, hardboard, or particle board. If the organic archaic material is not whole wood, the flame spread classification could be well over 200 and thus would be particularly unsuited for use in exits and other critical locations in a building. Some plywoods and various wood fiberboards have flame spreads over 200. Although they can be treated with fire retardants to reduce their flame spread, it would be advisable to assume that all such products have a flame spread over 200 unless there is information to the contrary.

Smoke Production

The evaluation of smoke density is part of the ASTM E 84 tunnel test. For the eight species of lumber shown in the table above, the highest levels are 275-305 for Yellow Pine, but most of the others are less smoky than red oak which has an index of 100. The advent of plastics caused substantial increases in the smoke density values measured by the tunnel test. The ensuing limitation of the smoke production for wall and ceiling materials by the model building codes has been a reaction to the introduction of plastic materials. In general, cellulosic materials fall in the 50-300 range of smoke density which is below the general limitation of 450 adopted by many codes.

Degree of Combustibility

The model building codes tend to define "noncombustibility" on the basis of having passed ASTM E 136 or if the material is totally inorganic. The acceptance of gypsum wallboard as noncombustible is based on limiting paper thickness to not over $^1/_8$ inch and a 0-50 flame spread rating by ASTM E 84. At times there were provisions to define a Class I or A material (0-25 FSR) as noncombustible, but this is not currently recognized by most model building codes.

If there is any doubt whether or not an archaic material is noncombustible, it would be appropriate to send out samples for evaluation. If an archaic material is determined to be noncombustible according to ASTM E 136, it can be expected that it will not contribute fuel to the fire.

* Some codes are Roman numerals, others use letters

1.2 COMBUSTIBLE CONSTRUCTION TYPES

One of the earliest forms of timber construction used exterior load-bearing masonry walls with columns and/or wooden walls supporting wooden beams and floors in the interior of the building. This form of construction, often called "mill" or "heavy timber" construction, has approximately 1 hour fire resistance. The exterior walls will generally contain the fire within the building.

With the development of dimensional lumber, there was a switch from heavy timber to "balloon frame" construction. The balloon frame uses load-bearing exterior wooden walls which have long timbers often extending from foundation to roof. When longer lumber became scarce, another form of construction, "platform" framing, replaced the balloon framing. The difference between the two systems is significant because platform framing is automatically fire-blocked at every floor while balloon framing commonly has concealed spaces that extend unblocked from basement to attic. The architect, engineer, and code official must be alert to the details of construction and the ease with which fire can spread in concealed spaces.

2 BUILDING EVALUATION

A given rehabilitation project will most likely go through several stages. The preliminary evaluation process involves the designer in surveying the prospective building. The fire resistance of existing building materials and construction systems is identified; potential problems are noted for closer study. The final evaluation phase includes: developing design solutions to upgrade the fire resistance of building elements, if necessary; preparing working drawings and specifications; and the securing of the necessary code approvals.

2.1 PRELIMINARY EVALUATION

A preliminary evaluation should begin with a building survey to determine the existing materials, the general arrangement of the structure and the use of the occupied spaces, and the details of construction. The designer needs to know "what is there" before a decision can be reached about what to keep and what to remove during the rehabilitation process. This preliminary evaluation should be as detailed as necessary to make initial plans. The fire-related properties need to be determined from the applicable building or rehabilitation code, and the materials and assemblies existing in the building then need to be evaluated for these properties. Two work sheets are shown below to facilitate the preliminary evaluation.

Two possible sources of information helpful in the preliminary evaluation are the original building plans and the building code in effect at the time of original construction. Plans may be on file with the local building department or in the offices of the original designers (e.g., architect, engineer) or their successors. If plans are available, the investigator should verify that the building was actually constructed as called for in the plans, as well as incorporate any later alterations or

changes to the building. Earlier editions of the local building code should be on file with the building official. The code in effect at the time of construction will contain fire performance criteria. While this is no guarantee that the required performance was actually provided, it does give the investigator some guidance as to the level of performance which may be expected. Under some code administration and enforcement systems, the code in effect at the time of construction also defines the level of performance that must be provided at the time of rehabilitation.

Figure 1 illustrates one method for organizing preliminary field notes. Space is provided for the materials, dimensions, and condition of the principal building elements. Each floor of the structure should be visited and the appropriate information obtained. In practice, there will often be identical materials and construction on every floor, but the exception may be of vital importance. A schematic diagram should be prepared of each floor showing the layout of exits and hallways and indicating where each element described in the field notes fits into the structure as a whole. The exact arrangement of interior walls within apartments is of secondary importance from a fire safety point of view and need not be shown on the drawings unless these walls are required by code to have a fire resistance rating.

The location of stairways and elevators should be clearly marked on the drawings. All exterior means of escape (e.g., fire escapes) should be identified.*

The following notes explain the entries in Figure 1.

Exterior Bearing Walls: Many old buildings utilize heavily constructed walls to support the floor/ceiling assemblies at the exterior of the building. There may be columns and/or interior bearing walls within the structure, but the exterior walls are an important factor in assessing the fire safety of a building.

The field investigator should note how the floor/ceiling assemblies are supported at the exterior of the building. If columns are incorporated in the exterior walls, the walls may be considered non-bearing.

Interior Bearing Walls: It may be difficult to determine whether or not an interior wall is load bearing, but the field investigator should attempt to make this determination. At a later stage of the rehabilitation process, this question will need to be determined exactly. Therefore, the field notes should be as accurate as possible.

Exterior Nonbearing Walls: The fire resistance of the exterior walls is important for two reasons. These walls (both bearing and non-bearing) are depended upon to: a) contain a fire within the building of origin; or b) keep an exterior fire *outside* the building. It is therefore important to indicate on the drawings where any openings are located as well as the materials and construction of all doors or shutters. The drawings should indicate the presence of wired glass, its thickness and framing, and identify the materials used for windows and door frames. The protection of openings adjacent to exterior means of escape (e.g., exterior stairs, fire escapes) is particularly important. The ground floor drawing should locate the building on the property and indicate the precise distances to adjacent buildings.

Interior Nonbearing Walls (Partitions): A partition is a "wall that extends from floor to ceiling and subdivides space within any story of a building." (48) Figure 1 has two categories (A & B) for Interior Nonbearing Walls (Partitions) which can be used for different walls, such as hallway walls as compared to inter-apartment walls. Under some circumstances there may be only one type of wall construction; in others, three or more types of wall construction may occur.

* Problems providing adequate exiting are discussed at length in the *Egress Guideline for Residential Rehabilitation.*

FIGURE 1 PRELIMINARY EVALUATION FIELD NOTES

Building Element		Materials	Thickness	Condition	Notes
Exterior Bearing Walls					
Interior Bearing Walls					
Exterior Nonbearing Walls					
Interior Nonbearing Walls or Partitions:	A				
	B				
Structural Frame: Columns					
Beams					
Other					
Floor/Ceiling Structural System Spanning					
Roofs					
Doors (including frame and hardware): a) Enclosed vertical exitway					
b) Enclosed horizontal exitway					
c) Other					

The field investigator should be alert for differences in function as well as in materials and construction details. In general, the details within apartments are not as important as the major exit paths and stairwells. The preliminary field investigation should attempt to determine the thickness of all walls. A term introduced below called "thickness design" will depend on an accurate ($\pm$ $^1/_4$ inch) determination. Even though this initial field survey is called "preliminary," the data generated should be as accurate and complete as possible.

The field investigator should note the exact location from which observations are recorded. For instance, if a hole is found through a stairwell wall which allows a cataloguing of the construction details, the field investigation notes should reflect the location of the "find." At the preliminary stage it is not necessary to core every wall; the interior details of construction can usually be determined at some location.

Structural Frame: There may or may not be a complete skeletal frame, but usually there are columns, beams, trusses, or other like elements. The dimensions and spacing of the structural elements should be measured and indicated on the drawings. For instance, if there are ten inch square columns located on a thirty foot square grid throughout the building, this should be noted. The structural material and cover or protective materials should be identified wherever possible. The thickness of the cover materials should be determined to an accuracy of $\pm$ $^1/_4$ inch. As discussed above, the preliminary field survey usually relies on accidental openings in the cover materials rather than a systematic coring technique.

Floor/Ceiling Structural Systems: The span between supports should be measured. If possible, a sketch of the cross-section of the system should be made. If there is no location where accidental damage has opened the floor/ceiling construction to visual inspection, it is necessary to make such an opening. An evaluation of the fire resistance of a floor/ceiling assembly requires detailed knowledge of the materials and their arrangement. Special attention should be paid to the cover on structural steel elements and the condition of suspended ceilings and similar membranes.

Roofs: The preliminary field survey of the roof system is initially concerned with water-tightness. However, once it is apparent that the roof is sound for ordinary use and can be retained in the rehabilitated building, it becomes necessary to evaluate the fire performance. The field investigator must measure the thickness and identify the types of materials which have been used. Be aware that there may be several layers of roof materials.

Doors: Doors to stairways and hallways represent some of the most important fire elements to be considered within a building. The uses of the spaces separated largely controls the level of fire performance necessary. Walls and doors enclosing stairs or elevator shafts would normally require a higher level of performance than between a the bedroom and bath. The various uses are differentiated in Figure 1.

Careful measurements of the thickness of door panels must be made, and the type of core material within each door must be determined. It should be noted whether doors have self-closing devices; the general operation of the doors should be checked. The latch should engage and the door should fit tightly in the frame. The hinges should be in good condition. If glass is used in the doors, it should be identified as either plain glass or wired glass mounted in either a wood or steel frame.

Materials: The field investigator should be able to identify ordinary building materials. In situations where an unfamiliar material is found, a sample should be obtained. This sample should measure at least 10 cubic inches so that an ASTM E 136 fire test can be conducted to determine if it is combustible.

Thickness: The thickness of all materials should be measured accurately since, under certain circumstances, the level of fire resistance is very sensitive to the material thickness.

Condition: The method of attaching the various layers and facings to one another or to the supporting structural element should be noted under the appropriate building element. The "secureness" of the attachment and the general condition of the layers and facings should be noted here.

Notes: The "Notes" column can be used for many purposes, but it might be a good idea to make specific references to other field notes or drawings.

After the building survey is completed, the data collected must be analyzed. A suggested work sheet for organizing this information is given below as Figure 2.

The required fire resistance and flame spread for each building element are normally established by the local building or rehabilitation code. The fire performance of the existing materials and assemblies should then be estimated, using one of the techniques described below. If the fire performance of the existing building element(s) is equal to or greater than that required, the materials and assemblies may remain. If the fire performance is less than required, then corrective measures must be taken.

The most common methods of upgrading the level of protection are to either remove and replace the existing building element(s) or to repair and upgrade the existing materials and assemblies. Other fire protection measures, such as automatic sprinklers or detection and alarm systems, also could be considered, though they are beyond the scope of this guideline. If the upgraded protection is still less than that required or deemed to be acceptable, additional corrective measures must be taken. This process must continue until an acceptable level of performance is obtained.

FIGURE 2 PRELIMINARY EVALUATION WORKSHEET

Building Element		Required Fire Resistance	Required Flame Spread	Estimated Fire Resistance	Estimated Flame Spread	Method of Upgrading	Estimated Upgraded Protection	Notes
Exterior Bearing Walls								
Interior Bearing Walls								
Exterior Nonbearing Walls								
Interior Nonbearing Walls or Partitions:	A							
	B							
Structural Frame: Columns								
Beams								
Other								
Floor/Ceiling Structural System Spanning								
Roofs								
Doors (including frame and hardware): a) Enclosed vertical exitway								
b) Enclosed horizontal exitway								
c) Others								

2.2 FIRE RESISTANCE OF EXISTING BUILDING ELEMENTS

The fire resistance of the existing building elements can be estimated from the tables and histograms contained in the Appendix. The Appendix is organized first by type of building element: walls, columns, floor/ceiling assemblies, beams, and doors. Within each building element, the tables are organized by type of construction (e.g., masonry, metal, wood frame), and then further divided by minimum dimensions or thickness of the building element.

A histogram precedes every table that has 10 or more entries. The X-axis measures fire resistance in hours; the Y-axis shows the number of entries in that table having a given level of fire resistance. The histograms also contain the location of each entry within that table for easy cross-referencing.

The histograms, because they are keyed to the tables, can speed the preliminary investigation. For example, Table 1.3.2, *Wood Frame Walls 4" to Less Than 6" Thick*, contains 96 entries. Rather than study each table entry, the histogram shows that every wall assembly listed in that table has a fire resistance of less than 2 hours. If the building code required the wall to have 2 hours fire resistance, the designer, with a minimum of effort, is made aware of a problem that requires closer study.

Suppose the code had only required a wall of 1 hour fire resistance. The histogram shows far fewer complying elements (19) than noncomplying ones (77). If the existing assembly is not one of the 19 complying entries, there is a strong possibility the existing assembly is deficient. The histograms can also be used in the converse situation. If the existing assembly is not one of the smaller number of entries with a lower than required fire resistance, there is a strong possibility the existing assembly will be acceptable.

At some point, the existing building component or assembly must be located within the tables. Otherwise, the fire resistance must be determined through one of the other techniques presented in the guideline. Locating the building component in the Appendix Tables not only guarantees the accuracy of the fire resistance rating, but also provides a source of documentation for the building official.

2.3
EFFECTS OF PENETRATIONS IN FIRE RESISTANT ASSEMBLIES

There are often many features in existing walls or floor/ceiling assemblies which were not included in the original certification or fire testing. The most common examples are pipes and utility wires passed through holes poked through an assembly. During the life of the building, many penetrations are added, and by the time a building is ready for rehabilitation it is not sufficient to just consider the fire resistance of the assembly as originally constructed. It is necessary to consider all penetrations and their relative impact upon fire performance. For instance, the fire resistance of the corridor wall may be less important than the effect of plain glass doors or transoms. In fact, doors are the most important single class of penetrations.

A fully developed fire generates substantial quantities of heat and excess gaseous fuel capable of penetrating any holes which might be present in the walls or ceiling of the fire compartment. In general, this leads to a severe degradation of the fire resistance of those building elements and to a greater potential for fire spread. This is particularly applicable to penetrations located high in a compartment where the positive pressure of the fire can force the unburned gases through the penetration.

Penetrations in a floor/ceiling assembly will generally completely negate the barrier qualities of the assembly and will lead to rapid spread of fire to the space above. It will not be a problem, however, if the penetrations are filled with noncombustible materials strongly fastened to the structure. The upper half of walls are similar to the floor/ceiling assembly in that a positive pressure can reasonably be expected in the top of the room, and this will push hot and/or burning gases through the penetration unless it is completely sealed.

Building codes require doors installed in fire resistive walls to resist the passage of fire for a specified period of time. If the door to a fully involved room is not closed, a large plume of fire will typically escape through the doorway, preventing anyone from using the space outside the door while allowing the fire to spread. This is why door closers are so important. Glass in doors and transoms can be expected to rapidly shatter unless constructed of listed or approved wire glass in a steel frame. As with other building elements, penetrations or non-rated portions of doors and transoms must be upgraded or otherwise protected.

Table 5.1 in Section V of the Appendix contains 41 entries of doors mounted in sound tightfitting frames. Part 3.4 below outlines one procedure for evaluating and possibly upgrading existing doors.

3
FINAL EVALUATION AND DESIGN SOLUTION

The final evaluation begins after the rehabilitation project has reached the final design stage and the choices made to keep certain archaic materials and assemblies in the rehabilitated building. The final evaluation process is essentially a more refined and detailed version of the preliminary evaluation. The specific fire resistance and flame spread requirements are determined for the project. This may involve local building and fire officials reviewing the preliminary evaluation as depicted in Figures 1 and 2 and the field drawings and notes. When necessary, provisions must be made to upgrade existing building elements to provide the required level of fire performance.

There are several approaches to design solutions that can make possible the continued use of archaic materials and assemblies in the rehabilitated structure. The simplest case occurs when the materials and assembly in question are found within the Appendix Tables and the fire performance properties satisfy code requirements. Other approaches must be used, though, if the assembly cannot be found within the Appendix or the fire performance needs to be upgraded. These approaches have been grouped into two classes: experimental and theoretical.

3.1
THE EXPERIMENTAL APPROACH

If a material or assembly found in a building is not listed in the Appendix Tables, there are several other ways to evaluate fire performance. One approach is to conduct the appropriate fire test(s) and thereby determine the fire-related properties directly. There are a number of laboratories in the United States which routinely conduct the various fire tests. A current list can be obtained by writing the Center for Fire Research, National Bureau of Standards, Washington, D.C. 20234.

The contract with any of these testing laboratories should require their observation of specimen preparation as well as the testing of the specimen. A complete description of where and how the specimen was obtained from the building, the transportation of the specimen, and its preparation for testing should be noted in detail so that the building official can be satisfied that the fire test is representative of the actual use.

The test report should describe the fire test procedure and the response of the material or assembly. The laboratory usually submits a cover letter with the report to describe the provisions of the fire test that were satisfied by the material or assembly under investigation. A building official will generally require this cover letter, but will also read the report to confirm that the material or assembly complies with the code requirements. Local code officials should be involved in all phases of the testing process.

The experimental approach can be costly and time consuming because specimens must be taken from the building and transported to the testing laboratory. When a load bearing assembly has continuous reinforcement, the test specimen must be removed from the building, transported, and tested in one piece. However, when the fire performance cannot be determined by other means, there may be no alternative to a full-scale test.

A "nonstandard" small-scale test can be used in special cases. Sample sizes need only be 10-25 square feet (0.93-2.3 m^2), while full-scale tests require test samples of either 100 or 180 square feet (9.3 or 17 m^2) in size. This small-scale test is best suited for testing nonload-bearing assemblies against thermal transmission only.

3.2
THE THEORETICAL APPROACH

There will be instances when materials and assemblies in a building undergoing rehabilitation cannot be found in the Appendix Tables. Even where test results are available for more or less similar construction, the proper classification may not be immediately apparent. Variations in dimensions, loading conditions, materials, or workmanship may markedly affect the performance of the individual building elements, and the extent of such a possible effect cannot be evaluated from the tables.

Theoretical methods being developed offer an alternative to the full-scale fire tests discussed above. For example, Section 4302(b) of the 1979 edition of the *Uniform Building Code* specifically allows an engineering design for fire resistance in lieu of conducting full-scale tests. These techniques draw upon computer simulation and mathematical modeling, thermodynamics, heat-flow analysis, and materials science to predict the fire performance of building materials and assemblies.

One theoretical method, known as the "Ten Rules of Fire Endurance Ratings," was published by T. Z. Harmathy in the May, 1965 edition of *Fire Technology.* (35) Harmathy's Rules provide a foundation for extending the data within the Appendix Tables to analyze or upgrade current as well as archaic building materials or assemblies.

HARMATHY'S TEN RULES

Rule 1: The "thermal" fire endurance of a construction consisting of a number of parallel layers is greater than the sum of the "thermal" fire endurances characteristic of the individual layers when exposed separately to fire.*

The minimum performance of an untested assembly can be estimated if the fire endurance of the individual components is known. Though the exact rating of the assembly cannot be stated, the endurance of the assembly is greater than the sum of the endurance of the components.

When a building assembly or component is found to be deficient, the fire endurance can be upgraded by providing a protective membrane. This membrane could be a new layer of brick, plaster, or drywall. The fire endurance of this membrane is called the "finish rating." Appendix Tables 1.5.1 and 1.5.2 contain the finish ratings for the most commonly employed materials. (See also the notes to Rule 2).

The test criteria for the finish rating is the same as for the thermal fire endurance of the total assembly: average temperature increases of 250°F (121°C) above ambient or 325°F (163°C) above ambient at any one place with the membrane being exposed to the fire. The temperature is measured at the interface of the assembly and the protective membrane.

Rule 2: The fire endurance of a construction does not decrease with the addition of further layers.

Harmathy notes that this rule is a consequence of the previous rule. Its validity follows from the fact that the additional layers increase both the resistance to heat flow and the heat capacity of the construction. This, in turn, reduces the rate of temperature rise at the unexposed surface.

This rule is not just restricted to "thermal" performance but affects the other fire test criteria: direct flame passage, cotton waste ignition, and load bearing performance. This means that certain restrictions must be imposed on the materials to be added and on the loading conditions. One restriction is that a new layer, if applied to the exposed surface, must not produce additional thermal stresses in the construction, i.e., its thermal expansion characteristics must be similar to those of the adjacent layer. Each new layer must also be capable of contributing enough additional strength to the assembly to sustain the added dead load. If this requirement is not fulfilled, the allowable live load must be reduced by an amount equal to the weight of the new layer. Because of these limitations, this rule should not be applied without careful consideration.

Particular care must be taken if the material added is a good thermal insulator. Properly located, the added insulation could improve the "thermal" performance of the assembly. Improperly located, the insulation could block necessary thermal transmission through the assembly, thereby subjecting the structural elements to greater temperatures for longer periods of time, and could cause premature structural failure of the supporting members.

Rule 3: The fire endurance of constructions containing continuous air gaps or cavities is greater than the fire endurance of similar constructions of the same weight, but containing no air gaps or cavities.

By providing for voids in a construction, additional resistances are produced in the path of heat flow. Numerical heat flow analyses indicate that a 10 to 15 percent increase in fire endurance can be achieved by creating an air gap at the midplane of a brick wall. Since the gross volume is also increased by the presence of voids, the air gaps and cavities have a beneficial effect on stability as well. However, constructions containing combustible materials within an air gap may be regarded as exceptions to this rule because of the possible development of burning in the gap.

There are numerous examples of this rule in the tables. For instance:

Table 1.1.4; Item W-8-M-82: Cored concrete masonry, nominal 8 inch thick wall with one unit in wall thickness and with 62 percent minimum of solid material in each unit, load bearing (80 PSI). Fire endurance: $2^1/_2$ hours.

Table 1.1.5; Item W-10-M-11: Cored concrete mansonry, nominal 10 inch thick wall with two units in wall thickness and a 2-inch (51 mm) air space, load bearing (80 PSI). The units are essentially the same as item W-8-M-82. Fire endurance: $3^1/_2$ hours.

These walls show 1 hour greater fire endurance by the addition of the 2-inch (51 mm) air space.

Rule 4: The farther an air gap or cavity is located from the exposed surface, the more beneficial is its effect on the fire endurance.

Radiation dominates the heat transfer across an air gap or cavity, and it is markedly higher where the temperature is higher.

* The "thermal" fire endurance is the time at which the average temperature on the unexposed side of a construction exceeds its initial value by 250° when the other side is exposed to the "standard" fire specified by ASTM Test Method E-19.

The air gap or cavity is thus a poor insulator if it is located in a region which attains high temperatures during fire exposure.

Some of the clay tile designs take advantage of these factors. The double cell design, for instance, ensures that there is a cavity near the unexposed face. Some floor/ceiling assemblies have air gaps or cavities near the top surface and these enhance their thermal performance.

Rule 5: The fire endurance of a construction cannot be increased by increasing the thickness of a completely enclosed air layer.

Harmathy notes that there is evidence that if the thickness of the air layer is larger than about $^1/_2$ inch (12.7 mm), the heat transfer through the air layer depends only on the temperature of the bounding surfaces, and is practically independent of the distance between them. This rule is not applicable if the air layer is not completely enclosed, i.e., if there is a possibility of fresh air entering the gap at an appreciable rate.

Rule 6: Layers of materials of low thermal conductivity are better utilized on that side of the construction on which fire is more likely to happen.

As in Rule 4, the reason lies in the heat transfer process, though the conductivity of the solid is much less dependent on the ambient temperature of the materials. The low thermal conductor creates a substantial temperature differential to be established across its thickness under transient heat flow conditions. This rule may not be applicable to materials undergoing physico-chemical changes accompanied by significant heat absorption or heat evolution.

Rule 7: The fire endurance of asymmetrical constructions depends on the direction of heat flow.

This rule is a consequence of Rules 4 and 6 as well as other factors. This rule is useful in determining the relative protection of corridors and stairwells from the surrounding spaces. In addition, there are often situations where a fire is more likely, or potentially more severe, from one side or the other.

Rule 8: The presence of moisture, if it does not result in explosive spalling, increases the fire endurance.

The flow of heat into an assembly is greatly hindered by the release and evaporation of the moisture found within cementitious materials such as gypsum, portland cement, or magnesium oxychloride. Harmathy has shown that the gain in fire endurance may be as high as 8 percent for each percent (by volume) of moisture in the construction. It is the moisture chemically bound within the construction material at the time of manufacture or processing that leads to increased fire endurance. There is no direct relationship between the relative humidity of the air in the pores of the material and the increase in fire endurance.

Under certain conditions there may be explosive spalling of low permeability cementitious materials such as dense concrete. In general, one can assume that extremely old concrete has developed enough minor cracking that this factor should not be significant.

Rule 9: Load-supporting elements, such as beams, girders and joists, yield higher fire endurances when subjected to fire endurance tests as parts of floor, roof, or ceiling assemblies than they would when tested separately.

One of the fire endurance test criteria is the ability of a load-supporting element to carry its design load. The element will be deemed to have failed when the load can no longer be supported.

Failure usually results for two reasons. Some materials, particularly steel and other metals, lose much of their structural strength at elevated temperatures. Physical deflection of the supporting element, due to decreased strength or thermal expansion, causes a redistribution of the load forces and stresses throughout the element. Structural failure often results because the supporting element is not designed to carry the redistributed load.

Roof, floor, and ceiling assemblies have primary (e.g., beams) and secondary (e.g., floor joists) structural members. Since the primary load-supporting elements span the largest distances, their deflection becomes significant at a stage when the strength of the secondary members (including the roof or floor surface) is hardly affected by the heat. As the secondary members follow the deflection of the primary load-supporting element, an increasingly larger portion of the load is transferred to the secondary members.

When load-supporting elements are tested separately, the imposed load is constant and equal to the design load throughout the test. By definition, no distribution of the load is possible because the element is being tested by itself. Without any other structural members to which the load could be transferred, the individual elements cannot yield a higher fire endurance than they do when tested as parts of a floor, roof or ceiling assembly.

Rule 10: The load-supporting elements (beams, girders, joists, etc.) of a floor, roof, or ceiling assembly can be replaced by such other load-supporting elements which, when tested separately, yielded fire endurances not less than that of the assembly.

This rule depends on Rule 9 for its validity. A beam or girder, if capable of yielding a certain performance when tested separately, will yield an equally good or better performance when it forms a part of a floor, roof, or ceiling assembly. It must be emphasized that the supporting element of one assembly must not be replaced by the supporting element of another assembly if the performance of this latter element is not known from a separate (beam) test. Because of the load-reducing effect of the secondary elements that results from a test performed on an assembly, the performance of the supporting element alone cannot be evaluated by simple arithmetic. This rule also indicates the advantage of performing separate fire tests on primary load-supporting elements.

ILLUSTRATION OF HARMATHY'S RULES

Harmathy provided one schematic figure which illustrated his Rules.* It should be useful as a quick reference to assist in applying his Rules.

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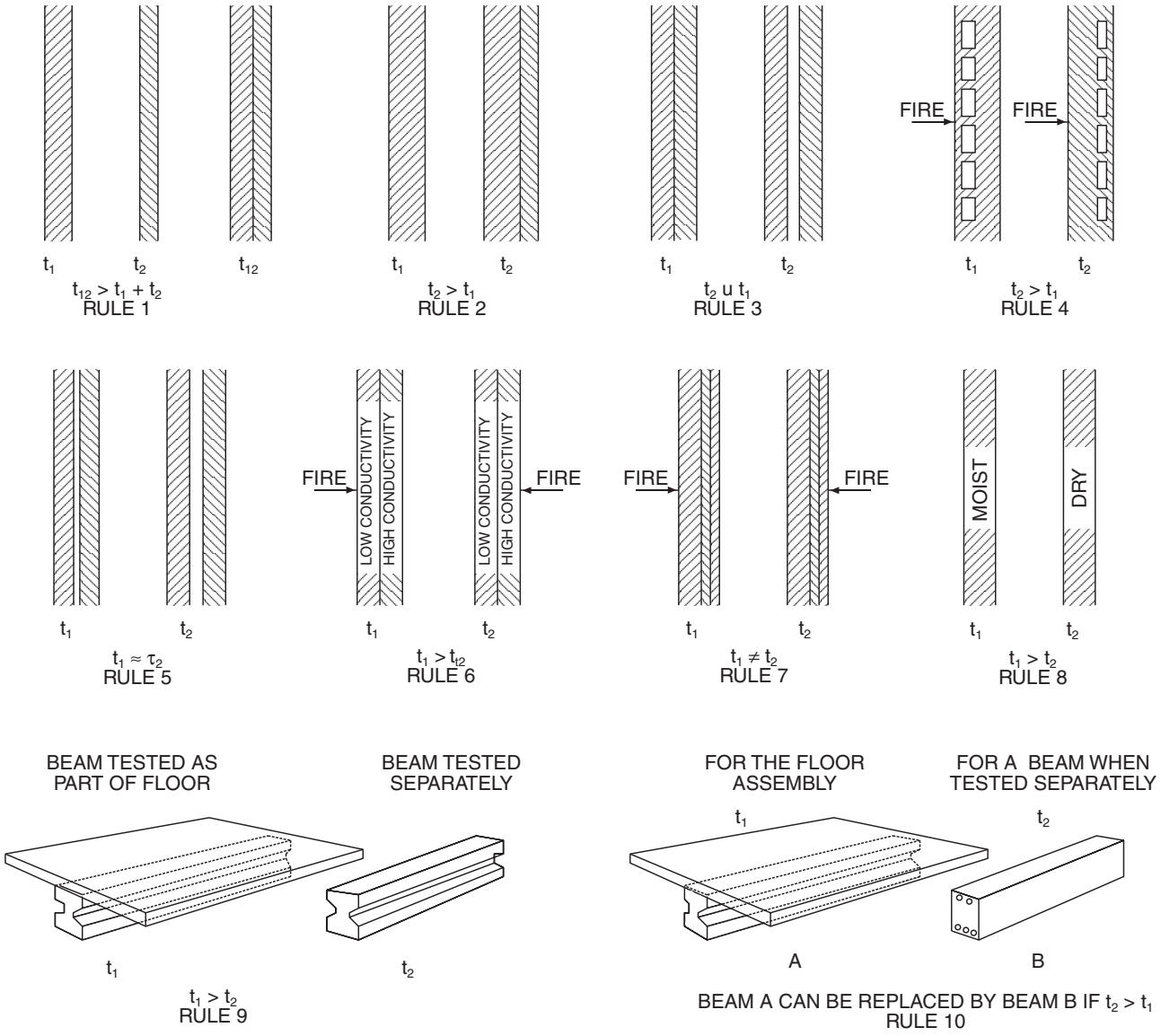


Diagrammatic illustration of ten rules.
t = fire endurance

EXAMPLE APPLICATION OF HARMATHY'S RULES

The following examples, based in whole or in part upon those presented in Harmathy's paper (35), show how the Rules can be applied to practical cases.

Example 1

Problem

A contractor would like to keep a partition which consists of a $3^3/_4$-inch (95 mm) thick layer of red clay brick, a $1^1/_4$-inch (32 mm) thick layer of plywood, and a $^3/_8$ inch (9.5 mm) thick layer of gypsum wallboard, at a location where 2-hour fire endurance is required. Is this assembly capable of providing a 2-hour protection?

Solution

(1) This partition does not appear in the Appendix Tables.

(2) Bricks of this thickness yield fire endurances of approximately 75 minutes (Table 1.1.2, Item W-4-M-2).

(3) The $1^1/_4$-inch (32 mm) thick plywood has a finish rating of 30 minutes.

(4) The $^3/_8$-inch (9.5 mm) gypsum wallboard has a finish rating of 10 minutes.

(5) Using the recommended values from the tables and applying Rule 1, the fire endurance (FI) of the assembly is larger than the sum of the individual layers, or

$$FI > 75 + 30 + 10 = 115 \text{ minutes}$$

Discussion

This example illustrates how the Appendix Tables can be utilized to determine the fire resistance of assemblies not explicitly listed.

Example 2

Problem

(1) A number of buildings to be rehabilitated have the same type of roof slab which is supported with different structural elements.

(2) The designer and contractor would like to determine whether or not this roof slab is capable of yielding a 2-hour fire endurance. According to a rigorous interpretation of ASTM E 119, however, only the roof assembly, including the roof slab as well as the cover and the supporting elements, can be subjected to a fire test. Therefore, a fire endurance classification cannot be issued for the slabs separately.

(3) The designer and contractor believe this slab will yield a 2-hour fire endurance even without the cover, and any beam of at least 2-hour fire endurance will provide satisfactory support. Is it possible to obtain a classification for the slab separately?

Solution

(1) The answer to the question is yes.

(2) According to Rule 10 it is not contrary to common sense to test and classify roofs and supporting elements separately. Furthermore, according to Rule 2, if the roof slabs actually yield a 2 hour fire endurance, the endurance of an assembly, including the slabs, cannot be less than 2 hours.

(3) The recommended procedure would be to review the tables to see if the slab appears as part of any tested roof or floor/ceiling assembly. The supporting system can be regarded as separate from the slab specimen, and the fire endurance of the assembly listed in the table is at least the fire endurance of the slab. There would have to be an adjustment for the weight of the roof cover in the allowable load if the test specimen did not contain a cover.

(4) The supporting structure or element would have to have at least a 2-hour fire endurance when tested separately.

Discussion

If the tables did not include tests on assemblies which contained the slab, one procedure would be to assemble the roof slabs on any convenient supporting system (not regarded as part of the specimen) and to subject them to a load which, besides the usually required superimposed load, includes some allowances for the weight of the cover.

Example 3

Problem

A steel-joisted floor and ceiling assembly is known to have yielded a fire endurance of 1 hour and 35 minutes. At a certain location, a 2-hour endurance is required. What is the most economical way of increasing the fire endurance by at least 25 minutes?

Solution

(1) The most effective technique would be to increase the ceiling plaster thickness. Existing coats of paint would have to be removed and the surface properly prepared before the new plaster could be applied. Other materials (e.g., gypsum wallboard) could also be considered.

(2) There may be other techniques based on other principles, but an examination of the drawings would be necessary.

Discussion

(1) The additional plaster has at least three effects:

a) The layer of plaster is increased and thus there is a gain of fire endurance (Rule 1).

b) There is a gain due to shifting the air gap farther from the exposed surface (Rule 4).

c) There is more moisture in the path of heat flow to the structural elements (Rules 7 and 8).

(2) The increase in fire endurance would be at least as large as that of the finish rating for the added thickness of plaster. The combined effects in (1) above would further increase this by a factor of 2 or more, depending upon the geometry of the assembly.

Example 4

Problem

The fire endurance of item W-l0-M-l in Table 1.1.5 is 4 hours. This wall consists of two $3^3/_4$-inch (95 mm) thick layers of structural tiles separated by a 2-inch (51 mm) air gap and $^3/_4$-inch (19 mm) portland cement plaster or stucco on both sides. If the actual wall in the building is identical to item W-10-M-1 except that it has a 4-inch (102 mm) air gap, can the fire endurance be estimated at 5 hours?

Solution

The answer to the question is no for the reasons contained in Rule 5.

Example 5

Problem

In order to increase the insulating value of its precast roof slabs, a company has decided to use two layers of different concretes. The lower layer of the slabs, where the strength of the concrete is immaterial (all the tensile load is carried by the steel reinforcement), would be made with a concrete of low strength but good insulating value. The upper layer, where the concrete is supposed to carry the compressive load, would remain the original high strength, high thermal conductivity concrete. How will the fire endurance of the slabs be affected by the change?

Solution

The effect on the thermal fire endurance is beneficial:

(1) The total resistance to heat flow of the new slabs has been increased due to the replacement of a layer of high thermal conductivity by one of low conductivity.

(2) The layer of low conductivity is on the side more likely to be exposed to fire, where it is more effectively utilized according to Rule 6. The layer of low thermal conductivity also provides better protection for the steel reinforcement, thereby extending the time before reaching the temperature at which the creep of steel becomes significant.

3.3 "THICKNESS DESIGN" STRATEGY

The "thickness design" strategy is based upon Harmathy's Rules 1 and 2. This design approach can be used when the construction materials have been identified and measured, but the specific assembly cannot be located within the tables. The

tables should be surveyed again for thinner walls of like material and construction detail that have yielded the desired or greater fire endurance. If such an assembly can be found, then the thicker walls in the building have more than enough fire resistance. The thickness of the walls thus becomes the principal concern.

This approach can also be used for floor/ceiling assemblies, except that the thickness of the cover* and the slab become the central concern. The fire resistance of the untested assembly will be at least the fire resistance of an assembly listed in the table having a similar design but with less cover and/or thinner slabs. For other structural elements (e.g., beams and columns), the element listed in the table must also be of a similar design but with less cover thickness.

3.4 EVALUATION OF DOORS

A separate section on doors has been included because the process for evaluation presented below differs from those suggested previously for other building elements. The impact of unprotected openings or penetrations in fire resistant assemblies has been detailed in Part 2.3 above. It is sufficient to note here that openings left unprotected will likely lead to failure of the barrier under actual fire conditions.

For other types of building elements (e.g., beams, columns), the Appendix Tables can be used to establish a minimum level of fire performance. The benefit to rehabilitation is that the need for a full-scale fire test is then eliminated. For doors, however, this cannot be done. The data contained in Appendix Table 5.1, Resistance of Doors to Fire Exposure, can only provide guidance as to whether a successful fire test is even feasible.

For example, a door required to have 1 hour fire resistance is noted in the tables as providing only 5 minutes. The likelihood of achieving the required 1 hour, even if the door is upgraded, is remote. The ultimate need for replacement of the doors is reasonably clear, and the expense and time needed for testing can be saved. However, if the performance documented in the table is near or in excess of what is being required, then a fire test should be conducted. The test documentation can then be used as evidence of compliance with the required level of performance.

The table entries cannot be used as the sole proof of performance of the door in question because there are too many unknown variables which could measurably affect fire performance. The wood may have dried over the years; coats of flammable varnish could have been added. Minor deviations in the internal construction of a door can result in significant differences in performance. Methods of securing inserts in panel doors can vary. The major non-destructive method of analysis, an x-ray, often cannot provide the necessary detail. It is for these, and similar reasons, that a fire test is still felt to be necessary.

It is often possible to upgrade the fire performance of an existing door. Sometimes, "as is" and modified doors are evaluated in a single series of tests when failure of the unmodified door is expected. Because doors upgraded after an initial failure must be tested again, there is a potential savings of time and money.

The most common problems encountered are plain glass, panel inserts of insufficient thickness, and improper fit of a door in its frame. The latter problem can be significant because a fire can develop a substantial positive pressure, and the fire will work its way through otherwise innocent-looking gaps between door and frame.

One approach to solving these problems is as follows. The plain glass is replaced with approved or listed wire glass in a steel frame. The panel inserts can be upgraded by adding an additional layer of material. Gypsum wallboard is often used for this purpose. Intumescent paint applied to the edges of the door and frame will expand when exposed to fire, forming an effective seal around the edges. This seal, coupled with the generally even thermal expansion of a wood door in a wood frame, can prevent the passage of flames and other fire gases. Figure 3 below illustrates these solutions.

Because the interior construction of a door cannot be determined by a visual inspection, there is no absolute guarantee that the remaining doors are identical to the one(s) removed from the building and tested. But the same is true for doors constructed today, and reason and judgment must be applied. Doors that appear identical upon visual inspection can be weighed. If the weights are reasonably close, the doors can be assumed to be identical and therefore provide the same level of fire performance. Another approach is to fire test more than one door or to dismantle doors selected at random to see if they had been constructed in the same manner. Original building plans showing door details or other records showing that doors were purchased at one time or obtained from a single supplier can also be evidence of similar construction.

More often though, it is what is visible to the eye that is most significant. The investigator should carefully check the condition and fit of the door and frame, and for frames out of plumb or separating from the wall. Door closers, latches, and hinges must be examined to see that they function properly and are tightly secured. If these are in order and the door and frame have passed a full-scale test, there can be a reasonable basis for allowing the existing doors to remain.

4 SUMMARY

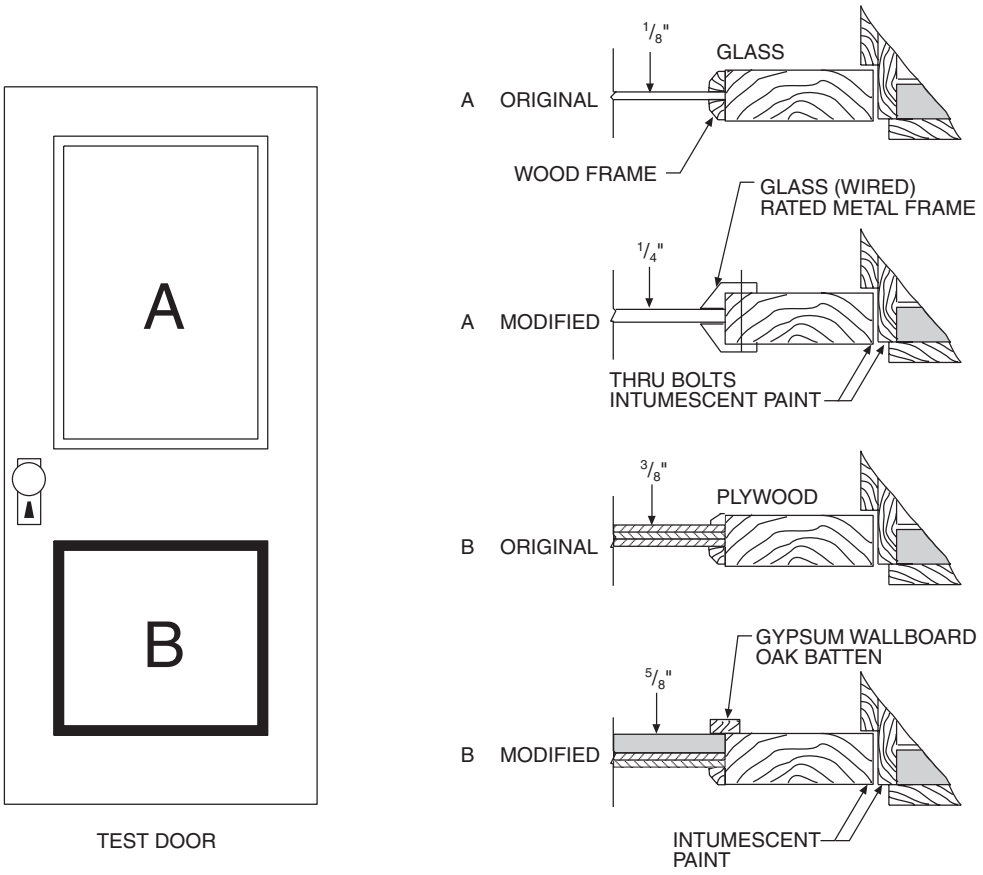
This section summarizes the various approaches and design solutions discussed in the preceding sections of the guideline. The term "structural system" includes: frames, beams, columns, and other structural elements. "Cover" is a protective layer(s) of materials or membrane which slows the flow of heat to the structural elements. It cannot be stressed too strongly that the fire endurance of actual building elements can be greatly reduced or totally negated by removing part of the cover to allow pipes, ducts, or conduits to pass through the element. This must be repaired in the rehabilitation process.

The following approaches shall be considered equivalent.

* Cover: the protective layer or membrane of material which slows the flow of heat to the structural elements.

FIGURE 3

MODIFICATION DETAILS



4.1 The fire resistance of a building element can be established from the Appendix Tables. This is subject to the following limitations:

- The building element in the rehabilitated building shall be constructed of the same materials with the same nominal dimensions as stated in the tables.
- All penetrations in the building element or its cover for services such as electricity, plumbing, and HVAC shall be packed with noncombustible cementitious materials and so fixed that the packing material will not fall out when it loses its water of hydration.

The effects of age and wear and tear shall be repaired so that the building element is sound and the original thickness of all components, particularly covers and floor slabs, is maintained.

This approach essentially follows the approach taken by model building codes. The assembly must appear in a table either published in or accepted by the code for a given fire resistance rating to be recognized and accepted.

4.2 The fire resistance of a building element which does not explicitly appear in the Appendix Tables can be established if one or more elements of same design but different dimensions have been listed in the tables. For walls, the existing element must be thicker than the one listed. For floor/ceiling assemblies, the assembly listed in the table must have the same or less cover and the same or thinner slab constructed of the same material as the actual floor/ceiling assembly. For other structural elements, the element listed in the table must be of a similar design but with less cover thickness. The fire resistance in all instances shall be the fire resistance recommended in the table. This is subject to the following limitations:

- The actual element in the rehabilitated building shall be constructed of the same materials as listed in the table. Only the following dimensions may vary from those specified: for walls, the overall thickness must exceed that specified in the table; for floor/ceiling assemblies, the thickness of the cover and the slab must be greater than, or equal to, that specified in the table; for other structural elements, the thickness of the cover must be greater than that specified in the table.
- All penetrations in the building element or its cover for services such as electricity, plumbing, or HVAC shall be packed with noncombustible cementitious materials and so fixed that the packing material will not fall out when it loses its water of hydration.
- The effects of age and wear and tear shall be repaired so that the building element is sound and the original thickness of all components, particularly covers and floor slabs, is maintained.

This approach is an application of the "thickness design" concept presented in Part 3.3 of the guideline. There should be many instances when a thicker building element was utilized than the one listed in the Appendix Tables. This guideline rec-

ognizes the inherent superiority of a thicker design. Note: "thickness design" for floor/ceiling assemblies and structural elements refers to cover and slab thickness rather than total thickness.

The "thickness design" concept is essentially a special case of Harmathy's Rules (specifically Rules 1 and 2). It should be recognized that the only source of data is the Appendix Tables. If other data are used, it must be in connection with the approach below.

4.3 The fire resistance of building elements can be established by applying Harmathy's Ten Rules of Fire Resistance Ratings as set forth in Part 3.2 of the guideline. This is subject to the following limitations:

- The data from the tables can be utilized subject to the limitations in 4.2 above.
- Test reports from recognized journals or published papers can be used to support data utilized in applying Harmathy's Rules.
- Calculations utilizing recognized and well established computational techniques can be used in applying Harmathy's Rules. These include, but are not limited to, analysis of heat flow, mechanical properties, deflections, and load bearing capacity.

APPENDIX

Introduction

The fire resistance tables that follow are a part of Resource A and provide a tabular form of assigning fire resistance ratings to various archaic building elements and assemblies.

These tables for archaic materials and assemblies do for archaic materials what Tables 720.1(1), 720.1(2), and 720.1(3) of the *International Building Code* do for more modern building elements and assemblies. The fire resistance tables of Resource A should be used as described in the "Purpose and Procedure" that follows the table of contents for these tables.

RESOURCE A TABLE OF CONTENTS

PURPOSE AND PROCEDURE

The tables and histograms which follow are to be used only within the analytical framework detailed in the main body of this guideline.

Histograms precede any table with 10 or more entries. The use and interpretation of these histograms is explained in Part 2 of the guideline. The tables are in a format similar to that found in the model building codes. The following example, taken from an entry in Table 1.1.2, best explains the table format.

1. Item Code: The item code consists of a four place series in the general form w-x-y-z in which each member of the series denotes the following:

   w = Type of building element (e.g., W=Walls; F=Floors, etc.)

   x = The building element thickness rounded down to the nearest one inch increment (e.g., $4^5/_8$ inches is rounded off to 4 inches)

   y = The general type of material from which the building element is constructed (e.g., M=Masonry; W=Wood, etc.)

   z = The item number of the particular building element in a given table

   The item code shown in the example W-4-M-50 denotes the following:

   W = Wall, as the building element

   4 = Wall thickness in the range of 4 inches (102 mm) to less than 5 inches (127 mm)

   M = Masonry construction

   50 = The 50th entry in Table 1.1.2

2. The specific name or heading of this column identifies the dimensions which, if varied, has the greatest impact on fire resistance. The critical dimension for walls, the example here, is thickness. It is different for other building elements (e.g., depth for beams; membrane thickness for some floor/ceiling assemblies). The table entry is the named dimension of the building element measured at the time of actual testing to within $\pm$ $^1/_8$ inch (3.2 mm) tolerance. The thickness tabulated includes facings where facings are a part of the wall construction.

3. Construction Details: The construction details provide a brief description of the manner in which the building element was constructed.

4. Performance: This heading is subdivided into two columns. The column labeled "Load" will either list the load that the building element was subjected to during the fire test or it will contain a note number which will list the load and any other significant details. If the building element was not subjected to a load during the test, this column will contain "n/a," which means "not applicable."

   The second column under performance is labeled "Time" and denotes the actual fire endurance time observed in the fire test.

5. Reference Number: This heading is subdivided into three columns: Pre-BMS-92; BMS-92; and Post-BMS-92. The table entry under this column is the number in the Bibliography of the original source reference for the test data.

6. Notes: Notes are provided at the end of each table to allow a more detailed explanation of certain aspects of the test. In certain tables the notes given to this column have also been listed under the "Construction Details" and/or "Load" columns.

7. Rec Hours: This column lists the recommended fire endurance rating, in hours, of a building element. In some cases, the recommended fire endurance will be less than that listed under the "Time" column. In no case is the "Rec Hours" greater than given in the "Time" column.

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-50	$4^5/_8$″	Core: structural clay tile, See notes 12, 16, 21; Facings on unexposed side only, see note 18	n/a	25 min.		1		3, 4, 24	$^1/_3$

SECTION I - WALLS
FIGURE 1.1.1—WALLS—MASONRY 0″ TO LESS THAN 4″ THICK

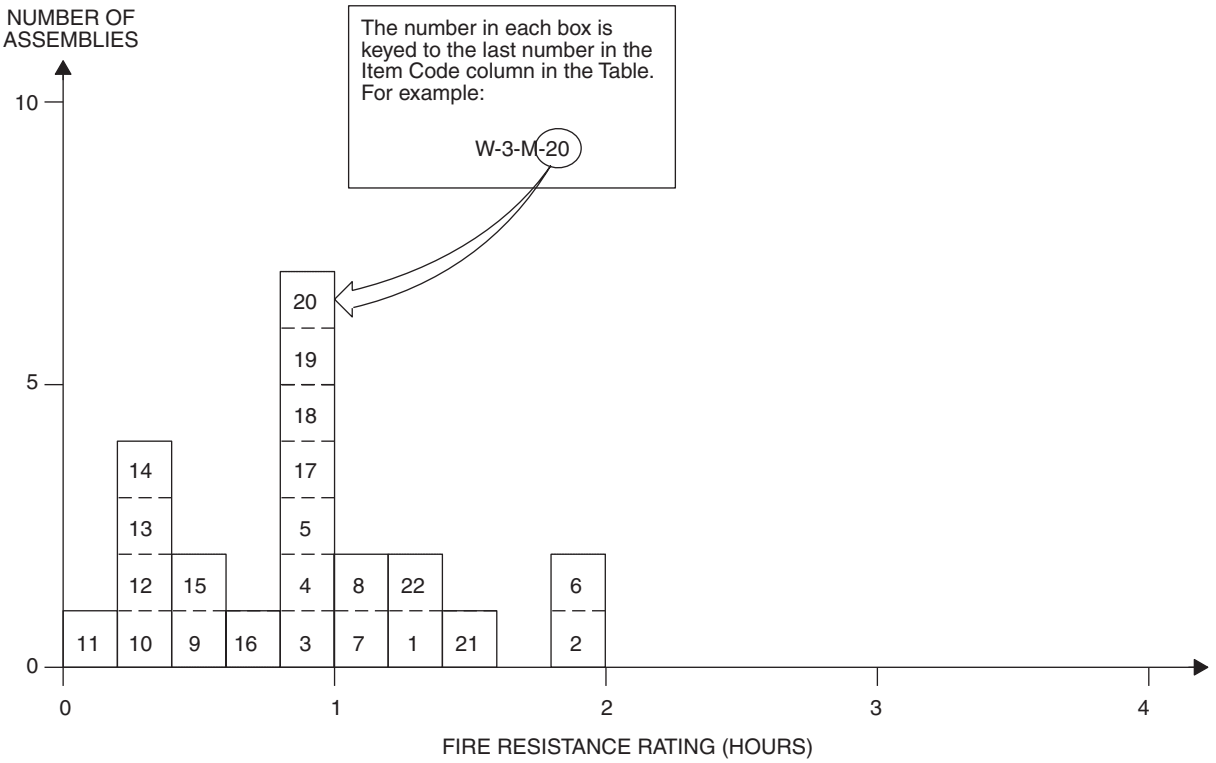


TABLE 1.1.1—MASONRY WALLS 0″ TO LESS THAN 4″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-2-M-1	$2^1/_4$″	Solid partition; $^3/_4$″ gypsum plank- 10′ × 1′6″; $^3/_4$″ plus gypsum plaster each side.	N/A	1 hr. 22 min.			7	1	$1^1/_4$
W-3-M-2	3″	Concrete block (18″ × 9″ × 3″) of fuel ash, portland cement and plasticizer; cement/sand mortar.	N/A	2 hrs.			7	2, 3	2
W-2-M-3	2″	Solid gypsum block wall; No facings	N/A	1 hr.		1		4	1
W-3-M-4	3″	Solid gypsum blocks, laid in 1:3 sanded gypsum mortar.	N/A	1 hr.		1		4	1
W-3-M-5	3″	Magnesium oxysulfate wood fiber blocks; 2″ thick, laid in portland cement-lime mortar; Facings: $^1/_2$″ of 1:3 sanded gypsum plaster on both sides.	N/A	1 hr.		1		4	1
W-3-M-6	3″	Magnesium oxysulfate bound wood fiber blocks; 3″ thick; laid in portland cement-lime mortar; Facings: $^1/_2$″ of 1:3 sanded gypsum plaster on both sides.	N/A	2 hrs.		1		4	2

(Continued)

**TABLE 1.1.1—MASONRY WALLS
0″ TO LESS THAN 4″ THICK—continued**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-M-7	3″	Clay tile; Ohio fire clay; single cell thick; Face plaster: $^5/_8$″ (both sides) 1:3 sanded gypsum; Design “E,” Construction “A.”	N/A	1 hr. 6 min.	0.		2	5, 6, 7, 11, 12, 39	1
W-3-M-8	3″	Clay tile; Illinois surface clay; single cell thick; Face plaster: $^5/_8$" (both sides) 1:3 sanded gypsum; Design “A,” Construction “E.”	N/A	1 hr. 1 min			2	5, 8, 9, 11, 12, 39	1
W-3-M-9	3″	Clay tile; Illinois surface clay; single cell thick; No face plaster; Design “A,” Construction “C.”	N/A	25 min.			2	5, 10, 11, 12, 39	$^1/_3$
W-3-M-10	$3^7/_8$″	8″ × $4^7/_8$″ glass blocks; weight 4 lbs. each; portland cement-lime mortar; horizontal mortar joints reinforced with metal lath.	N/A	15 min.		1		4	$^1/_4$
W-3-M-11	3″	Core: structural clay tile; see Notes 14, 18, 13; No facings.	N/A	10 min.		1		5, 11, 26	$^1/_6$
W-3-M-12	3″	Core: structural clay tile; see Notes 14, 19, 23; No facings.	N/A	20 min.		1		5, 11, 26	$^1/_3$
W-3-M-13	$3^5/_8$″	Core: structural clay tile; see Notes 14, 18, 23; Facings: unexposed side; see Note 20.	N/A	20 min.		1		5, 11, 26	$^1/_3$
W-3-M-14	$3^5/_8$″	Core: structural clay tile; see Notes 14, 19, 23; Facings: unexposed side only; see Note 20.	N/A	20 min.		1		5, 11, 26	$^1/_3$
W-3-M-15	$3^5/_8$″	Core: clay structural tile; see Notes 14, 18, 23; Facings: side exposed to fire; see Note 20.	N/A	30 min.		1		5, 11, 26	$^1/_2$
W-3-M-16	$3^5/_8$″	Core: clay structural tile; see Notes 14, 19, 23; Facings: side exposed to fire; see Note 20.	N/A	45 min.		1		5, 11, 26	$^3/_4$
W-2-M-17	2″	2″ thick solid gypsum blocks; see Note 27.	N/A	1 hr.		1		27	1
W-3-M-18	3″	Core: 3″ thick gypsum blocks 70% solid; see Note 2; No facings.	N/A	1 hr.		1		27	1
W-3-M-19	3″	Core: hollow concrete units; see Notes 29, 35, 36, 38; No facings.	N/A	1 hr.		1		27	1
W-3-M-20	3″	Core: hollow concrete units; see Notes 28, 35, 36, 37, 38; No facings.	N/A	1 hr.		1			1
W-3-M-21	$3^1/_2$″	Core: hollow concrete units; see Notes 28, 35, 36, 37, 38; Facings: one side; see Note 37.	N/A	$1^1/_2$ hrs.		1			$1^1/_2$

(Continued)

TABLE 1.1.1—MASONRY WALLS
0″ TO LESS THAN 4″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-M-22	$3^1/_2$″	Core: hollow concrete units; see Notes 29, 35, 36, 38; Facings: one side, see Note 37.	N/A	$1^1/_4$ hrs.		1			$1^1/_4$

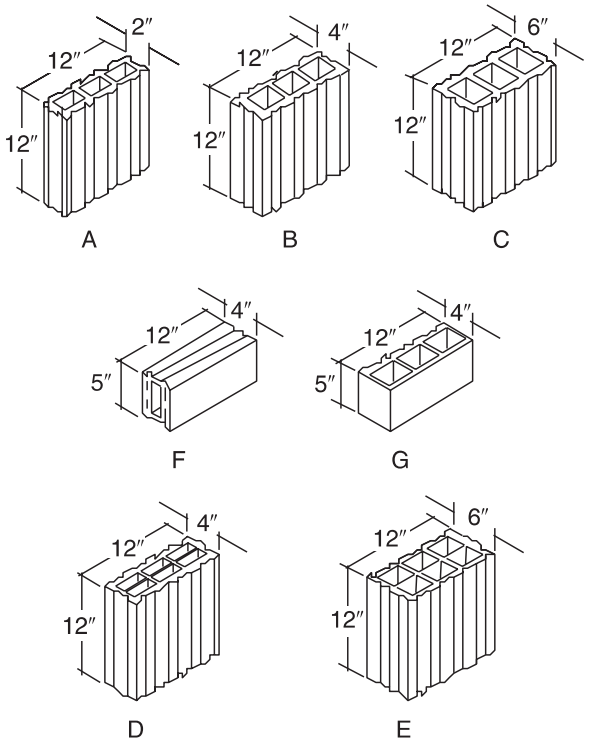
For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, °C = [(°F) - 32]/1.8.

Notes:

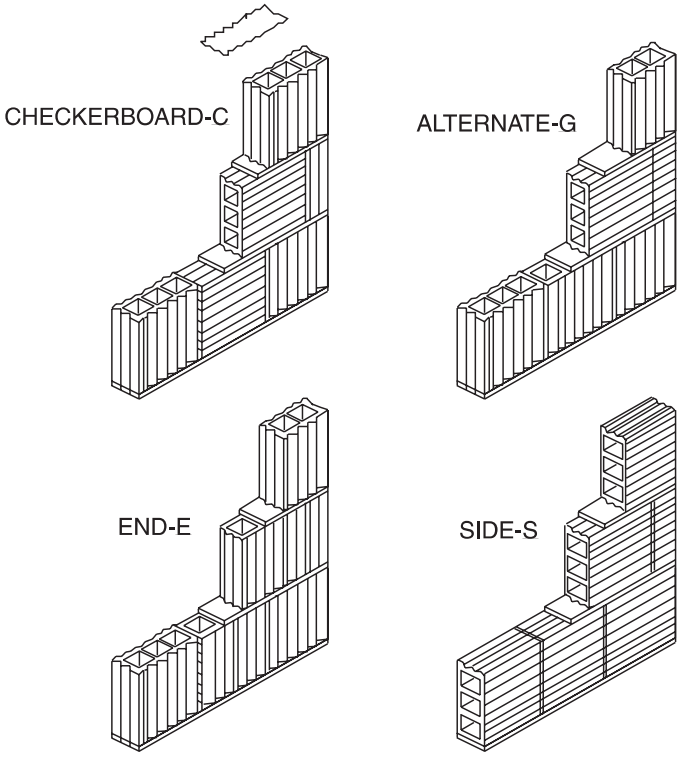
1. Failure mode - flame thru.
2. Passed 2-hour fire test (Grade “C” fire res. - British).
3. Passed hose stream test.
4. Tested at NBS under ASA Spec. No. A2-1934. As nonload bearing partitions.
5. Tested at NBS under ASA Spec. No. 42-1934 (ASTM C 19-33) except that hose stream testing where carried was run on test specimens exposed for full test duration, not for a reduced period as is contemporarily done.
6. Failure by thermal criteria - maximum temperature rise 325°F.
7. Hose stream failure.
8. Hose stream - pass.
9. Specimen removed prior to any failure occurring.
10. Failure mode - collapse.
11. For clay tile walls, unless the source or density of the clay can be positively identified or determined, it is suggested that the lowest hourly rating for the fire endurance of a clay tile partition of that thickness be followed. Identified sources of clay showing longer fire endurance can lead to longer time recommendations.
12. See appendix for construction and design details for clay tile walls.
13. Load: 80 psi for gross wall area.
14. One cell in wall thickness.
15. Two cells in wall thickness.
16. Double shells plus one cell in wall thickness.
17. One cell in wall thickness, cells filled with broken tile, crushed stone, slag cinders or sand mixed with mortar.
18. Dense hard-burned clay or shale tile.
19. Medium-burned clay tile.
20. Not less than $^5/_8$ inch thickness of 1:3 sanded gypsum plaster.
21. Units of not less than 30 percent solid material.
22. Units of not less than 40 percent solid material.
23. Units of not less than 50 percent solid material.
24. Units of not less than 45 percent solid material.
25. Units of not less than 60 percent solid material.
26. All tiles laid in portland cement-lime mortar.
27. Blocks laid in 1:3 sanded gypsum mortar voids in blocks not to exceed 30 percent.
28. Units of expanded slag or pumice aggregate.
29. Units of crushed limestone, blast furnace, slag, cinders and expanded clay or shale.
30. Units of calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
31. Units of siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
32. Unit at least 49 percent solid.
33. Unit at least 62 percent solid.
34. Unit at least 65 percent solid.
35. Unit at least 73 percent solid.
36. Ratings based on one unit and one cell in wall thickness.
37. Minimum of $^1/_2$ inch - 1:3 sanded gypsum plaster.
38. Nonload bearing.
39. See Clay Tile Partition Design Construction drawings, below.

(Continued)

**TABLE 1.1.1—MASONRY WALLS
0″ TO LESS THAN 4″ THICK—continued**



DESIGNS OF TILES USED IN FIRE-TEST PARTITIONS



THE FOUR TYPES OF CONSTRUCTION USED IN FIRE-TEST PARTITIONS

**FIGURE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK**

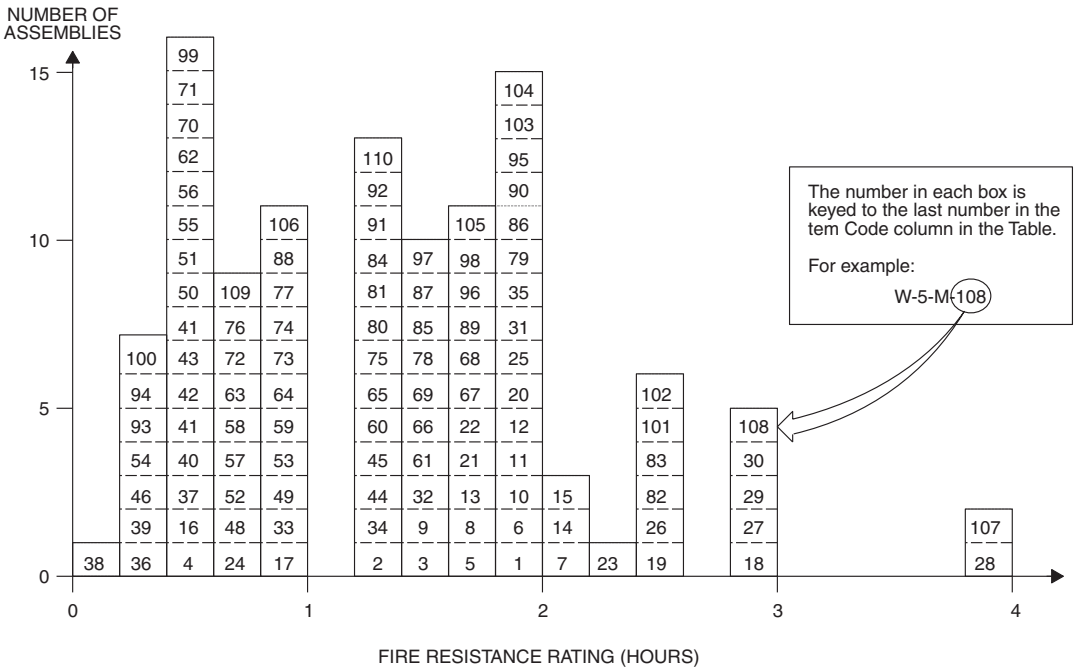


**TABLE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-1	4″	Solid 3″ thick, gypsum blocks laid in 1:3 sanded gypsum mortar; Facings: $^1/_2$″ of 1:3 sanded gypsum plaster (both sides).	N/A	2 hrs.		1		1	2
W-4-M-2	4″	Solid clay or shale brick.	N/A	1 hr. 15 min		1		1, 2	$1^1/_4$
W-4-M-3	4″	Concrete; No facings.	N/A	1 hr. 30 min.		1		1	$1^1/_2$
W-4-M-4	4″	Clay tile; Illinois surface clay; single cell thick; No face plaster; Design "B," Construction "C."	N/A	25 min.			2	3-7, 36	$^1/_3$
W-4-M-5	4″	Solid sand-lime brick.	N/A	1 hr. 45 min.		1		1	$1^3/_4$
W-4-M-6	4″	Solid wall; 3″ thick block; $^1/_2$″ plaster each side; $17^3/_4$″ × $8^3/_4$″ × 4″ "Breeze Blocks"; portland cement/sand mortar.	N/A	1 hr. 52 min.			7	2	$1^3/_4$
W-4-M-7	4″	Concrete (4020 psi); Reinforcement: vertical $^3/_8$″; horizontal $^1/_4$″; 6″ × 6″ grid.	N/A	2 hrs. 10 min.			7	2	2
W-4-M-8	4″	Concrete wall (4340 psi crush); reinforcement $^1/_4$″ diameter rebar on 8″ centers (vertical and horizontal).	N/A	1 hr. 40 min.			7	2	$1^2/_3$

(Continued)

TABLE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-9	$4^{3}/_{16}$″	$4^{3}/_{16}$″ × $2^{5}/_{8}$″ cellular fletton brick (1873 psi) with $^{1}/_{2}$″ sand mortar; bricks are U-shaped yielding hollow cover (approx. 2″ × 4″) in final cross-section configuration.	N/A	1 hr. 25 min.			7	2	$1^{1}/_{3}$
W-4-M-10	$4^{1}/_{4}$″	$4^{1}/_{4}$″ × $2^{1}/_{2}$″ fletton (1831 psi) brick in $^{1}/_{2}$″ sand mortar.	N/A	1 hr. 53 min			7	2	$1^{3}/_{4}$
W-4-M-11	$4^{1}/_{4}$″	$4^{1}/_{4}$″ × $2^{1}/_{2}$″ London stock (683 psi) brick; $^{1}/_{2}$″ grout.	N/A	1 hr. 52 min.			7	2	$1^{3}/_{4}$
W-4-M-12	$4^{1}/_{2}$″	$4^{1}/_{4}$″ × $2^{1}/_{2}$″ Leicester red, wire-cut brick (4465 psi) in $^{1}/_{2}$″ sand mortar.	N/A	1 hr. 56 min.			7	6	$1^{3}/_{4}$
W-4-M-13	$4^{1}/_{4}$″	$4^{1}/_{4}$″ × $2^{1}/_{2}$″ stairfoot brick (7527 psi) $^{1}/_{2}$″ sand mortar.	N/A	1 hr. 37 min.			7	2	$1^{1}/_{2}$
W-4-M-14	$4^{1}/_{4}$″	$4^{1}/_{4}$″ × $2^{1}/_{2}$″ sand-lime brick (2603 psi) $^{1}/_{2}$″ sand mortar.	N/A	2 hrs. 6 min.			7	2	2
W-4-M-15	$4^{1}/_{4}$″	$4^{1}/_{4}$″ × $2^{1}/_{2}$″ concrete brick (2527 psi) $^{1}/_{2}$″ sand mortar.	N/A	2 hrs. 10 min.			7	2	2
W-4-M-16	$4^{1}/_{2}$″	4″ thick clay tile; Ohio fire clay; single cell thick; No plaster exposed face; $^{1}/_{2}$″ 1:2 gypsum back face; Design “F,” Construction “S.”	N/A	31 min.			2	3-6, 36	$^{1}/_{2}$
W-4-M-17	$4^{1}/_{2}$"	4″ thick clay tile; Ohio fire clay; single cell thick; Plaster exposed face; $^{1}/_{2}$″ 1:2 sanded gypsum; Back Face: none; Construction “S,” Design “F.”	80 psi	50 min.			2	3-5, 8, 36	$^{3}/_{4}$
W-4-M-18	$4^{1}/_{2}$″	Core: solid sand-lime brick; $^{1}/_{2}$″ sanded gypsum plaster facings on both sides.	80 psi	3 hrs.		1		1, 11	3
W-4-M-19	$4^{1}/_{2}$″	Core: solid sand-lime brick; $^{1}/_{2}$″ sanded gypsum plaster facings on both sides.	80 psi	2 hrs. 30 min.		1		1, 11	$2^{1}/_{2}$
W-4-M-20	$4^{1}/_{2}$″	Core: concrete brick $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	80 psi	2 hrs.		1		1, 11	2
W-4-M-21	$4^{1}/_{2}$″	Core: solid clay or shale brick; $^{1}/_{2}$″ thick, 1:3 sanded gypsum plaster facings on fire sides.	80 psi	1 hr. 45 min.		1		1, 2, 11	$1^{3}/_{4}$
W-4-M-22	$4^{3}/_{4}$″	4″ thick clay tile; Ohio fire clay; single cell thick; cells filled with cement and broken tile concrete; Plaster on exposed face; none on unexposed face; $^{3}/_{4}$″ 1:3 sanded gypsum; Design “G,” Construction “E.”	N/A	1 hr. 48 min.			2	2, 3-5, 9, 36	$1^{3}/_{4}$
W-4-M-23	$4^{3}/_{4}$″	4″ thick clay tile; Ohio fire clay; single cell thick; cells filled with cement and broken tile concrete; No plaster exposed faced; $^{3}/_{4}$″ neat gypsum plaster on unexposed face; Design “G,” Construction “E.”	N/A	2 hrs. 14 min.			2	2, 3-5, 9, 36	2

(Continued)

TABLE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-M-24	5″	3″ × 13″ air space; 1″ thick metal reinforced concrete facings on both sides; faces connected with wood splines.	2,250 lbs./ft.	45 min.		1		1	3/4
W-5-M-25	5″	Core: 3″ thick void filled with "nondulated" mineral wool weighing 10 lbs./ft.^{3}; 1″ thick metal reinforced concrete facings on both sides.	2,250 lbs./ft.	2 hrs.		1		1	2
W-5-M-26	5″	Core: solid clay or shale brick; 1/2″ thick, 1:3 sanded gypsum plaster facings on both sides.	40 psi	2 hrs. 30 min.		1		1, 2, 11	2 1/2
W-5-M-27	5″	Core: solid 4″ thick gypsum blocks, laid in 1:3 sanded gypsum mortar; 1/2″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	3 hrs.		1		1	3
W-5-M-28	5″	Core: 4″ thick hollow gypsum blocks with 30% voids; blocks laid in 1:3 sanded gypsum mortar; No facings.	N/A	4 hrs.		1		1	4
W-5-M-29	5″	Core: concrete brick; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	160 psi	3 hrs.		1		1	3
W-5-M-30	5 1/4″	4″ thick clay tile; Illinois surface clay; double cell thick; Plaster: 5/8″ sanded gypsum 1:3 both faces; Design "D," Construction "S."	N/A	2 hrs. 53 min.			2	2-5, 9, 36	2 3/4
W-5-M-31	5 1/4″	4" thick clay tile; New Jersey fire clay; double cell thick; Plaster: 5/8" sanded gypsum 1:3 both faces; Design "D," Construction "S."	N/A	1 hr. 52 min.			2	2-5, 9, 36	1 3/4
W-5-M-32	5 1/4″	4″ thick clay tile; New Jersey fire clay; single cell thick; Plaster: 5/8″ sanded gypsm 1:3 both faces; Design "D," Construction "S."	N/A	1 hr. 34 min.	2		2	2-5, 9, 36	1 1/2
W-5-M-33	5 1/4″	4″ thick clay tile; New Jersey fire clay; single cell thick; Face plaster: 5/8″ both sides; 1:3 sanded gypsum; Design "B," Construction "S."	N/A	50 min.			2	3-5, 8, 36	3/4
W-5-M-34	5 1/4″	4″ thick clay tile; Ohio fire clay; single cell thick; Face plaster: 5/8″ both sides; 1:3 sanded gypsum; Design "B," Construction "A."	N/A	1 hr. 19 min.			2	2-5, 9, 36	1 1/4
W-5-M-35	5 1/4″	4″ thick clay tile; Illinois surface clay; single cell thick; Face plaster: 5/8″ both sides; 1:3 sanded gypsum; Design "B," Construction "S."	N/A	1 hr. 59 min.			2	2-5, 10 36	1 3/4
W-5-M-36	4″	Core: structural clay tile; see Notes 12, 16, 21; No facings.	N/A	15 min.		1		3, 4, 24	1/4

(Continued)

TABLE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-37	4″	Core: structural clay tile; see Notes 12, 17, 21; No facings.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-38	4″	Core: structural clay tile; see Notes 12, 16, 20; No facings.	N/A	10 min.		1		3, 4, 24	1/6
W-4-M-39	4″	Core: structural clay tile; see Notes 12, 17, 20; No facings.	N/A	20 min.		1		3, 4, 24	1/3
W-4-M-40	4″	Core: structural clay tile; see Notes 13, 16, 23; No facings.	N/A	30 min.		1		3, 4, 24	1/2
W-4-M-41	4″	Core: structural clay tile; see Notes 13, 17, 23; No facings.	N/A	35 min.		1		3, 4, 24	1/2
W-4-M-42	4″	Core: structural clay tile; see Notes 13, 16, 21; No facings.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-43	4″	Core: structural clay tile; see Notes 13, 17, 21; No facings.	N/A	30 min.		1		3, 4, 24	1/2
W-4-M-44	4″	Core: structural clay tile; see Notes 15, 16, 20; No facings	N/A	1 hr. 15 min.		1		3, 4, 24	1 1/4
W-4-M-45	4″	Core: structural clay tile; see Notes 15, 17, 20; No facings.	N/A	1 hr. 15 min.		1		3, 4, 24	1 1/4
W-4-M-46	4″	Core: structural clay tile; see Notes 14, 16, 22; No facings.	N/A	20 min.		1		3, 4, 24	1/3
W-4-M-47	4″	Core: structural clay tile; see Notes 14, 17, 22; No facings.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-48	4 1/4″	Core: structural clay tile; see Notes 12, 16, 21; Facings: both sides; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4
W-4-M-49	4 1/4″	Core: structural clay tile; see Notes 12, 17, 21; Facings: both sides; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-50	4 5/8″	Core: structural clay tile; see Notes 12, 16, 21; Facings: unexposed side only; see Note 18.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-51	4 5/8″	Core: structural clay tile; see Notes 12, 17, 21; Facings: unexposed side only; see Note 18.	N/A	30 min.		1		3, 4, 24	1/2
W-4-M-52	4 5/8″	Core: structural clay tile; see Notes 12, 16, 21; Facings: unexposed side only; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4
W-4-M-53	4 5/8″	Core: structural clay tile; see Notes 12, 17, 21; Facings: fire side only; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-54	4 5/8″	Core: structural clay tile; see Notes 12, 16, 20; Facings: unexposed side; see Note 18.	N/A	20 min.		1		3, 4, 24	1/3
W-4-M-55	4 5/8″	Core: structural clay tile; see Notes 12, 17, 20; Facings: exposed side; see Note 18.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-56	4 5/8″	Core: structural clay tile; see Notes 12, 16, 20; Facings: fire side only; see Note 18.	N/A	30 min.		1		3, 4, 24	1/2
W-4-M-57	4 5/8″	Core: structural clay tile; see Notes 12, 17, 20; Facings: fire side only; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4

(Continued)

TABLE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-58	4 5/8″	Core: structural clay tile; see Notes 13, 16, 23; Facings: unexposed side only; see Note 18.	N/A	40 min.		1		3, 4, 24	2/3
W-4-M-59	4 5/8″	Core: structural clay tile; see Notes 13, 17, 23; Facings: unexposed side only; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-60	4 5/8″	Core: structural clay tile; see Notes 13, 16, 23; Facings: fire side only; see Note 18.	N/A	1 hr. 15 min.		1		3, 4, 24	1 1/4
W-4-M-61	4 5/8″	Core: structural clay tile; see Notes 13, 17, 23; Facings: fire side only; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	1 1/2
W-4-M-62	4 5/8″	Core: structural clay tile; see Notes 13, 16, 21; Facings: unexposed side only; see Note 18.	N/A	35 min.		1		3, 4, 24	1/2
W-4-M-63	4 5/8″	Core: structural clay tile; see Notes 13, 17, 21; Facings: unexposed face only; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4
W-4-M-64	4 5/8″	Core: structural clay tile; see Notes 13, 16, 23; Facings: exposed face only; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-65	4 5/8″	Core: structural clay tile; see Notes 13, 17, 21; Facings: exposed side only; see Note 18.	N/A	1 hr. 15 min.		1		3, 4, 24	1 1/4
W-4-M-66	4 5/8″	Core: structural clay tile; see Notes 15, 17, 20; Facings: unexposed side only; see Note 18	N/A	1 hr. 30 min.		1		3, 4, 24	1 1/2
W-4-M-67	4 5/8″	Core: structural clay tile; see Notes 15, 16, 20; Facings: exposed side only; see Note 18.	N/A	1 hr. 45 min.		1		3, 4, 24	1 3/4
W-4-M-68	4 5/8″	Core: structural clay tile; see Notes 15, 17, 20; Facings: exposed side only; see Note 18.	N/A	1 hr. 45 min.		1		3, 4, 24	1 3/4
W-4-M-69	4 5/8″	Core: structural clay tile; see Notes 15, 16, 20; Facings: unexposed side only; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	1 3/4
W-4-M-70	4 5/8″	Core: structural clay tile; see Notes 14, 16, 22; Facings: unexposed side only; see Note 18.	N/A	30 min.		1		3, 4, 24	1/2
W-4-M-71	4 5/8″	Core: structural clay tile; see Notes 14, 17, 22; Facings: exposed side only; see Note 18.	N/A	35 min.		1		3, 4, 24	1/2
W-4-M-72	4 5/8″	Core: structural clay tile; see Notes 14, 16, 22; Facings: fire side of wall only; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4
W-4-M-73	4 5/8″	Core: structural clay tile; see Notes 14, 17, 22; Facings: fire side of wall only; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-74	5 1/4″	Core: structural clay tile; see Notes 12, 16, 21; Facings: both sides; see Note 18.	N/A	1 hr.		1		3, 4, 24	1

(Continued)

TABLE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-M-75	$5^1/_4$″	Core: structural clay tile; see Notes 12, 17, 21; Facings: both sides; see Note 18	N/A	1 hr. 15 min.		1		3, 4, 24	$1^1/_4$
W-5-M-76	$5^1/_4$″	Core: structural clay tile; see Notes 12, 16, 20; Facings: both sides; see Note 18.	N/A	45 min.		1		3, 4, 24	$^3/_4$
W-5-M-77	$5^1/_4$″	Core: structural clay tile; see Notes 12, 17, 20; Facings: both sides; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-5-M-78	$5^1/_4$″	Core: structural clay tile; see Notes 13, 16, 23; Facings: both sides of wall; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	$1^1/_2$
W-5-M-79	$5^1/_4$″	Core: structural clay tile; see Notes 13, 17, 23; Facings: both sides of wall; see Note 18.	N/A	2 hrs.		1		3, 4, 24	2
W-5-M-80	$5^1/_4$″	Core: structural clay tile; see Notes 13, 16, 21; Facings: both sides of wall; see Note 18.	N/A	1 hr. 15 min.		1		3, 4, 24	$1^1/_4$
W-5-M-81	$5^1/_4$″	Core: structural clay tile; see Notes 13, 16, 21; Facings: both sides of wall; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	$1^1/_2$
W-5-M-82	$5^1/_4$″	Core: structural clay tile; see Notes 15, 16, 20; Facings: both sides; see Note 18.	N/A	2 hrs. 30 min.		1		3, 4, 24	$2^1/_2$
W-5-M-83	$5^1/_4$″	Core: structural clay tile; see Notes 15, 17, 20; Facings: both sides; see Note 18.	N/A	2 hrs. 30 min.		1		3, 4, 24	$2^1/_2$
W-5-M-84	$5^1/_4$″	Core: structural clay tile; see Notes 14, 16, 22; Facings: both sides of wall; see Note 18.	N/A	1 hr. 15 min.		1		3, 4, 24	$1^1/_4$
W-5-M-85	$5^1/_4$″	Core: structural clay tile; see Notes 14, 17, 22; Facings: both sides of wall; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	$1^1/_2$
W-4-M-86	4″	Core: 3" thick gypsum blocks 70% solid; see Note 26; Facings: both sides; see Note 25.	N/A	2 hrs.		1			2
W-4-M-87	4″	Core: hollow concrete units; see Notes 27, 34, 35; No facings.	N/A	1 hr. 30 min.		1			$1^1/_2$
W-4-M-88	4″	Core: hollow concrete units; see Notes 28, 33, 35; No facings.	N/A	1 hr.		1			1
W-4-M-89	4″	Core: hollow concrete units; see Notes 28, 34, 35; Facings: both sides; see Note 25.	N/A	1 hr. 45 min.		1			$1^3/_4$
W-4-M-90	4″	Core: hollow concrete units; see Notes 27, 34, 35; Facings: both sides; see Note 25.	N/A	2 hrs.		1			2
W-4-M-91	4″	Core: hollow concrete units; see Notes 27, 32, 35; No facings.	N/A	1 hr. 15 min.		1			$1^1/_4$
W-4-M-92	4″	Core: hollow concrete units; see Notes 28, 34, 35; No facings.	N/A	1 hr. 15 min.		1			$1^1/_4$
W-4-M-93	4″	Core: hollow concrete units; see Notes 29, 32, 35; No facings.	N/A	20 min.		1			$^1/_3$

(Continued)

TABLE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-94	4″	Core: hollow concrete units; see Notes 30, 34, 35; No facings.	N/A	15 min.		1			1/4
W-4-M-95	4 1/2″	Core: hollow concrete units; see Notes 27, 34, 35; Facings: one side only; see Note 25.	N/A	2 hrs.		1			2
W-4-M-96	4 1/2″	Core: hollow concrete units; see Notes 27, 32, 35; Facings: one side only; see Note 25.	N/A	1 hr. 45 min.		1			1 3/4
W-4-M-97	4 1/2″	Core: hollow concrete units; see Notes 28, 33, 35; Facings: one side; see Note 25.	N/A	1 hr. 30 min.		1			1 1/2
W-4-M-98	4 1/2″	Core: hollow concrete units; see Notes 28, 34, 35; Facings: one side only; see Note 25.	N/A	1 hr. 45 min.		1			1 3/4
W-4-M-99	4 1/2″	Core: hollow concrete units; see Notes 29, 32, 35; Facings: one side; see Note 25.	N/A	30 min.		1			1/2
W-4-M-100	4 1/2″	Core: hollow concrete units; see Notes 30, 34, 35; Facings: one side; see Note 25.	N/A	20 min.		1			1/3
W-5-M-101	5″	Core: hollow concrete units; see Notes 27, 34, 35; Facings: both sides; see Note 25.	N/A	2 hrs. 30 min.		1			2 1/2
W-5-M-102	5″	Core: hollow concrete units; see Notes 27, 32, 35; Facings: both sides; see Note 25.	N/A	2 hrs. 30 min.		1			2 1/2
W-5-M-103	5″	Core: hollow concrete units; see Notes 28, 33, 35; Facings: both sides; see Note 25.	N/A	2 hrs.		1			2
W-5-M-104	5″	Core: hollow concrete units; see Notes 28, 31, 35; Facings: both sides; see Note 25.	N/A	2 hrs.		1			2
W-5-M-105	5″	Core: hollow concrete units; see Notes 29, 32, 35; Facings: both sides; see Note 25.	N/A	1 hr. 45 min.		1			1 3/4
W-5-M-106	5″	Core: hollow concrete units; see Notes 30, 34, 35; Facings: both sides; see Note 25.	N/A	1 hr.		1			1
W-5-M-107	5″	Core: 5″ thick solid gypsum blocks; see Note 26; No facings.	N/A	4 hrs.		1			4
W-5-M-108	5″	Core: 4″ thick hollow gypsum blocks; see Note 26; Facings: both sides; see Note 25.	N/A	3 hrs.		1			3
W-5-M-109	4″	Concrete with 4″ × 4″ No. 6 welded wire mesh at wall center.	100 psi	45 min.			43	2	3/4

(Continued)

TABLE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-110	4″	Concrete with 4″ × 4″ No. 6 welded wire mesh at wall center.	N/A	1 hr. 15 min.			43	2	$1^1/_4$

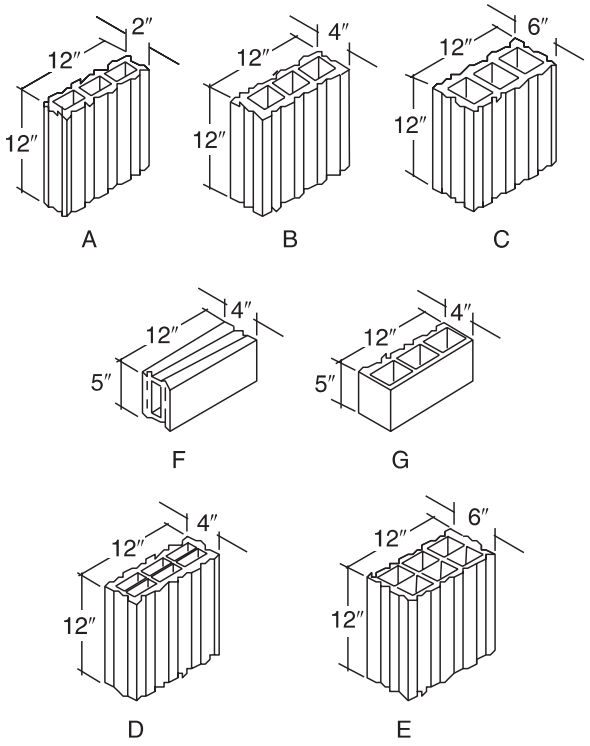
For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

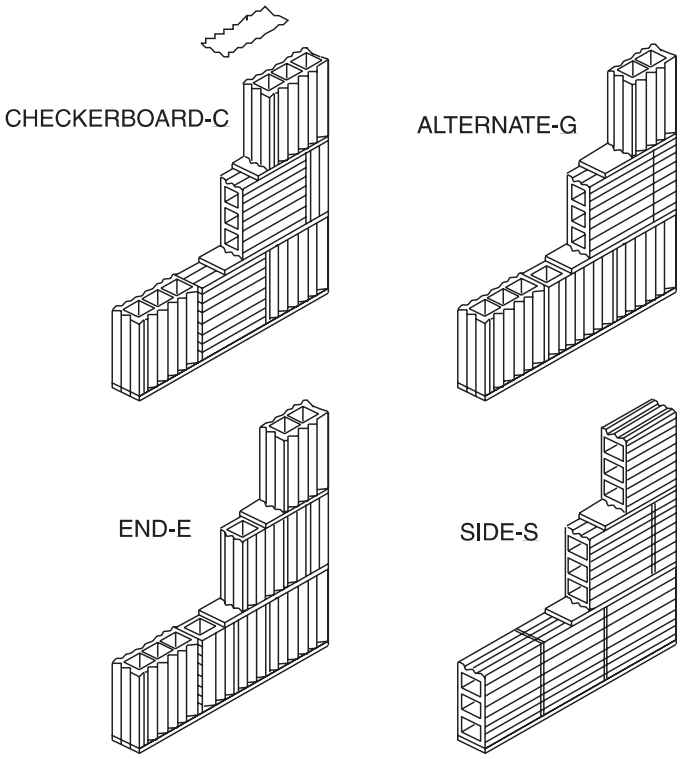
1. Tested as NBS under ASA Spec. No. A 2-1934.
2. Failure mode - maximum temperature rise.
3. Treated at NBS under ASA Spec. No. 42-1934 (ASTM C 19-53) except that hose stream testing where carried out was run on test specimens exposed for full test duration, not for or reduced period as is contemporarily done.
4. For clay tile walls, unless the source the clay can be positively identified, it is suggested that the most pessimistic hour rating for the fire endurance of a clay tile partition of that thickness to be followed. Identified sources of clay showing longer fire endurance can lead to longer time recommendations.
5. See appendix for construction and design details for clay tile walls.
6. Failure mode - flame thru or crack formation showing flames.
7. Hole formed at 25 minutes; partition collapsed at 42 minutes or removal from furnace.
8. Failure mode - collapse.
9. Hose stream pass.
10. Hose stream hole formed in specimen.
11. Load: 80 psi for gross wall cross sectional area.
12. One cell in wall thickness.
13. Two cells in wall thickness.
14. Double cells plus one cell in wall thickness.
15. One cell in wall thickness, cells filled with broken tile, crushed stone, slag, cinders or sand mixed with mortar.
16. Dense hard-burned clay or shale tile.
17. Medium-burned clay tile.
18. Not less than $^5/_8$ inch thickness of 1:3 sanded gypsum plaster.
19. Units of not less than 30 percent solid material.
20. Units of not less than 40 percent solid material.
21. Units of not less than 50 percent solid material.
22. Units of not less than 45 percent solid material.
23. Units of not less than 60 percent solid material.
24. All tiles laid in portland cement-lime mortar.
25. Minimum $^1/_2$ inch - 1:3 sanded gypsum plaster.
26. Laid in 1:3 sanded gypsum mortar. Voids in hollow units not to exceed 30 percent.
27. Units of expanded slag or pumice aggregate.
28. Units of crushed limestone, blast furnace slag, cinders and expanded clay or shale.
29. Units of calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
30. Units of siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
31. Unit at least 49 percent solid.
32. Unit at least 62 percent solid.
33. Unit at least 65 percent solid.
34. Unit at least 73 percent solid.
35. Ratings based on one unit and one cell in wall thickness.
36. See Clay Tile Partition Design Construction drawings, below.

(Continued)

TABLE 1.1.2—MASONRY WALLS
4″ TO LESS THAN 6″ THICK—continued



DESIGNS OF TILES USED IN FIRE-TEST PARTITIONS



THE FOUR TYPES OF CONSTRUCTION USED IN FIRE-TEST PARTITIONS

**FIGURE 1.1.3—MASONRY WALLS
6″ TO LESS THAN 8″ THICK**

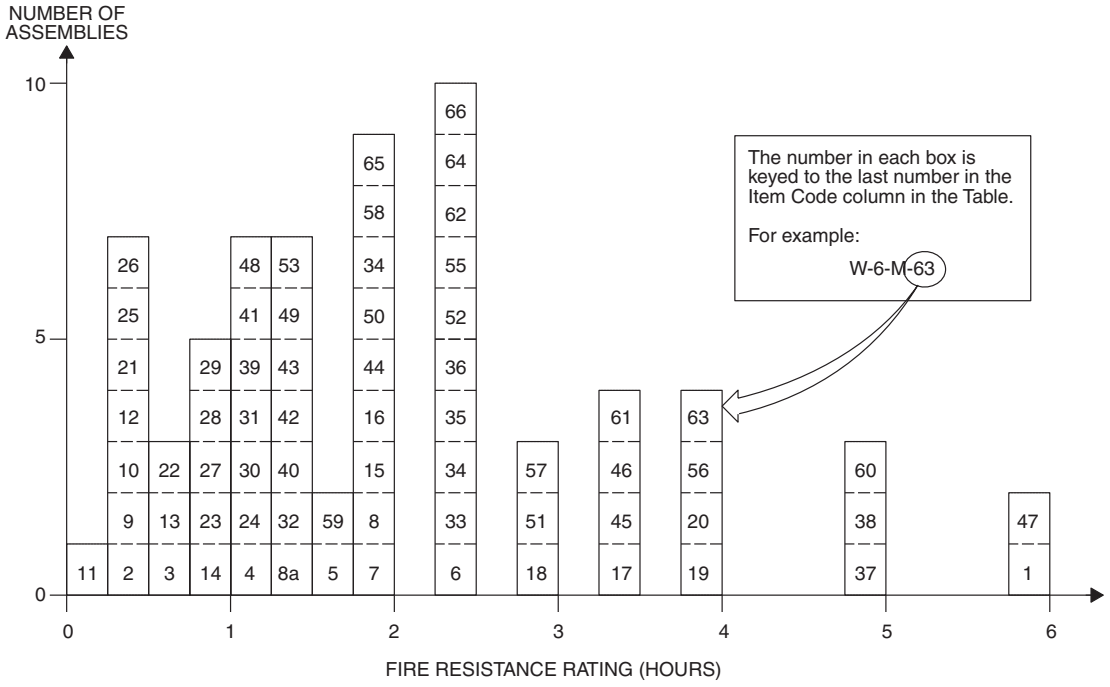


**TABLE 1.1.3—MASONRY WALLS
6″ TO LESS THAN 8″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-M-1	6″	Core: 5″ thick, solid gypsum blocks laid in 1:3 sanded gypsum mortar; $^1/_2$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	6 hrs.		1			6
W-6-M-2	6″	6″ clay tile; Ohio fire clay; single cell thick; No plaster; Design “C,” Construction “A.”	N/A	17 min.			2	1, 3, 4, 6, 55	$^1/_4$
W-6-M-3	6″	6″ clay tile; Illinois surface clay; double cell thick; No plaster; Design “E,” Construction “C.”	N/A	45 min.			2	1-4, 7, 55	$^3/_4$
W-6-M-4	6″	6″ clay tile; New Jersey fire clay; double cell thick; No plaster; Design “E,” Construction “S.”	N/A	1 hr. 1 min.			2	1-4, 8, 55	1
W-7-M-5	$7^1/_4$″	6″ clay tile; Illinois surface clay; double cell thick; Plaster: $^5/_8$″ - 1:3 sanded gypsum both faces; Design “E,” Construction “A.”	N/A	1 hr. 41 min.			2	1-4, 55	$1^2/_3$
W-7-M-6	$7^1/_4$″	6″ clay tile; New Jersey fire clay; double cell thick; Plaster: $^5/_8$″ - 1:3 sanded gypsum both faces; Design “E,” Construction “S.”	N/A	2 hrs. 23 min.			2	1-4, 9, 55	$2^1/_3$
W-7-M-7	$7^1/_4$″	6″ clay tile; Ohio fire clay; single cell thick; Plaster: $^5/_8$″ sanded gypsum; 1:3 both faces; Design “C,” Construction “A.”	N/A	1 hr. 54 min.			2	1-4, 9, 55	$2^3/_4$

(Continued)

TABLE 1.1.3—MASONRY WALLS
6″ TO LESS THAN 8″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-7-M-8	7 1/4″	6″ clay tile; Illinois surface clay; single cell thick; Plaster: 5/8″ sanded gypsum 1:3 both faces; Design “C,” Construction “S.”	N/A	2 hrs.			2	1, 3, 4, 9, 10, 55	2
W-7-M-8a	7 1/4″	6″ clay tile; Illinois surface clay; single cell thick; Plaster: 5/8″ sanded gypsum 1:3 both faces; Design “C,” Construction “E.”	N/A	1 hr. 23 min			2	1-4, 9, 10, 55	1 3/4
W-6-M-9	6″	Core: structural clay tile; see Notes 12, 16, 20; No facings.	N/A	20 min.		1		3, 5, 24	1/3
W-6-M-10	6″	Core: structural clay tile; see Notes 12, 17, 20; No facings.	N/A	25 min.		1		3, 5, 24	1/3
W-6-M-11	6″	Core: structural clay tile; see Notes 12, 16, 19; No facings.	N/A	15 min.		1		3, 5, 24	1/4
W-6-M-12	6″	Core: structural clay tile; see Notes 12, 17, 19; No facings.	N/A	20 min.		1		3, 5, 24	1/3
W-6-M-13	6″	Core: structural clay tile; see Notes 13, 16, 22; No facings.	N/A	45 min.		1		3, 5, 24	3/4
W-6-M-14	6″	Core: structural clay tile; see Notes 13, 17, 22; No facings.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-15	6″	Core: structural clay tile; see Notes 15, 17, 19; No facings.	N/A	2 hrs.		1		3, 5, 24	2
W-6-M-16	6″	Core: structural clay tile; see Notes 15, 16, 19; No facings.	N/A	2 hrs.		1		3, 5, 24	2
W-6-M-17	6″	Cored concrete masonry; see Notes 12, 34, 36, 38, 41; No facings.	80 psi	3 hrs. 30 min.		1		5, 25	3 1/2
W-6-M-18	6″	Cored concrete masonry; see Notes 12, 33, 36, 38, 41; No facings.	80 psi	3 hrs.		1		5, 25	3
W-6-M-19	6 1/2″	Cored concrete masonry; see Notes 12, 34, 36, 38, 41; Facings: side 1; see Note 35.	80 psi	4 hrs.		1		5, 25	4
W-6-M-20	6 1/2″	Cored concrete masonry; see Notes 12, 33, 36, 38, 41; Facings: side 1; see Note 35.	80 psi	4 hrs.		1		5, 25	4
W-6-M-21	6 5/8″	Core: structural clay tile; see Notes 12, 16, 20; Facings: unexposed face only; see Note 18.	N/A	30 min.		1		3, 5, 24	1/2
W-6-M-22	6 5/8″	Core: structural clay tile; see Notes 12, 17, 20; Facings: unexposed face only; see Note 18.	N/A	40 min.		1		3, 5, 24	2/3
W-6-M-23	6 5/8″	Core: structural clay tile; see Notes 12, 16, 20; Facings: exposed face only; see Note 18.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-24	6 5/8″	Core: structural clay tile; see Notes 12, 17, 20; Facings: exposed face only; see Note 18.	N/A	1 hr. 5 min.		1		3, 5, 24	1
W-6-M-25	6 5/8″	Core: structural clay tile; see Notes 12, 16, 19; Facings: unexposed side only; see Note 18.	N/A	25 min.		1		3, 5, 24	1/3

(Continued)

TABLE 1.1.3—MASONRY WALLS
6″ TO LESS THAN 8″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-M-26	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 12, 7, 19; Facings: unexposed face only; see Note 18.	N/A	30 min.		1		3, 5, 24	$^{1}/_{2}$
W-6-M-27	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 12, 16, 19; Facings: exposed side only; see Note 18.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-28	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 12, 17, 19; Facings: fire side only; see Note 18.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-29	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 13, 16, 22; Facings: unexposed side only; see Note 18.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-30	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 13, 17, 22; Facings: unexposed side only; see Note 18.	N/A	1 hr. 15 min.		1		3, 5, 24	$1^{1}/_{4}$
W-6-M-31	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 13, 16, 22; Facings: fire side only; see Note 18.	N/A	1 hr. 15 min.		1		3, 5, 24	$1^{1}/_{4}$
W-6-M-32	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 13, 17, 22; Facings: fire side only; see Note 18.	N/A	1 hr. 30 min.		1		3, 5, 24	$1^{1}/_{2}$
W-6-M-33	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 15, 16, 19; Facings: unexposed side only; see Note 18.	N/A	2 hrs. 30 min.		1		3, 5, 24	$2^{1}/_{2}$
W-6-M-34	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 15, 17, 19; Facings: unexposed side only; see Note 18.	N/A	2 hrs. 30 min.		1		3, 5, 24	$2^{1}/_{2}$
W-6-M-35	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 15, 16, 19; Facings: fire side only; see Note 18.	N/A	2 hrs. 30 min.		1		3, 5, 24	$2^{1}/_{2}$
W-6-M-36	$6^{5}/_{8}$″	Core: structural clay tile; see Notes 15, 17, 19; Facings: fire side only; see Note 18.	N/A	2 hrs. 30 min.		1		3, 5, 24	$2^{1}/_{2}$
W-6-M-37	7″	Cored concrete masonry; see Notes 12, 34, 36, 38, 41; see Note 35 for facings on both sides.	80 psi	5 hrs.		1		5, 25	5
W-6-M-38	7″	Cored concrete masonry; see Notes 12, 33, 36, 38, 41; see Note 35 for facings.	80 psi	5 hrs.		1		5, 25	5
W-6-M-39	$7^{1}/_{4}$″	Core: structural clay tile; see Notes 12, 16, 20; Facings: both sides; see Note 18.	N/A	1 hr. 15 min.		1		3, 5, 24	$1^{1}/_{4}$
W-6-M-40	$7^{1}/_{4}$″	Core: structural clay tile; see Notes 12, 17, 20; Facings: both sides; see Note 18.	N/A	1 hr. 30 min.		1		3, 5, 24	$1^{1}/_{2}$
W-6-M-41	$7^{1}/_{4}$″	Core: structural clay tile; see Notes 12, 16, 19; Facings: both sides; see Note 18.	N/A	1 hr. 15 min.		1		3, 5, 24	$1^{1}/_{4}$
W-6-M-42	$7^{1}/_{4}$″	Core: structural clay tile; see Notes 12, 17, 19; Facings: both sides; see Note 18.	N/A	1 hr. 30 min.		1		3, 5, 24	$1^{1}/_{2}$

(Continued)

TABLE 1.1.3—MASONRY WALLS
6″ TO LESS THAN 8″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-7-M-43	7 1/4″	Core: structural clay tile; see Notes 13, 16, 22; Facings: both sides of wall; see Note 18.	N/A	1 hr. 30 min.		1		3, 5, 24	1 1/2
W-7-M-44	7 1/4″	Core: structural clay tile; see Notes 13, 17, 22; Facings: both sides of wall; see Note 18.	N/A	2 hrs.		1		3, 5, 24	1 1/2
W-7-M-45	7 1/4″	Core: structural clay tile; see Notes 15, 16, 19; Facings: both sides; see Note 18.	N/A	3 hrs. 30 min.		1		3, 5, 24	3 1/2
W-7-M-46	7 1/4″	Core: structural clay tile; see Notes 15, 17, 19; Facings: both sides; see Note 18.	N/A	3 hrs. 30 min.		1		3, 5, 24	3 1/2
W-6-M-47	6″	Core: 5" thick solid gypsum blocks; see Note 45; Facings: both sides; see Note 45.	N/A	6 hrs.		1			6
W-6-M-48	6″	Core: hollow concrete units; see Notes 47, 50, 54; No facings.	N/A	1 hr. 15 min.		1			1 1/4
W-6-M-49	6″	Core: hollow concrete units; see Notes 46, 50, 54; No facings.	N/A	1 hr. 30 min.		1			1 1/2
W-6-M-50	6″	Core: hollow concrete units; see Notes 46, 41, 54; No facings.	N/A	2 hrs.		1			2
W-6-M-51	6″	Core: hollow concrete units; see Notes 46, 53, 54; No facings.	N/A	3 hrs.		1			3
W-6-M-52	6″	Core: hollow concrete units; see Notes 47, 53, 54; No facings.	N/A	2 hrs. 30 min.		1			2 1/2
W-6-M-53	6″	Core: hollow concrete units; see Notes 47, 51, 54; No facings.	N/A	1 hr. 30 min.		1			1 1/2
W-6-M-54	6 1/2″	Core: hollow concrete units; see Notes 46, 50, 54; Facings: one side only; see Note 35.	N/A	2 hrs.		1			2
W-6-M-55	6 1/2″	Core: hollow concrete units; see Notes 4, 51, 54; Facings: one side; see Note 35.	N/A	2 hrs. 30 min.		1			2 1/2
W-6-M-56	6 1/2″	Core: hollow concrete units; see Notes 46, 53, 54; Facings: one side; see Note 35.	N/A	4 hrs.		1			4
W-6-M-57	6 1/2″	Core: hollow concrete units; see Notes 47, 53, 54; Facings: one side; see Note 35.	N/A	3 hrs.		1			3
W-6-M-58	6 1/2″	Core: hollow concrete units; see Notes 47, 51, 54; Facings: one side; see Note 35.	N/A	2 hrs.		1			2
W-6-M-59	6 1/2″	Core: hollow concrete units; see Notes 47, 50, 54; Facings: one side; see Note 35.	N/A	1 hr. 45 min.		1			1 3/4
W-7-M-60	7″	Core: hollow concrete units; see Notes 46, 53, 54; Facings: both sides; see Note 35.	N/A	5 hrs.		1			5
W-7-M-61	7″	Core: hollow concrete units; see Notes 46, 51, 54; Facings: both sides; see Note 35.	N/A	3 hrs. 30 min.		1			3 1/2

(Continued)

**TABLE 1.1.3—MASONRY WALLS
6″ TO LESS THAN 8″ THICK—continued**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-7-M-62	7″	Core: hollow concrete units; see Notes 46, 50, 54; Facings: both sides; see Note 35.	N/A	2 hrs. 30 min.		1			$2^1/_2$
W-7-M-63	7″	Core: hollow concrete units; see Notes 47, 53, 54; Facings: both sides; see Note 35.	N/A	4 hrs.		1			4
W-7-M-64	7″	Core: hollow concrete units; see Notes 47, 51, 54; Facings: both sides; see Note 35.	N/A	2 hrs. 30 min.		1			$2^1/_2$
W-7-M-65	7″	Core: hollow concrete units; see Notes 47, 50, 54; Facings: both sides; see Note 35.	N/A	2 hrs.		1			2
W-6-M-66	6″	Concrete wall with 4″ × 4″ No. 6 wire fabric (welded) near wall center for reinforcement.	N/A	2 hrs. 30 min.			43	2	$2^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

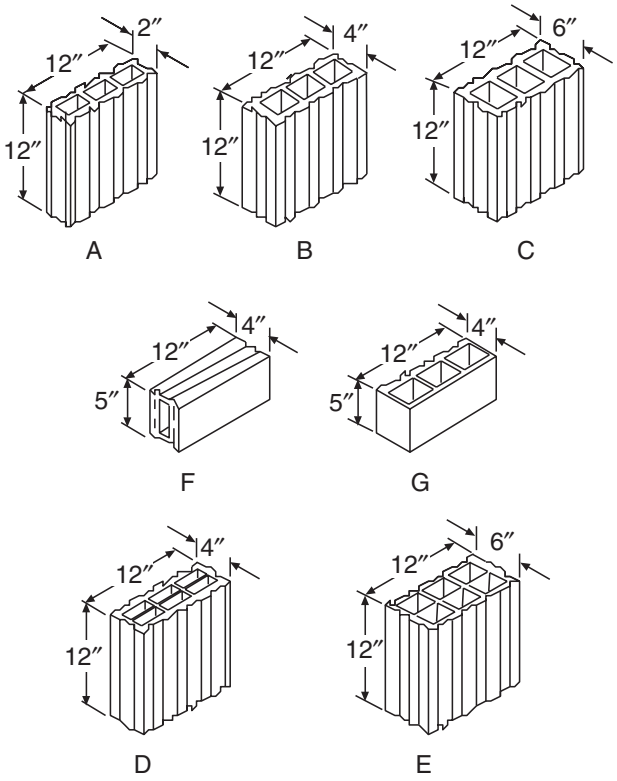
Notes:

1. Tested at NBS under ASA Spec. No. 43-1934 (ASTM C 19-53) except that hose stream testing where carried out was run on test specimens exposed for full test duration, not for a reduced period as is contemporarily done.
2. Failure by thermal criteria - maximum temperature rise.
3. For clay tile walls, unless the source or density of the clay can be positively identified or determined, it is suggested that the lowest hourly rating for the fire endurance of a clay tile partition of that thickness be followed. Identified sources of clay showing longer fire endurance can lead to longer time recommendations.
4. See Note 55 for construction and design details for clay tile walls.
5. Tested at NBS under ASA Spec. No. A2-1934.
6. Failure mode - collapse.
7. Collapsed on removal from furnace at 1 hour 9 minutes.
8. Hose stream - failed.
9. Hose stream - passed.
10. No end point met in test.
11. Wall collapsed at 1 hour 28 minutes.
12. One cell in wall thickness.
13. Two cells in wall thickness.
14. Double shells plus one cell in wall thickness.
15. One cell in wall thickness, cells filled with broken tile, crushed stone, slag, cinders or sand mixed with mortar.
16. Dense hard-burned clay or shale tile.
17. Medium-burned clay tile.
18. Not less than $^5/_8$ inch thickness of 1:3 sanded gypsum plaster.
19. Units of not less than 30 percent solid material.
20. Units of not less than 40 percent solid material.
21. Units of not less than 50 percent solid material.
22. Units of not less than 45 percent solid material.
23. Units of not less than 60 percent solid material.
24. All tiles laid in portland cement-lime mortar.
25. Load: 80 psi for gross cross sectional area of wall.
26. Three cells in wall thickness.
27. Minimum percent of solid material in concrete units = 52.
28. Minimum percent of solid material in concrete units = 54.
29. Minimum percent of solid material in concrete units = 55.
30. Minimum percent of solid material in concrete units = 57.
31. Minimum percent of solid material in concrete units = 62.
32. Minimum percent of solid material in concrete units = 65.
33. Minimum percent of solid material in concrete units = 70.
34. Minimum percent of solid material in concrete units = 76.
35. Not less than $^1/_2$ inch of 1:3 sanded gypsum plaster.
36. Noncombustible or no members framed into wall.
37. Combustible members framed into wall.
38. One unit in wall thickness.
39. Two units in wall thickness.

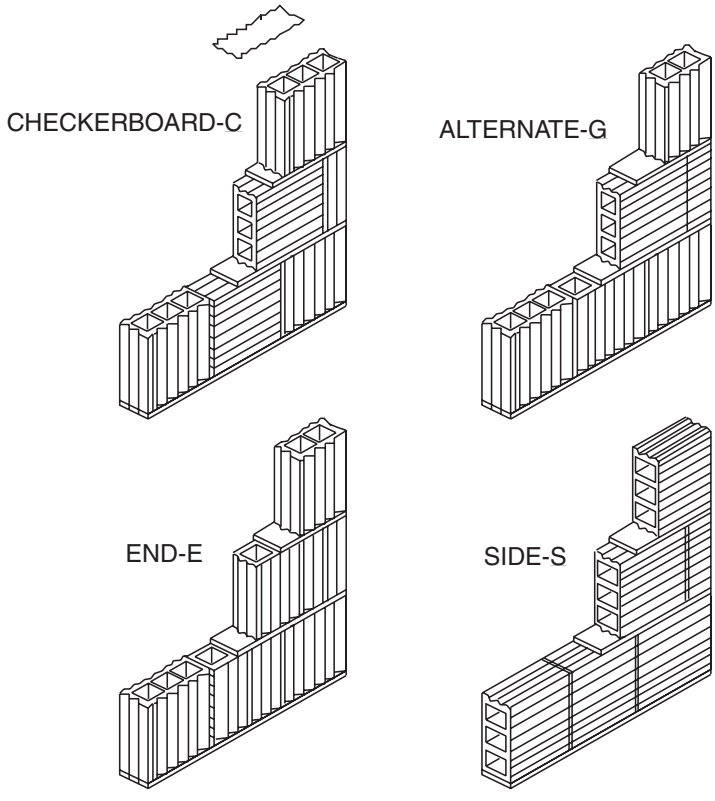
(Continued)

TABLE 1.1.3—MASONRY WALLS
6″ TO LESS THAN 8″ THICK—continued

40. Three units in wall thickness.
41. Concrete units made with expanded slag or pumice aggregates.
42. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
43. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
44. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
45. Laid in 1:3 sanded gypsum mortar.
46. Units of expanded slag or pumice aggregate.
47. Units of crushed limestone, blast furnace, slag, cinder and expanded clay or shale.
48. Units of calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
49. Units of siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
50. Unit minimum 49 percent solid.
51. Unit minimum 62 percent solid.
52. Unit minimum 65 percent solid.
53. Unit minimum 73 percent solid.
54. Ratings based on one unit and one cell in wall section.
55. See Clay Tile Partition Design Construction drawings, below.



DESIGNS OF TILES USED IN FIRE-TEST PARTITIONS



THE FOUR TYPES OF CONSTRUCTION USED IN FIRE-TEST PARTITIONS

**FIGURE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK**

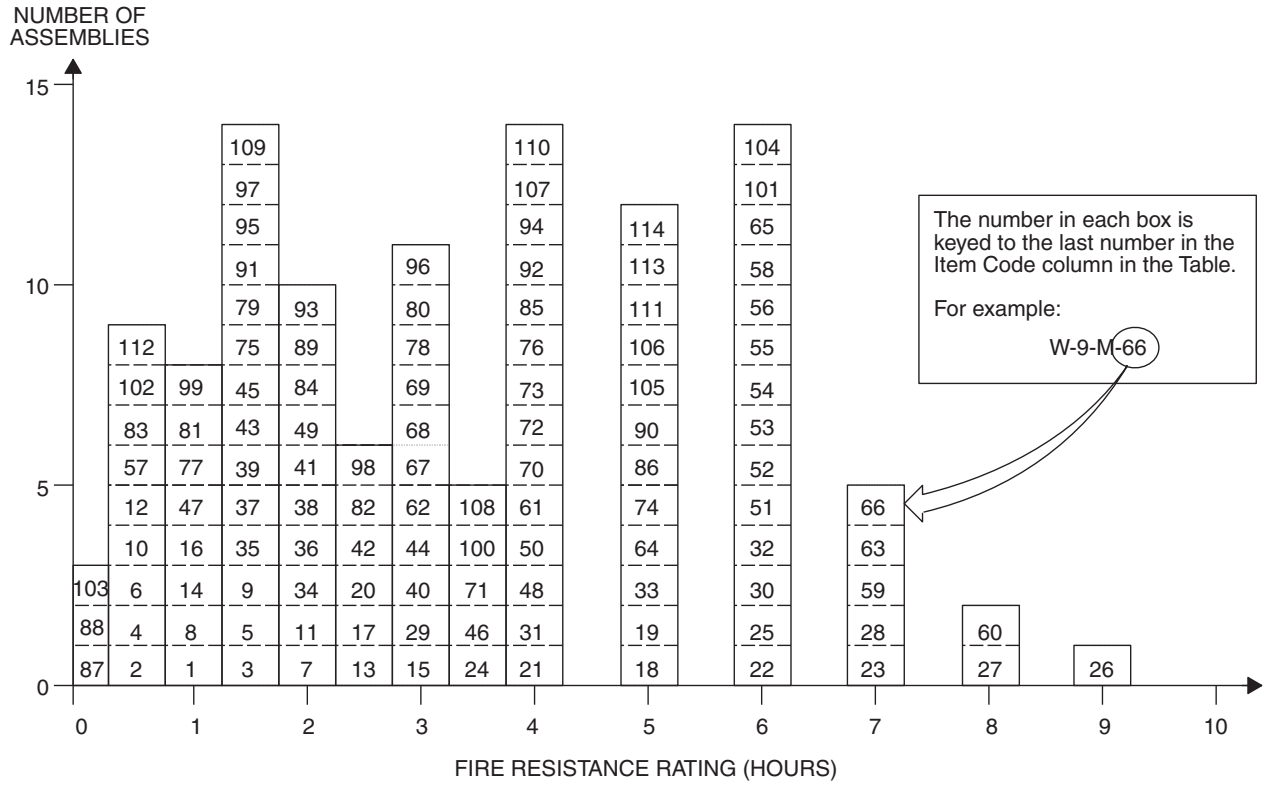


**TABLE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-1	8″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40.	80 psi	1 hr. 15 min.		1		1, 20	$1^1/_4$
W-8-M-2	8″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40; No facings; Result for wall with combustible members framed into interior.	80 psi	45 min.		1		1, 20	$^3/_4$
W-8-M-3	8″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43.	80 psi	1 hr. 30 min.		1		1, 20	$1^1/_2$
W-8-M-4	8″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43; No facings; Combustible members framed into wall.	80 psi	45 min.		1		1, 20	$^3/_4$
W-8-M-5	8″	Core: clay or shale structural tile; No facings.	See Notes	1 hr. 30 min.		1		1, 2, 5, 10, 18, 20, 21	$1^1/_2$

(Continued)

TABLE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-6	8″	Core: clay or shale structural tile; No facings.	See Notes	45 min.		1		1, 2, 5, 10,19, 20, 21	3/4
W-8-M-7	8″	Core: clay or shale structural tile; No facings	See Notes	2 hrs.		1		1, 2, 5, 13, 18, 20, 21	2
W-8-M-8	8″	Core: clay or shale structural tile; No facings.	See Notes	1 hr. 45 min.		1		1, 2, 5, 13, 19, 20, 21	1 1/4
W-8-M-9	8″	Core: clay or shale structural tile; No facings.	See Notes	1 hr. 15 min.		1		1, 2, 6, 9, 18, 20, 21	1 3/4
W-8-M-0	8″	Core: clay or shale structural tile; No facings.	See Notes	45 min.		1		1, 2, 6, 9, 19, 20, 21	3/4
W-8-M-1	8″	Core: clay or shale structural tile; No facings.	See Notes	2 hrs.		1		1, 2, 6, 10, 18, 20, 21	2
W-8-M-2	8″	Core: clay or shale structural tile; No facings.	See Notes	45 min.		1		1, 2, 6, 10, 19, 20, 21	3/4
W-8-M-3	8″	Core: clay or shale structural tile; No facings.	See Notes	2 hrs. 30 min.		1		1, 3, 6, 12, 18, 20, 21	2 1/2
W-8-M-4	8″	Core: clay or shale structural tile; No facings.	See Notes	1 hr.		1		1, 2, 6, 12, 19, 20, 21	1
W-8-M-5	8″	Core: clay or shale structural tile; No facings.	See Notes	3 hrs.		1		1, 2, 6, 16, 18, 20, 21	3
W-8-M-6	8″	Core: clay or shale structural tile; No facings.	See Notes	1 hr. 15 min.		1		1, 2, 6, 16, 19, 20, 21	1 1/4
W-8-M-7	8″	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 1; Minimum % solids: 70; No facings.	See Notes	2 hrs. 30 min.		1		1, 44	2 1/2
W-8-M-8	8″	Cored clay or shale brick; Units in wall thickness: 2; Cells in wall thickness: 2; Minimum % solids: 87; No facings.	See Notes	5 hrs.		1		1, 45	5
W-8-M-9	8″	Core: solid clay or shale brick; No facings.	See Notes	5 hrs.		1		1, 22, 45	5
W-8-M-0	8″	Core: hollow rolok of clay or shale.	See Notes	2 hrs. 30 min.		1		1, 22, 45	2 1/2
W-8-M-1	8″	Core: hollow rolok bak of clay or shale; No facings.	See Notes	4 hrs.		1		1, 45	4
W-8-M-2	8″	Core: concrete brick; No facings.	See Notes	6 hrs.		1		1, 45	6
W-8-M-3	8″	Core: sand-lime brick; No facings.	See Notes	7 hrs.		1		1, 45	7

(Continued)

TABLE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-24	8″	Core: 4″, 40% solid clay or shale structural tile; 1 side 4″ brick facing.	See Notes	3 hrs. 30 min.		1		1, 20	$3^1/_2$
W-8-M-25	8″	Concrete wall (3220 psi); Reinforcing vertical rods 1″ from each face and 1″ diameter; horizontal rods $^5/_8$″ diameter.	22,200 lbs./ft.	6 hrs.			7		6
W-8-M-26	8″	Core: sand-line brick; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	9 hrs.		1		1, 45	9
W-8-M-27	$8^1/_2$″	Core: sand-line brick; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	8 hrs.		1		1, 45	8
W-8-M-28	$8^1/_2$″	Core: concrete; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	7 hrs.		1		1, 45	7
W-8-M-29	$8^1/_2$″	Core: hollow rolok of clay or shale; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	3 hrs.		1		1, 45	3
W-8-M-30	$8^1/_2$″	Core: solid clay or shale brick $^1/_2$″ thick, 1:3 sanded gypsum plaster facings on one side.	See Notes	6 hrs.		1		1, 22, 45,	6
W-8-M-31	$8^1/_2$″	Core: cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 1; Minimum % solids: 70; $^1/_2$″ of 1:3 sanded gypsum plaster facings on both sides.	See Notes	4 hrs.		1		1, 44	4
W-8-M-32	$8^1/_2$″	Core: cored clay or shale brick; Units in wall thickness: 2; Cells in wall thickness: 2; Minimum % solids: 87; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	6 hrs.		1		1, 45	6
W-8-M-33	$8^1/_2$″	Core: hollow Rolok Bak of clay or shale; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	5 hrs.		1		1, 45	5
W-8-M-34	$8^5/_8$″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40; $^5/_8$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	2 hrs.		1		1, 20 21	2
W-8-M-35	$8^5/_8$″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40; Exposed face: $^5/_8$″ of 1:3 sanded gypsum plaster.	See Notes	1 hr. 30 min.		1		1, 20, 21	$1^1/_2$

(Continued)

TABLE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-36	$8^5/_8$″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43; $^5/_8$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	2 hrs.				1, 20, 21	2
W-8-M-37	$8^5/_8$″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43; $^5/_8$″ of 1:3 sanded gypsum plaster of the exposed face only.	See Notes	1 hr. 30 min.		1		1, 20, 21	$1^1/_2$
W-8-M-38	$8^5/_8$″	Core: clay or shale structural tile; Facings: side 1; see Note 17.	See Notes	2 hrs.		1		1, 2, 5, 10, 18, 20, 21	2
W-8-M-39	$8^5/_8$″	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	1 hr. 30 min.		1		1, 2, 5, 10, 19, 20, 21	$1^1/_2$
W-8-M-40	$8^5/_8$″	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	3 hrs.		1		1, 2, 5, 13, 18, 20, 21	3
W-8-M-41	$8^5/_8$″	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	2 hrs.		1		1, 2, 5, 13, 19, 20, 21	2
W-8-M-42	$8^5/_8$″	Core: clay or shale structural tile; Facings: side 1; see Note 17.	See Notes	2 hrs. 30 min.		1		1, 2, 9, 18, 20, 21	$2^1/_2$
W-8-M-43	$8^5/_8$″	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	1 hr. 30 min.		1		1, 2, 6, 9, 19, 20, 21	$1^1/_2$
W-8-M-44	$8^5/_8$″	Core: clay or shale structural tile; Facings: side 1, see Note 17; side 2, none.	See Notes	3 hrs.		1		1, 2, 10, 18, 20, 21	3
W-8-M-45	$8^5/_8$″	Core: clay or shale structural tile; Facings: fire side only; see Note 17.	See Notes	1 hr. 30 min.		1		1, 2, 6, 10, 19, 20, 21	$1^1/_2$
W-8-M-46	$8^5/_8$″	Core: clay or shale structural tile; Facings: side 1, see Note 17; side 2, none.	See Notes	3 hrs. 30 min.		1		1, 2, 6, 12, 18, 20, 21	$3^1/_2$
W-8-M-47	$8^5/_8$″	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	1 hr. 45 min.		1		1, 2, 6, 12, 19, 20, 21	$1^3/_4$
W-8-M-48	$8^5/_8$″	Core: clay or shale structural tile; Facings: side 1, see Note 17; side 2, none.	See Notes	4 hrs.		1		1, 2, 6, 16, 18, 20, 21	4
W-8-M-49	$8^5/_8$″	Core: clay or shale structural tile; Facings: fire side only; see Note 17.	See Notes	2 hrs.		1		1, 2, 6, 16, 19, 20, 21	2

(Continued)

TABLE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-50	$8^5/_8$″	Core: 4″, 40% solid clay or shale clay structural tile; 4″ brick plus $^5/_8$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	4 hrs.		1		1, 20	4
W-8-M-51	$8^3/_4$″	$8^3/_4$″ × $2^1/_2$″ and 4″ × $2^1/_2$″ cellular fletton (1873 psi) single and triple cell hollow brick set in $^1/_2$″ sand mortar in alternate courses.	3.6 tons/ft.	6 hrs.			7	23, 29	6
W-8-M-52	$8^3/_4$″	$8^3/_4$″ thick cement brick (2527 psi) with P.C. and sand mortar.	3.6 tons/ft.	6 hrs.			7	23, 24	6
W-8-M-53	$8^3/_4$″	$8^3/_4$″ × $2^1/_2$″ fletton brick (1831 psi) in $^1/_2$″ sand mortar.	3.6 tons/ft.	6 hrs.			7	23, 24	6
W-8-M-54	$8^3/_4$″	$8^3/_4$″ × $2^1/_2$″ London stock brick (683 psi) in $^1/_2$″ P.C. - sand mortar.	7.2 tons/ft.	6 hrs.			7	23, 24	6
W-9-M-55	9″	9″ × $2^1/_2$″ Leicester red wire-cut brick (4465 psi) in $^1/_2$″ P.C. - sand mortar.	6.0 tons/ft.	6 hrs.			7	23, 24	6
W-9-M-56	9″	9″ × 3″ sand-lime brick (2603 psi) in $^1/_2$″ P.C. - sand mortar.	3.6 tons/ft.	6 hrs.			7	23, 24	6
W-9-M-57	9″	2 layers $2^7/_8$″ fletton brick (1910 psi) with $3^1/_4$″ air space; Cement and sand mortar.	1.5 tons/ft.	32 min.			7	23, 25	$^1/_3$
W-9-M-58	9″	9″ × 3″ stairfoot brick (7527 psi) in $^1/_2$″ sand-cement mortar.	7.2 tons/ft.	6 hrs.			7	23, 24	6
W-9-M-59	9"	Core: solid clay or shale brick; $^1/_2$″ thick; 1:3 sanded gypsum plaster facings on both sides.	See Notes	7 hrs.		1		1, 22, 45	7
W-9-M-60	9″	Core: concrete brick; $^1/_2$″ of 1:3 sanded gypsum plaster facings on both sides.	See Notes	8 hrs.		1		1, 45	8
W-9-M-61	9″	Core: hollow Rolok of clay or shale; $^1/_2$″ of 1:3 sanded gypsum plaster facings on both sides.	See Notes	4 hrs.		1		1, 45	4
W-9-M-62	9″	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 1; Minimum % solids: 70; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	3 hrs.		1		1, 44	3
W-9-M-63	9″	Cored clay or shale brick; Units in wall thickness: 2; Cells in wall thickness: 2; Minimum % solids: 87; $^1/_2$″ of 1:3 sanded gypsum plaster facings on both sides.	See Notes	7 hrs.		1		1, 45	7
W-9-M-64	9-10″	Core: cavity wall of clay or shale brick; No facings.	See Notes	5 hrs.		1		1, 45	5
W-9-M-65	9-10″	Core: cavity construction of clay or shale brick; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See Notes	6 hrs.		1		1, 45	6

(Continued)

TABLE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-9-M-66	9-10″	Core: cavity construction of clay or shale brick; 1/2″ of 1:3 sanded gypsum plaster facings on both sides.	See Notes	7 hrs.		1		1, 45	7
W-9-M-67	9 1/4″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40; 5/8″ of 1:3 sanded gypsum plaster facings on both sides.	See Notes	3 hrs.		1		1, 20, 21	3
W-9-M-68	9 1/4″	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43; 5/8″ of 1:3 sanded gypsum plaster facings on both sides.	See Notes	3 hrs.		1		1, 20, 21	3
W-9-M-69	9 1/4″	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	3 hrs.		1		1, 2, 5, 10, 18, 20, 21	3
W-9-M-70	9 1/4″	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	4 hrs.		1		1, 2, 5, 13, 18, 20, 21	4
W-9-M-71	9 1/4″	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	3 hrs. 30 min.		1		1, 2, 6, 9, 18, 20, 21	3 1/2
W-9-M-72	9 1/4″	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	4 hrs.		1		1, 2, 6, 10, 18, 20, 21	4
W-9-M-73	9 1/4″	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	4 hrs.		1		1, 2, 6, 12, 18, 20, 21	4
W-9-M-74	9 1/4″	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	5 hrs.		1		1, 2, 6 16, 18, 20, 21	5
W-9-M-75	8″	Cored concrete masonry; see Notes 2, 19, 26, 34, 40; No facings.	80 psi	1 hr. 30 min.		1		1, 20	1 1/2
W-8-M-76	8″	Cored concrete masonry; see Notes 2, 18, 26, 34, 40; No facings	80 psi	4 hrs.		1		1, 20	4
W-8-M-77	8″	Cored concrete masonry; see Notes 2, 19, 26, 31, 40; No facings.	80 psi	1 hr. 15 min.		1		1, 20	1 1/4
W-8-M-78	8″	Cored concrete masonry; see Notes 2, 18, 26, 31, 40; No facings.	80 psi	3 hrs.		1		1, 20	3
W-8-M-79	8″	Cored concrete masonry; see Notes 2, 19, 26, 36, 42; No facings.	80 psi	1 hr. 30 min.		1		1, 20	1 1/2
W-8-M-80	8″	Cored concrete masonry; see Notes 2, 18, 26, 36, 41; No facings.	80 psi	3 hrs.		1		1, 20	3

(Continued)

TABLE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-81	8″	Cored concrete masonry; see Notes 2, 19, 26, 34, 41; No facings.	80 psi	1 hr.		1		1, 20	1
W-8-M-82	8″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; No facings.	80 psi	2 hrs. 30 min.		1		1, 20	$2^1/_2$
W-8-M-83	8″	Cored concrete masonry; see Notes 2, 19, 26, 29, 41; No facings.	80 psi	45 min.		1		1, 20	$^3/_4$
W-8-M-84	8″	Cored concrete masonry; see Notes 2, 18, 26, 29, 41; No facings.	80 psi	2 hrs.		1		1, 20	2
W-8-M-85	$8^1/_2$″	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; Facings: $2^1/_4$″ brick.	80 psi	4 hrs.		1		1, 20	4
W-8-M-86	8″	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; Facings: $3^3/_4$″ brick face.	80 psi	5 hrs.		1		1, 20	5
W-8-M-87	8″	Cored concrete masonry; see Notes 2, 19, 26, 30, 43; No facings.	80 psi	12 min.		1		1, 20	$^1/_5$
W-8-M-88	8″	Cored concrete masonry; see Notes 2, 18, 26, 30, 43; No facings.	80 psi	12 min.		1		1, 20	$^1/_5$
W-8-M-89	$8^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 34, 40; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-8-M-90	$8^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 34, 40; Facings: side 1; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-91	$8^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 31, 40; Facings: fire side only; see Note 38.	80 psi	1 hr. 45 min.		1		1, 20	$1^3/_4$
W-8-M-92	$8^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 31, 40; Facings: one side; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-8-M-93	$8^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 36, 41; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-8-M-94	$8^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 36, 41; Facings: fire side only; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-8-M-95	$8^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 34, 41; Facings: fire side only; see Note 38.	80 psi	1 hr. 30 min.		1		1, 20	$1^1/_2$
W-8-M-96	$8^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; Facings: one side; see Note 38.	80 psi	3 hrs.				1, 20	3
W-8-M-97	$8^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 29, 41; Facings: fire side only; see Note 38.	80 psi	1 hr. 30 min.		1		1, 20	$1^1/_2$

(Continued)

TABLE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-98	8 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 29, 41; Facings: one side; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2 1/2
W-8-M-99	8 1/2″	Cored concrete masonry; see Notes 3, 19, 23, 27, 41; No facings.	80 psi	1 hr. 15 min.		1		1, 20	1 1/4
W-8-M-100	8 1/2″	Cored concrete masonry; see Notes 3, 18, 23, 27, 41; No facings.	80 psi	3 hrs. 30 min.		1		1, 20	3 1/2
W-8-M-101	8 1/2″	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; Facings: 3 3/4" brick face; one side only; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-8-M-102	8 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 30, 43; Facings: fire side only; see Note 38.	80 psi	30 min.		1		1, 20	1/2
W-8-M-103	8 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 30, 43; Facings: one side only; see Note 38.	80 psi	12 min.		1		1, 20	1/5
W-8-M-104	9″	Cored concrete masonry; see Notes 2, 18, 26, 34, 40; Facings: both sides; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-8-M-105	9″	Cored concrete masonry; see Notes 2, 18, 26, 31, 40; Facings: both sides; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-106	9″	Cored concrete masonry; see Notes 2, 18, 26, 36, 41; Facings: both sides of wall; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-107	9″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; Facings: both sides; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-8-M-108	9″	Cored concrete masonry; see Notes 2, 18, 26, 29, 41; Facings: both sides; see Note 38.	80 psi	3 hrs. 30 min.		1		1, 20	3 1/2
W-8-M-109	9″	Cored concrete masonry; see Notes 3, 19, 23, 27, 40; Facings: fire side only; see Note 38.	80 psi	1 hr. 45 min.		1		1, 20	1 3/4
W-8-M-110	9″	Cored concrete masonry; see Notes 3, 18, 23, 27, 41; Facings: one side only; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-8-M-111	9″	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; 2 1/4" brick face on one side only; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-112	9″	Cored concrete masonry; see Notes 2, 18, 26, 30, 43; Facings: both sides; see Note 38.	80 psi	30 min.		1		1, 20	1/2

(Continued)

TABLE 1.1.4—MASONRY WALLS
8″ TO LESS THAN 10″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-9-M-113	$9^1/_2$″	Cored concrete masonry; see Notes 3, 18, 23, 27, 41; Facings: both sides; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-114	8″		200 psi	5 hrs.			43	22	5

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS under ASA Spec. No. 43-1934 (ASTM C 19-53).
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than $^5/_8$ inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross cross-sectional area of wall.
21. Portland cement-lime mortar.
22. Failure mode thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52.
30. Minimum percent of solid material in concrete units = 54.
31. Minimum percent of solid material in concrete units = 55.
32. Minimum percent of solid material in concrete units = 57.
33. Minimum percent of solid material in concrete units = 60.
34. Minimum percent of solid material in concrete units = 62.
35. Minimum percent of solid material in concrete units = 65.
36. Minimum percent of solid material in concrete units = 70.
37. Minimum percent of solid material in concrete units = 76.
38. Not less than $^1/_2$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
43. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert and dolomite.
44. Load: 120 psi for gross cross-sectional area of wall.
45. Load: 160 psi for gross cross-sectional area of wall.

**FIGURE 1.1.5—MASONRY WALLS
10″ TO LESS THAN 12″ THICK**

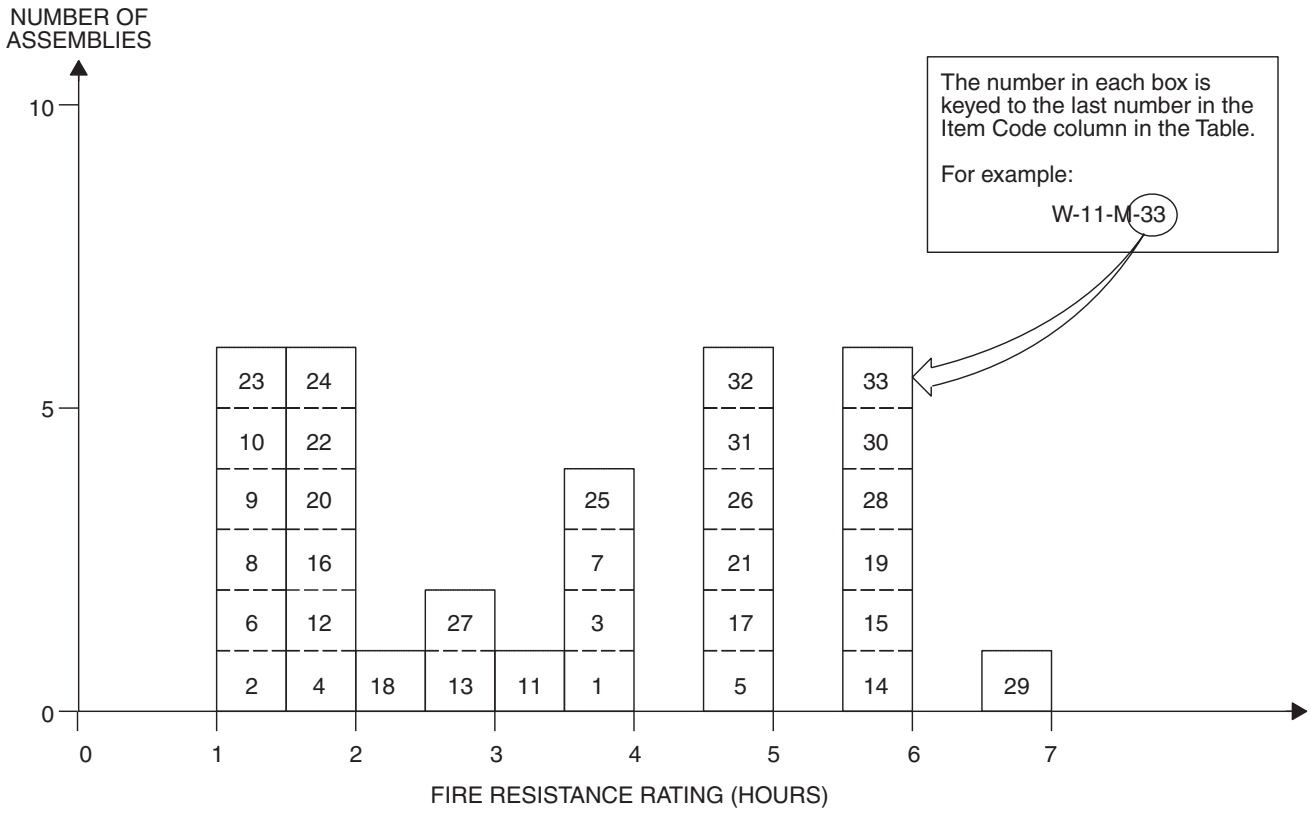


**TABLE 1.1.5—MASONRY WALLS
10″ TO LESS THAN 12″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-10-M-1	10″	Core: two $3^3/_4$″, 40% solid clay or shale structural tiles with 2″ air space between; Facings: $^3/_4$″ portland cement plaster on stucco on both sides.	80 psi	4 hrs.		1		1, 20	4
W-10-M-2	10″	Core: cored concrete masonry, 2″ air cavity; see Notes 3, 19, 27, 34, 40; No facings.	80 psi	1 hr. 30 min.		1		1, 20	$1^1/_2$
W-10-M-3	10″	Cored concrete masonry; see Notes 3, 18, 27, 34, 40; No facings.	80 psi	4 hrs.		1		1, 20	4
W-10-M-4	10″	Cored concrete masonry; see Notes 2, 19, 26, 34, 40; No facings.	80 psi	2 hrs.		1		1, 20	2
W-10-M-5	10″	Cored concrete masonry; see Notes 2, 18, 26, 33, 40; No facings.	80 psi	5 hrs.		1		1, 20	5
W-10-M-6	10″	Cored concrete masonry; see Notes 2, 19, 26, 33, 41; No facings.	80 psi	1 hr. 30 min.		1		1, 20	$1^1/_2$
W-10-M-7	10″	Cored concrete masonry; see Notes 2, 18, 26, 33, 41; No facings.	80 psi	4 hrs.		1		1, 20	4

(Continued)

TABLE 1.1.5—MASONRY WALLS
10″ TO LESS THAN 12″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-10-M-8	10″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 19, 27, 34, 42; No facings.	80 psi	1 hr. 15min.		1		1, 20	1 1/4
W-10-M-9	10″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 42; No facings.	80 psi	1 hr. 15 min.		1		1, 20	1 1/4
W-10-M-10	10″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 19, 27, 34, 41; No facings.	80 psi	1 hr. 15 min.		1		1, 20	1 1/4
W-10-M-11	10″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 41; No facings.	80 psi	3 hrs. 30 min.		1		1, 20	3 1/2
W-10-M-12	10″	9″ thick concrete block (11 3/4″ × 9″ × 4 1/4″) with two 2″ thick voids included; 3/8″ P.C. plaster 1/8″ neat gypsum.	N/A	1 hr. 53 min.			7	23, 44	1 3/4
W-10-M-13	10″	Holly clay tile block wall - 8 1/2″ block with two 3″ voids in each 8 1/2″ section; 3/4″ gypsum plaster - each face.	N/A	2 hrs. 42 min.			7	23, 25	2 1/2
W-10-M-14	10″	Two layers 4 1/4″ brick with 1 1/2″ air space; No ties sand cement mortar. (Fletton brick - 1910 psi).	N/A	6 hrs.			7	23, 24	6
W-10-M-15	10″	Two layers 4 1/4″ thick Fletton brick (1910 psi); 1 1/2″ air space; Ties: 18″ o.c. vertical; 3′ o.c. horizontal.	N/A	6 hrs.			7	23, 24	6
W-10-M-16	10 1/2″	Cored concrete masonry; 2″ air cavity; see Notes 3, 19, 27, 34, 40; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-10-M-17	10 1/2″	Cored concrete masonry; see Notes 3, 18, 27, 34, 40; Facings: side 1 only; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-10-M-18	10 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 33, 40; Facings: fire side only; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2 1/2
W-10-M-19	10 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 33, 40; Facings: one side; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-10-M-20	10 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 33, 41; Facings: fire side of wall only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-10-M-21	10 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 33, 41; Facings: one side only; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-10-M-22	10 1/2″	Cored concrete masonry (cavity type 2″ air space); see Notes 3,19, 27, 34, 42; Facings: fire side only; see Note 38.	80 psi	1 hr. 45 min.		1		1, 20	1 3/4

(Continued)

TABLE 1.1.5—MASONRY WALLS
10″ TO LESS THAN 12″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-10-M-23	$10^1/_2$″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 42; Facings: one side only; see Note 38.	80 psi	1 hr. 15 min.		1		1, 20	$1^1/_4$
W-10-M-24	$10^1/_2$″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 19, 27, 34, 41; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-10-M-25	$10^1/_2$″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 41; Facings: one side only; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-10-M-26	$10^5/_8$″	Core: 8″, 40% solid tile plus 2″ furring tile; $^5/_8$″ sanded gypsum plaster between tile types; Facings: both sides $^3/_4$″ portland cement plaster or stucco.	80 psi	5 hrs.		1		1, 20	5
W-10-M-27	$10^5/_8$″	Core: 8″, 40% solid tile plus 2″ furring tile; $^5/_8$″ sanded gypsum plaster between tile types; Facings: one side $^3/_4$″ portland cement plaster or stucco.	80 psi	3 hrs. 30 min.		1		1, 20	$3^1/_2$
W-11-M-28	11″	Cored concrete masonry; see Notes 3, 18, 27, 34, 40; Facings: both sides; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-11-M-29	11″	Cored concrete masonry; see Notes 2, 18, 26, 33, 40; Facings: both sides; see Note 38.	80 psi	7 hrs.		1		1, 20	7
W-11-M-30	11″	Cored concrete masonry; see Notes 2, 18, 26, 33, 41; Facings: both sides of wall; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-11-M-31	11″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 42; Facings: both sides; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-11-M-32	11″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 41; Facings: both sides; see Note 38.	80 psi	5 hrs.		1		1, 20	5

(Continued)

TABLE 1.1.5—MASONRY WALLS
10″ TO LESS THAN 12″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-11-M-33	11″	Two layers brick ($4^1/_2$″ Fletton, 2,428 psi) 2″ air space; galvanized ties; 18″ o.c. - horizontal; 3′ o.c. - vertical.	3 tons/ft.	6 hrs.			7	23, 24	6

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS - ASA Spec. No. A2-1934.
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than $^5/_8$ inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross cross sectional area of wall.
21. Portland cement-lime mortar.
22. Failure mode - thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52%.
30. Minimum percent of solid material in concrete units = 54%.
31. Minimum percent of solid material in concrete units = 55%.
32. Minimum percent of solid material in concrete units = 57%.
33. Minimum percent of solid material in concrete units = 60%.
34. Minimum percent of solid material in concrete units = 62%.
35. Minimum percent of solid material in concrete units = 65%.
36. Minimum percent of solid material in concrete units = 70%.
37. Minimum percent of solid material in concrete units = 76%.
38. Not less than $^1/_2$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.

**FIGURE 1.1.6—MASONRY WALLS
12″ TO LESS THAN 14″ THICK**

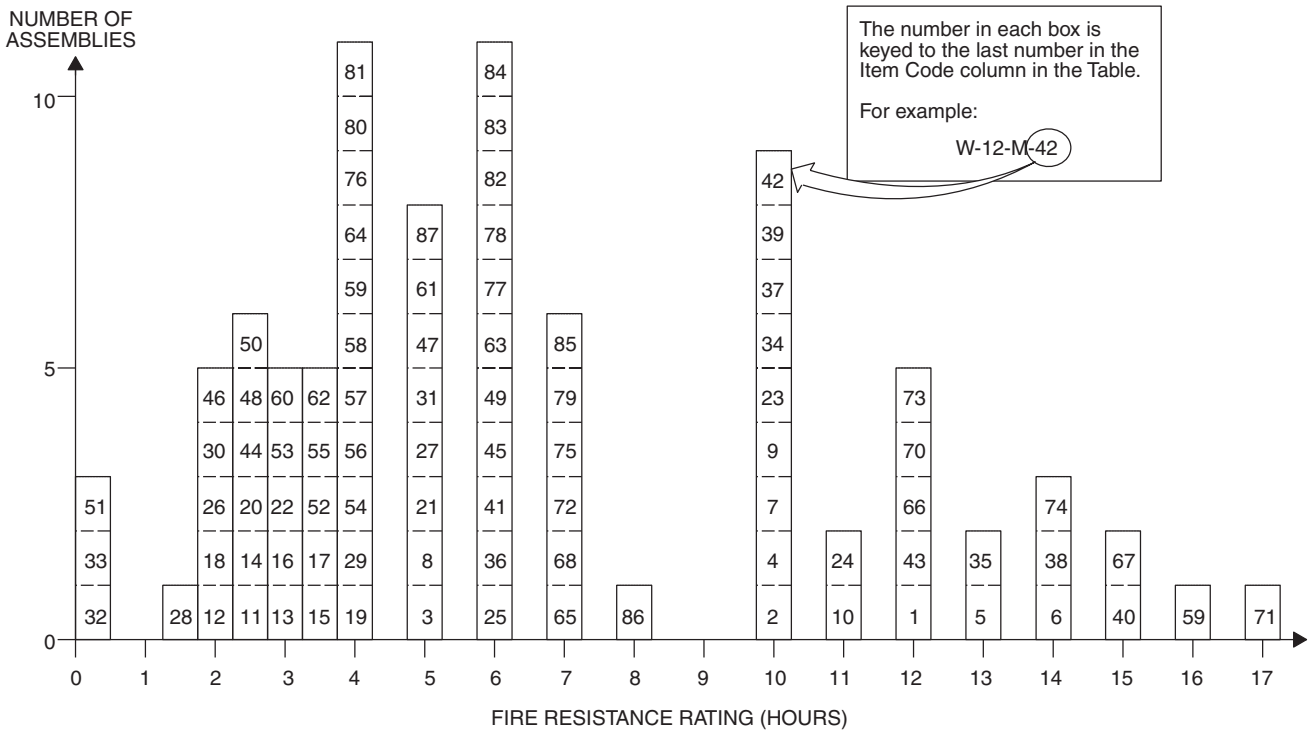


**TABLE 1.1.6—MASONRY WALLS
12″ TO LESS THAN 14″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-1	12″	Core: solid clay or shale brick; No facings.	N/A	12 hrs.		1		1	12
W-12-M-2	12″	Core: solid clay or shale brick; No facings.	160 psi	10 hrs.		1		1, 44	10
W-12-M-3	12″	Core: hollow Rolok of clay or shale; No facings.	160 psi	5 hrs.		1		1, 44	5
W-12-M-4	12″	Core: hollow Rolok Bak of clay or shale; No facings.	160 psi	10 hrs.		1		1, 44	10
W-12-M-5	12″	Core: concrete brick; No facings.	160 psi	13 hrs.		1		1, 44	13
W-12-M-6	12″	Core: sand-lime brick; No facings.	N/A	14 hrs.		1		1	14
W-12-M-7	12″	Core: sand-lime brick; No facings.	160 psi	10 hrs.		1		1, 44	10
W-12-M-8	12″	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids: 70; No facings.	120 psi	5 hrs.		1		1, 45	5
W-12-M-9	12″	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; No facings.	160 psi	10 hrs.		1		1, 44	10

(Continued)

TABLE 1.1.6—MASONRY WALLS
12″ TO LESS THAN 14″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-10	12″	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; No facings.	N/A	11 hrs.		1		1	11
W-12-M-11	12″	Core: clay or shale structural tile; see Notes 2, 6, 9, 18; No facings.	80 psi	2 hrs.		1		1, 20	2 1/2
W-12-M-12	12″	Core: clay or shale structural tile; see Notes 2, 4, 9, 19; No facings.	80 psi	2 hrs.		1		1, 20	2
W-12-M-13	12″	Core: clay or shale structural tile; see Notes 2, 6, 14, 19; No facings.	80 psi	3 hrs.		1		1, 20	3
W-12-M-14	12″	Core: clay or shale structural tile; see Notes 2, 6, 14, 18; No facings.	80 psi	2 hrs. 30 min.		1		1, 20	2 1/2
W-12-M-15	12″	Core: clay or shale structural tile; see Notes 2, 4, 13, 18; No facings.	80 psi	3 hrs. 30 min.		1		1, 20	3 1/2
W-12-M-16	12″	Core: clay or shale structural tile; see Notes 2, 4, 13, 19; No facings.	80 psi	3 hrs.		1		1, 20	3
W-12-M-17	12″	Core: clay or shale structural tile; see Notes 3, 6, 9, 18; No facings.	80 psi	3 hrs. 30 min.		1		1, 20	3 1/2
W-12-M-18	12″	Core: clay or shale structural tile; see Notes 3, 6, 9, 19; No facings.	80 psi	2 hrs.		1		1, 20	2
W-12-M-19	12″	Core: clay or shale structural tile; see Notes 3, 6, 14, 18; No facings.	80 psi	4 hrs.		1		1, 20	4
W-12-M-20	12″	Core: clay or shale structural tile; see Notes 3, 6, 14, 19; No facings.	80 psi	2 hrs. 30 min.		1		1, 20	2 1/2
W-12-M-21	12″	Core: clay or shale structural tile; see Notes 3, 6, 16, 18; No facings.	80 psi	5 hrs.		1		1, 20	5
W-12-M-22	12″	Core: clay or shale structural tile; see Notes 3, 6, 16, 19; No facings.	80 psi	3 hrs.		1		1, 20	3
W-12-M-23	12″	Core: 8″, 70% solid clay or shale structural tile; 4″ brick facings on one side.	80 psi	10 hrs.		1		1, 20	10
W-12-M-24	12″	Core: 8″, 70% solid clay or shale structural tile; 4″ brick facings on one side.	N/A	11 hrs.		1		1	11
W-12-M-25	12″	Core: 8″, 40% solid clay or shale structural tile; 4″ brick facings on one side.	80 psi	6 hrs.		1		1, 20	6
W-12-M-26	12″	Cored concrete masonry; see Notes 1, 9, 15, 16, 20; No facings.	80 psi	2 hrs.		1		1, 20	2
W-12-M-27	12″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; No facings.	80 psi	5 hrs.		1		1, 20	5
W-12-M-28	12″	Cored concrete masonry; see Notes 2, 19, 26, 31, 41; No facings.	80 psi	1 hr. 30 min.		1		1, 20	1 1/2
W-12-M-29	12″	Cored concrete masonry; see Notes 2, 18, 26, 31, 41; No facings.	80 psi	4 hrs.		1		1, 20	4

(Continued)

TABLE 1.1.6—MASONRY WALLS
12″ TO LESS THAN 14″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-30	12″	Cored concrete masonry; see Notes 3, 19, 27, 31, 43; No facings.	80 psi	2 hrs.		1		1, 20	2
W-12-M-31	12″	Cored concrete masonry; see Notes 3, 18, 27, 31, 43; No facings.	80 psi	5 hrs.		1		1, 20	5
W-12-M-32	12″	Cored concrete masonry; see Notes 2, 19, 26, 32, 43; No facings.	80 psi	25 min.		1		1, 20	1/3
W-12-M-33	12″	Cored concrete masonry; see Notes 2, 18, 26, 32, 43; No facings.	80 psi	25 min.		1		1, 20	1/3
W-12-M-34	12 1/2″	Core: solid clay or shale brick; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs.		1		1, 44	10
W-12-M-35	12 1/2″	Core: solid clay or shale brick; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	N/A	13 hrs.		1		1	13
W-12-M-36	12 1/2″	Core: hollow Rolok of clay or shale; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	6 hrs.		1		1, 44	6
W-12-M-37	12 1/2″	Core: hollow Rolok Bak of clay or shale; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs.		1		1, 44	10
W-12-M-38	12 1/2″	Core: concrete; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	14 hrs.		1		1, 44	14
W-12-M-39	12 1/2″	Core: sand-lime brick; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs.		1		1, 44	10
W-12-M-40	12 1/2″	Core: sand-lime brick; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	N/A	15 hrs.		1		1	15
W-12-M-41	12 1/2″	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids: 70; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	120 psi	6 hrs.		1		1, 45	6
W-12-M-42	12 1/2″	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs.		1		1, 44	10
W-12-M-43	12 1/2″	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	N/A	12 hrs.		1		1	12

(Continued)

TABLE 1.1.6—MASONRY WALLS
12″ TO LESS THAN 14″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-44	12 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 34, 41; Facings: fire side only; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2 1/2
W-12-M-45	12 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 34, 39, 41; Facings: one side only; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-12-M-46	12 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 31, 41; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-12-M-47	12 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 31, 41; Facings: one side of wall only; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-12-M-48	12 1/2″	Cored concrete masonry; see Notes 3, 19, 27, 31, 43; Facings: fire side only; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2 1/2
W-12-M-49	12 1/2″	Cored concrete masonry; see Notes 3, 18, 27, 31, 43; Facings: one side only; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-12-M-50	12 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 32, 43; Facings: fire side only; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2 1/2
W-12-M-51	12 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 32, 43; Facings: one side only; see Note 38.	80 psi	25 min.		1		1, 20	1/3
W-12-M-52	12 5/8″	Clay or shale structural tile; see Notes 2, 6, 9, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	3 hrs. 30 min.		1		1, 20	3 1/2
W-12-M-53	12 5/8″	Clay or shale structural tile; see Notes 2, 6, 9, 19; Facings: fire side only; see Note 17.	80 psi	3 hrs.		1		1, 20	3
W-12-M-54	12 5/8″	Clay or shale structural tile; see Notes 2, 6, 14, 19; Facings: side 1, see Note 17; side 2, none.	80 psi	4 hrs.		1		1, 20	4
W-12-M-55	12 5/8″	Clay or shale structural tile; see Notes 2, 6, 14, 18; Facings: exposed side only; see note 17.	80 psi	3 hrs. 30 min.		1		1, 20	3 1/2
W-12-M-56	12 5/8″	Clay or shale structural tile; see Notes 2, 4, 13, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	4 hrs.		1		1, 20	4
W-12-M-57	12 5/8″	Clay or shale structural tile; see Notes 1, 4, 13, 19; Facings: fire side only; see Note 17.	80 psi	4 hrs.		1		1, 20	4
W-12-M-58	12 5/8″	Clay or shale structural tile; see Notes 3, 6, 9, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	4 hrs.		1		1, 20	4
W-12-M-59	12 5/8″	Clay or shale structural tile; see Notes 3, 6, 9, 19; Facings: fire side only; see Note 17.	80 psi	3 hrs.		1		1, 20	3

(Continued)

TABLE 1.1.6—MASONRY WALLS
12″ TO LESS THAN 14″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-60	$12^{5}/_{8}$″	Clay or shale structural tile; see Notes 3, 6, 14, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	5 hrs.		1		1, 20	5
W-12-M-61	$12^{5}/_{8}$″	Clay or shale structural tile; see Notes 3, 6, 14, 19; Facings: fire side only; see Note 17.	80 psi	3 hrs. 30 min.		1		1, 20	$3^{1}/_{2}$
W-12-M-62	$12^{5}/_{8}$″	Clay or shale structural tile; see Notes 3, 6, 16, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	6 hrs.		1		1, 20	6
W-12-M-63	$12^{5}/_{8}$″	Clay or shale structural tile; see Notes 3, 6, 16, 19; Facings: fire side only; see Note 17.	80 psi	4 hrs.		1		1, 20	4
W-12-M-64	$12^{5}/_{8}$″	Core: 8″, 40% solid clay or shale structural tile; Facings: 4″ brick plus $^{5}/_{8}$″ of 1:3 sanded gypsum plaster on one side.	80 psi	7 hrs.		1		1, 20	7
W-13-M-65	13″	Core: solid clay or shale brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	160 psi	12 hrs.		1		1, 44	12
W-13-M-66	13″	Core: solid clay or shale brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	15 hrs.		1		1, 20	15
W-13-M-67	13″	Core: solid clay or shale brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	15 hrs.		1		1	15
W-13-M-68	13″	Core: hollow Rolok of clay or shale; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	80 psi	7 hrs.		1		1, 20	7
W-13-M-69	13″	Core: concrete brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	160 psi	16 hrs.		1		1, 44	16
W-13-M-70	13″	Core: sand-lime brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	160 psi	12 hrs.		1		1, 44	12
W-13-M-71	13″	Core: sand-lime brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	17 hrs.		1		1	17
W-13-M-72	13″	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids: 70; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	120 psi	7 hrs.		1		1, 45	7
W-13-M-73	13″	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	160 psi	12 hrs.		1		1, 44	12
W-13-M-74	13″	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 2; Minimum % solids: 87; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	14 hrs.		1		1	14

(Continued)

**TABLE 1.1.6—MASONRY WALLS
12″ TO LESS THAN 14″ THICK—continued**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-13-M-75	13″	Cored concrete masonry; see Notes 18, 23, 28, 39, 41; No facings.	80 psi	7 hrs.		1		1, 20	7
W-13-M-76	13″	Cored concrete masonry; see Notes 19, 23, 28, 39, 41; No facings.	80 psi	4 hrs.		1		1, 20	4
W-13-M-77	13″	Cored concrete masonry; see Notes 3, 18, 27, 31, 43; Facings: both sides; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-13-M-78	13″	Cored concrete masonry; see Notes 2, 18, 26, 31, 41; Facings: both sides; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-13-M-79	13″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; Facings: both sides of wall; see Note 38.	80 psi	7 hrs.		1		1, 20	7
W-13-M-80	$13^1/_4$″	Core: clay or shale structural tile; see Notes 2, 6, 9, 18; Facings: both sides; see Note 17.	80 psi	4 hrs.		1		1, 20	4
W-13-M-81	$13^1/_4$″	Core: clay or shale structural tile; see Notes 2, 6, 14, 19; Facings: both sides; see Note 17.	80 psi	4 hrs.		1		1, 20	4
W-13-M-82	$13^1/_4$″	Core: clay or shale structural tile; see Notes 2, 4, 13, 18; Facings: both sides; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-13-M-83	$13^1/_4$″	Core: clay or shale structural tile; see Notes 3, 6, 9, 18; Facings: both sides; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-13-M-84	$13^1/_4$″	Core: clay or shale structural tile; see Notes 3, 6, 14, 18; Facings: both sides; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-13-M-85	$13^1/_4$″	Core: clay or shale structural tile; see Notes 3, 6, 16, 18; Facings: both sides; see Note 17.	80 psi	7 hrs.		1		1, 20	7
W-13-M-86	$13^1/_2$″	Cored concrete masonry; see Notes 18, 23, 28, 39, 41; Facings: one side only; see Note 38.	80 psi	8 hrs.		1		1, 20	8

(Continued)

TABLE 1.1.6—MASONRY WALLS
12″ TO LESS THAN 14″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-13-M-87	$13^1/_2$″	Cored concrete masonry; see Notes 19, 23, 28, 39, 41; Facings: fire side only; see Note 38.	80 psi	5 hrs.		1		1, 20	5

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS - ASA Spec. No. A2-1934.
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than $^5/_8$ inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross area.
21. Portland cement-lime mortar.
22. Failure mode-thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52%.
30. Minimum percent of solid material in concrete units = 54%.
31. Minimum percent of solid material in concrete units = 55%.
32. Minimum percent of solid material in concrete units = 57%.
33. Minimum percent of solid material in concrete units = 60%.
34. Minimum percent of solid material in concrete units = 62%.
35. Minimum percent of solid material in concrete units = 65%.
36. Minimum percent of solid material in concrete units = 70%.
37. Minimum percent of solid material in concrete units = 76%.
38. Not less than $^1/_2$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
43. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
44. Load: 160 psi of gross wall cross sectional area.
45. Load: 120 psi of gross wall cross sectional area.

**FIGURE 1.1.7—MASONRY WALLS
14″ OR MORE THICK**

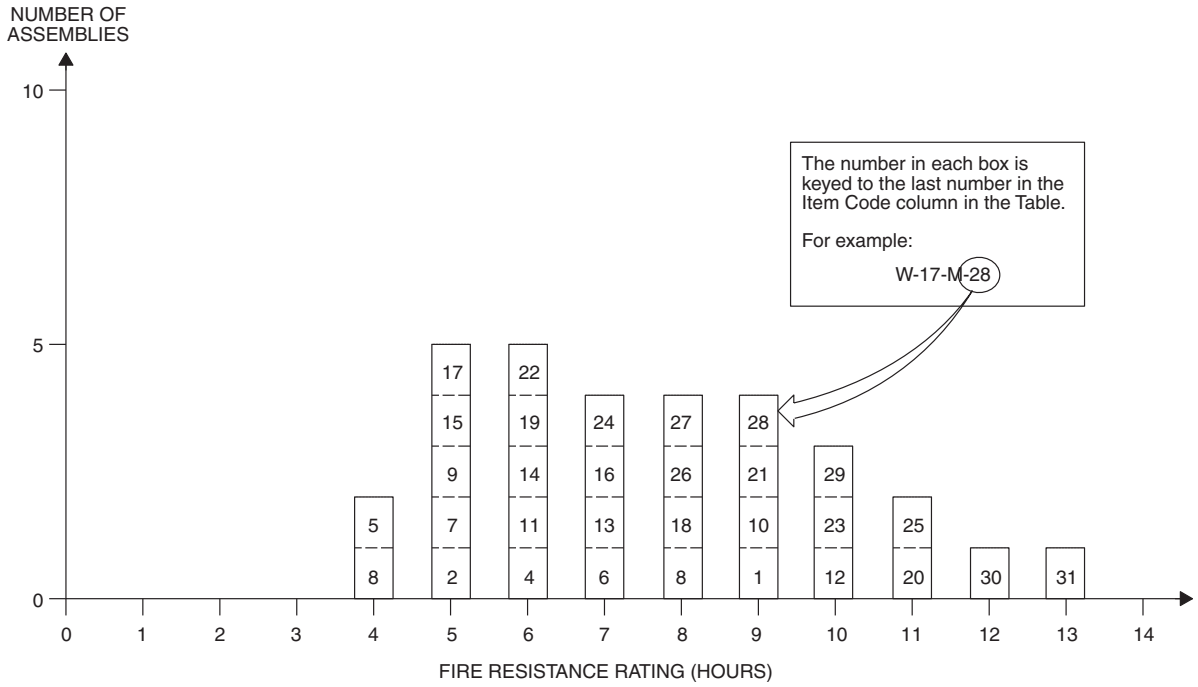


**TABLE 1.1.7—MASONRY WALLS
14″ OR MORE THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-14-M-1	14″	Core: cored masonry; see Notes 18, 28, 33, 39, 41; Facings: both sides; see Note 38.	80 psi	9 hrs.		1		1, 20	9
W-16-M-2	16″	Core: clay or shale structural tile; see Notes 4, 7, 9, 19; No facings.	80 psi	5 hrs.		1		1, 20	5
W-16-M-3	16″	Core: clay or shale structural tile; see Notes 4, 7, 9, 19; No facings.	80 psi	4 hrs.		1		1, 20	4
W-16-M-4	16″	Core: clay or shale structural tile; see Notes 4, 7, 10, 18; No facings.	80 psi	6 hrs.		1		1, 20	6
W-16-M-5	16″	Core: clay or shale structural tile; see Notes 4, 7, 10, 19; No facings.	80 psi	4 hrs.		1		1, 20	4
W-16-M-6	16″	Core: clay or shale structural tile; see Notes 4, 7, 11, 18; No facings.	80 psi	7 hrs.		1		1, 20	7
W-16-M-7	16″	Core: clay or shale structural tile; see Notes 4, 7, 11, 19; No facings.	80 psi	5 hrs.		1		1, 20	5
W-16-M-8	16″	Core: clay or shale structural tile; see Notes 4, 8, 13, 18; No facings.	80 psi	8 hrs.		1		1, 20	8
W-16-M-9	16″	Core: clay or shale structural tile; see Notes 4, 8, 13, 19; No facings.	80 psi	5 hrs.		1		1, 20	5
W-16-M-10	16″	Core: clay or shale structural tile; see Notes 4, 8, 15, 18; No facings.	80 psi	9 hrs.		1		1, 20	9
W-16-M-11	16″	Core: clay or shale structural tile; see Notes 3, 7, 14, 18; No facings.	80 psi	6 hrs.		1		1, 20	6

(Continued)

**TABLE 1.1.7—MASONRY WALLS
14″ OR MORE THICK—continued**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-16-M-12	16″	Core: clay or shale structural tile; see Notes 4, 8, 16, 18; No facings.	80 psi	10 hrs.		1		1, 20	10
W-16-M-13	16″	Core: clay or shale structural tile; see Notes 4, 6, 16, 19; No facings.	80 psi	7 hrs.		1		1, 20	7
W-16-M-14	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 9, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	6 hrs.		1		1, 20	6
W-16-M-15	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 9, 19; Facings: fire side only; see Note 17.	80 psi	5 hrs.		1		1, 20	5
W-16-M-16	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 10, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	7 hrs.		1		1, 20	7
W-16-M-17	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 10, 19; Facings: fire side only; see Note 17.	80 psi	5 hrs.		1		1, 20	5
W-16-M-18	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 11, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	5 hrs.		1		1, 20	8
W-16-M-19	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 11, 19; Facings: fire side only; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-16-M-20	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 13, 18; Facings: sides 1 and 2; see Note 17.	80 psi	11 hrs.		1		1, 20	11
W-16-M-21	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 13 18; Facings: side 1, see Note 17; side 2, none.	80 psi	9 hrs.		1		1, 20	9
W-16-M-22	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 13, 19; Facings: fire side only; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-16-M-23	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 15, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	10 hrs.		1		1, 20	10
W-16-M-24	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 15, 19; Facings: fire side only; see Note 17.	80 psi	7 hrs.		1		1, 20	7
W-16-M-25	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 6, 16, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	11 hrs.		1		1, 20	11
W-16-M-26	$16\frac{5}{8}$″	Core: clay or shale structural tile; see Notes 4, 6, 16, 19; Facings: fire side only; see Note 17.	80 psi	8 hrs.		1		1, 20	8
W-17-M-27	$17\frac{1}{4}$″	Core: clay or shale structural tile; see Notes 4, 7, 9, 18; Facings: sides 1 and 2; see Note 17.	80 psi	8 hrs.		1		1, 20	8
W-17-M-28	$17\frac{1}{4}$″	Core: clay or shale structural tile; see Notes 4, 7, 10, 18; Facings: sides 1 and 2; see Note 17.	80 psi	9 hrs.		1		1, 20	9

(Continued)

TABLE 1.1.7—MASONRY WALLS
14″ OR MORE THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-17-M-29	$17^{1}/_{4}$″	Core: clay or shale structural tile; see Notes 4, 7, 11, 18; Facings: sides 1 and 2; see Note 17.	80 psi	10 hrs.		1		1, 20	10
W-17-M-30	$17^{1}/_{4}$″	Core: clay or shale structural tile; see Notes 4, 8, 15, 18; Facings: sides 1 and 2; see Note 17.	80 psi	12 hrs.		1		1, 20	12
W-17-M-31	$17^{1}/_{4}$″	Core: clay or shale structural tile; see Notes 4, 6, 16, 18; Facings: sides 1 and 2; see Note 17.	80 psi	13 hrs.		1		1, 20	13

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS - ASA Spec. No. A2-1934.
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than $^{5}/_{8}$ inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross area.
21. Portland cement-lime mortar.
22. Failure mode - thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52%.
30. Minimum percent of solid material in concrete units = 54%.
31. Minimum percent of solid material in concrete units = 55%.
32. Minimum percent of solid material in concrete units = 57%.
33. Minimum percent of solid material in concrete units = 60%.
34. Minimum percent of solid material in concrete units = 62%.
35. Minimum percent of solid material in concrete units = 65%.
36. Minimum percent of solid material in concrete units = 70%.
37. Minimum percent of solid material in concrete units = 76%.
38. Not less than $^{1}/_{2}$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
43. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert or flint.

**FIGURE 1.2.1—METAL FRAME WALLS
0″ TO LESS THAN 4″ THICK**

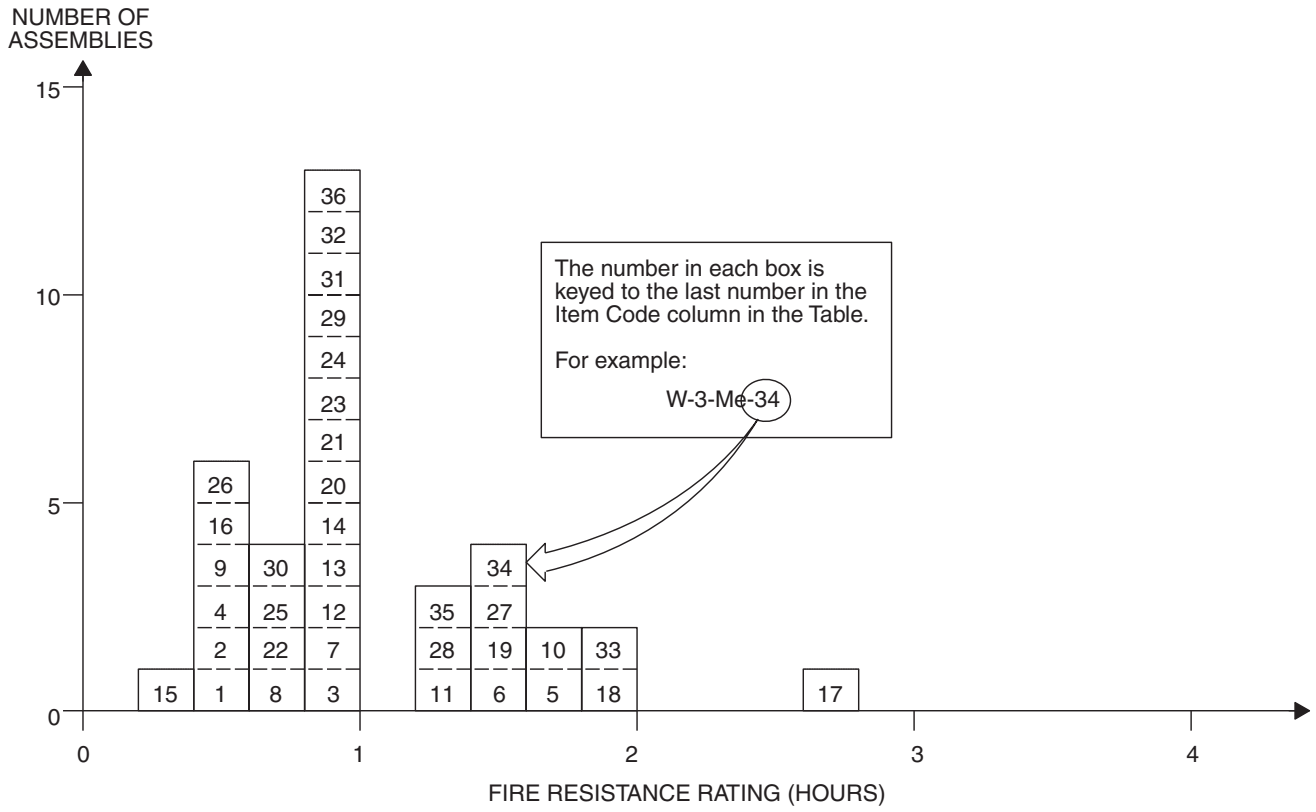


**TABLE 1.2.1—METAL FRAME WALLS
0″ TO LESS THAN 4″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-Me-1	3″	Core: steel channels having three rows of 4″ × 1/8″ staggered slots in web; core filled with heat expanded vermiculite weighing 1.5 lbs./ft.^{2} of wall area; Facings: sides 1 and 2, 18 gage steel, spot welded to core.	N/A	25 min.		1			1/3
W-3-Me-2	3″	Core: steel channels having three rows of 4″ × 1/8″ staggered slots in web; core filled with heat expanded vermiculite weighing 2 lbs./ft.^{2} of wall area; Facings: sides 1 and 2, 18 gage steel, spot welded to core.	N/A	30 min.		1			1/2
W-3-Me-3	2 1/2″	Solid partition: 3/8″ tension rods (vertical) 3′ o.c. with metal lath; Scratch coat: cement/sand/lime plaster; Float coats: cement/sand/lime plaster; Finish coats: neat gypsum plaster.	N/A	1 hr.			7	1	1
W-2-Me-4	2″	Solid wall: steel channel per Note 1; 2″ thickness of 1:2; 1:3 portland cement on metal lath.	N/A	30 min.		1			1/2

(Continued)

**TABLE 1.2.1—METAL FRAME WALLS
0″ TO LESS THAN 4″ THICK—continued**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-2-Me-5	2″	Solid wall: steel channel per Note 1; 2″ thickness of neat gypsum plaster on metal lath.	N/A	1 hr. 45 min.		1			1 3/4
W-2-Me-6	2″	Solid wall: steel channel per Note 1; 2″ thickness of 1:1 1/2; 1:1 1/2 gypsum plaster on metal lath.	N/A	1 hr. 30 min.		1			1 1/2
W-2-Me-7	2″	Solid wall: steel channel per Note 2; 2″ thickness of 1:1; 1:1 gypsum plaster on metal lath.	N/A	1 hr.		1			1
W-2-Me-8	2″	Solid wall: steel channel per Note 1; 2″ thickness of 1:2; 1:2 gypsum plaster on metal lath.	N/A	45 min.		1			3/4
W-2-Me-9	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″ thickness of 1:2; 1:3 portland cement on metal lath.	N/A	30 min.		1			1/2
W-2-Me-10	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″ thickness of neat gypsum plaster on metal lath.	N/A	2 hrs.		1			2
W-2-Me-11	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″ thickness of 1:1/2; 1:1/2 gypsum plaster on metal lath.	N/A	1 hr. 45 min.		1			1 3/4
W-2-Me-12	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″ thickness of 1:1; 1:1 gypsum plaster on metal lath.	N/A	1 hr. 15 min.		1			1 1/4
W-2-Me-13	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″ thickness of 1:2; 1:2 gypsum plaster on metal lath.	N/A	1 hr.		1			1
W-2-Me-14	2 1/2″	Solid wall: steel channel per Note 1; 2 1/2″ thickness of 4.5:1:7; 4.5:1:7 portland cement, sawdust and sand sprayed on wire mesh; see Note 3.	N/A	1 hr.		1			1
W-2-Me-15	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:4; 1:4 portland cement sprayed on wire mesh; see Note 3.	N/A	20 min.		1			1/3
W-2-Me-16	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:2; 1:3 portland cement on metal lath.	N/A	30 min.		1			1/2
W-2-Me-17	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of neat gypsum plaster on metal lath.	N/A	2 hrs. 30 min.		1			2 1/2
W-2-Me-18	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:1/2; 1:1/2 gypsum plaster on metal lath.	N/A	2 hrs.		1			2
W-2-Me-19	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:1; 1:1 gypsum plaster on metal lath.	N/A	1 hr. 30 min.		1			1 1/2
W-2-Me-20	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:2; 1:2 gypsum plaster on metal lath.	N/A	1 hr.		1			1

(Continued)

**TABLE 1.2.1—METAL FRAME WALLS
0″ TO LESS THAN 4″ THICK—continued**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-2-Me-21	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:2; 1:3 gypsum plaster on metal lath.	N/A	1 hr.		1			1
W-3-Me-22	3″	Core: steel channel per Note 2; 1:2; 1:2 gypsum plaster on 3/4″ soft asbestos lath; plaster thickness 2″.	N/A	45 min.		1			3/4
W-3-Me-23	3 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:2; 1:2 gypsum plaster on 3/4″ asbestos lath.	N/A	1 hr.		1			1
W-3-Me-24	3 1/2″	Solid wall: steel channel per Note 2; lath over and 1:2 1/2; 1:2 1/2 gypsum plaster on 1″ magnesium oxysulfate wood fiberboard; plaster thickness 2 1/2″.	N/A	1 hr.		1			1
W-3-Me-25	3 1/2″	Core: steel studs; see Note 4; Facings: 3/4″ thickness of 1:1/30:2; 1:1/30:3 portland cement and asbestos fiber plaster.	N/A	45 min.		1			3/4
W-3-Me-26	3 1/2″	Core: steel studs; see Note 4; Facings: both sides 3/4″ thickness of 1:2; 1:3 portland cement.	N/A	30 min.		1			1/2
W-3-Me-27	3 1/2″	Core: steel studs; see Note 4; Facings: both sides 3/4″ thickness of neat gypsum plaster.	N/A	1 hr. 30 min.		1			1 1/2
W-3-Me-28	3 1/2″	Core: steel studs; see Note 4; Facings: both sides 3/4″ thickness of 1:1/2; 1:1/2 gypsum plaster.	N/A	1 hr. 15 min.		1			1 1/4
W-3-Me-29	3 1/2″	Core: steel studs; see Note 4; Facings: both sides 3/4″ thickness of 1:2; 1:2 gypsum plaster.	N/A	1 hr.		1			1
W-3-Me-30	3 1/2″	Core: steel studs; see Note 4; Facings: both sides 3/4″ thickness of 1:2; 1:3 gypsum plaster.	N/A	45 min.		1			3/4
W-3-Me-31	3 3/4″	Core: steel studs; see Note 4; Facings: both sides 7/8″ thickness of 1:1/30:2; 1:1/30: 3 portland cement and asbestos fiber plaster.	N/A	1 hr.		1			1
W-3-Me-32	3 3/4″	Core: steel studs; see Note 4; Facings: both sides 7/8″ thickness of 1:2; 1:3 portland cement.	N/A	45 min.		1			3/4
W-3-Me-33	3 3/4″	Core: steel studs; see Note 4; Facings: both sides 7/8″ thickness of neat gypsum plaster.	N/A	2 hrs.		1			2
W-3-Me-34	3 3/4″	Core: steel studs; see Note 4; Facings: both sides 7/8″ thickness of 1:1/2; 1:1/2 gypsum plaster.	N/A	1 hr. 30 min.		1			1 1/2
W-3-Me-35	3 3/4″	Core: steel studs; see Note 4; Facings: both sides 7/8″ thickness of 1:2; 1:2 gypsum plaster.	N/A	1 hr. 15 min.		1			1 1/4

(Continued)

**TABLE 1.2.1—METAL FRAME WALLS
0″ TO LESS THAN 4″ THICK—continued**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-Me-36	$3\frac{3}{4}$″	Core: steel; see Note 4; Facings: $\frac{7}{8}$″ thickness of 1:2; 1:3 gypsum plaster on both sides.	N/A	1 hr.		1			1

For SI: 1 inch = 25.4 mm.

Notes:

1. Failure mode - local temperature rise - back face.
2. Three-fourths inch or 1 inch channel framing - hot-rolled or strip-steel channels.
3. Reinforcement is 4-inch square mesh of No. 6 wire welded at intersections (no channels).
4. Ratings are for any usual type of nonload-bearing metal framing providing 2 inches (or more) air space.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gauge of steel studs was provided when known. The cross-sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gauge of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

**FIGURE 1.2.2—METAL FRAME WALLS
4″ TO LESS THAN 6″ THICK**

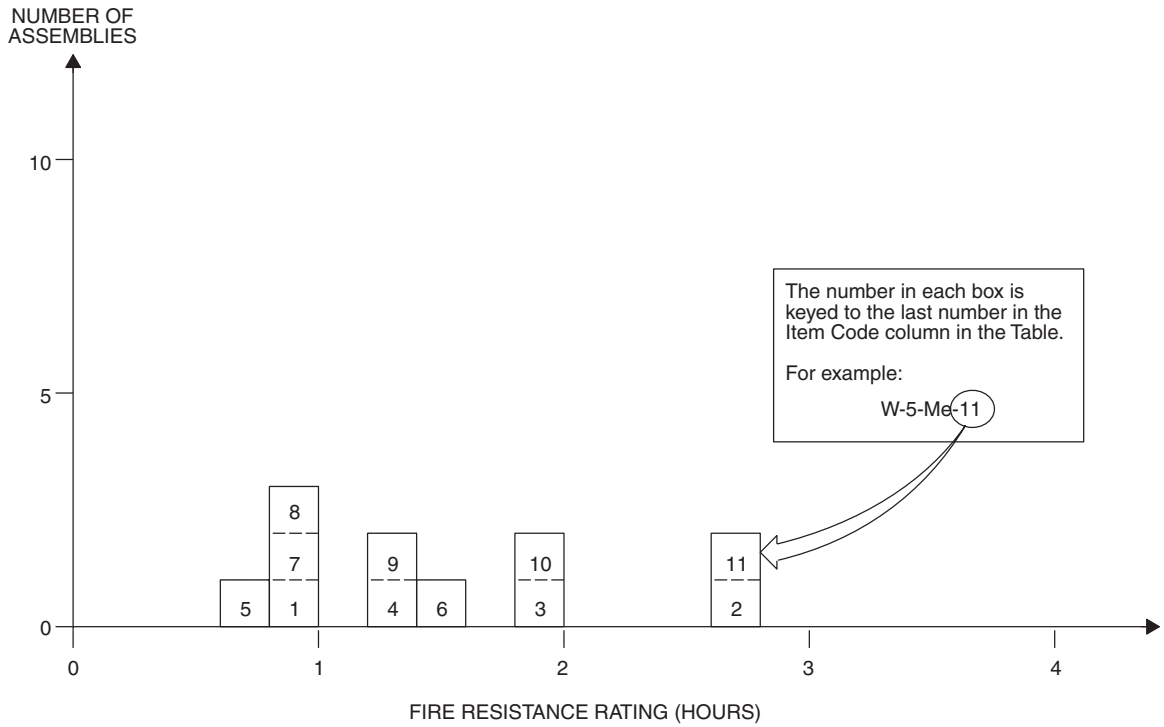


**TABLE 1.2.2—METAL FRAME WALLS
4″ TO LESS THAN 6″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-Me-1	$5^1/_2$″	3″ cavity with 16 ga. channel studs ($3^1/_2$″ o.c.) of $^1/_2$″ × $^1/_2$″ channel and 3″ spacer; Metal lath on ribs with plaster (three coats) $^3/_4$″ over face of lath; Plaster (each side): scratch coat, cement/lime/sand with hair; float coat, cement/lime/sand; finish coat, neat gypsum.	N/A	1 hr. 11 min.			7	1	1
W-4-Me-2	4″	Core: steel studs; see Note 2; Facings: both sides 1″ thickness of neat gypsum plaster.	N/A	2 hrs. 30 min.		1			$2^1/_2$
W-4-Me-3	4″	Core: steel studs; see Note 2; Facings: both sides 1″ thickness of 1:$^1/_2$; 1:$^1/_2$ gypsum plaster.	N/A	2 hrs.		1			2
W-4-Me-4	4″	Core: steel; see Note 2; Facings: both sides 1″ thickness of 1:2; 1:3 gypsum plaster.	N/A	1 hr. 15 min.		1			$1^1/_4$
W-4-Me-5	$4^1/_2$″	Core: lightweight steel studs 3″ in depth; Facings: both sides $^3/_4$″ thick sanded gypsum plaster, 1:2 scratch coat, 1:3 brown coat applied on metal lath.	See Note 4	45 min.		1		5	$^3/_4$
W-4-Me-6	$4^1/_2$″	Core: lightweight steel studs 3″ in depth; Facings: both sides $^3/_4$″ thick neat gypsum plaster on metal lath.	See Note 4	1 hr. 30 min.		1		5	$1^1/_2$

(Continued)

**TABLE 1.2.2—METAL FRAME WALLS
4″ TO LESS THAN 6″ THICK—continued**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-Me-7	$4^1/_2$″	Core: lightweight steel studs 3″ in depth; Facings: both sides $^3/_4$″ thick sanded gypsum plaster, 1:2 scratch and brown coats applied on metal lath.	See Note 4	1 hr.		1		5	1
W-4-Me-8	$4^3/_4$″	Core: lightweight steel studs 3″ in depth; Facings: both sides $^7/_8$″ thick sanded gypsum plaster, 1:2 scratch coat, 1:3 brown coat, applied on metal lath.	See Note 4	1 hr.		1		5	1
W-4-Me-9	$4^3/_4$″	Core: lightweight steel studs 3″ in depth; Facings: both sides $^7/_8$″ thick sanded gypsum plaster, 1:2 scratch and 1:3 brown coats applied on metal lath.	See Note 4	1 hr. 15 min.		1		5	$1^1/_4$
W-5-Me-10	5″	Core: lightweight steel studs 3″ in depth; Facings: both sides 1″ thick neat gypsum plaster on metal lath.	See Note 4	2 hrs.		1		5	2
W-5-Me-11	5″	Core: lightweight steel studs 3″ in depth; Facings: both sides 1" thick neat gypsum plaster on metal lath.	See Note 4	2 hrs. 30 min.		1		5, 6	$2^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Failure mode - local back face temperature rise.
2. Ratings are for any usual type of non-bearing metal framing providing a minimum 2 inches air space.
3. Facing materials secured to lightweight steel studs not less than 3 inches deep.
4. Rating based on loading to develop a maximum stress of 7270 psi for net area of each stud.
5. Spacing of steel studs must be sufficient to develop adequate rigidity in the metal-lath or gypsum-plaster base.
6. As per Note 4 but load/stud not to exceed 5120 psi.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gauge of steel studs was provided when known. The cross sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table “Notes.” More often, it is the thermal properties of the facing materials, rather than the specific gauge of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

TABLE 1.2.3—METAL FRAME WALLS
6″ TO LESS THAN 8″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-Me-1	$6^{5}/_{8}$″	On one side of 1″ magnesium oxysulfate wood fiberboard sheathing attached to steel studs (see Notes 1 and 2), 1″ air space, $3^{3}/_{4}$″ brick secured with metal ties to steel frame every fifth course; Inside facing of $^{7}/_{8}$″ 1:2 sanded gypsum plaster on metal lath secured directly to studs; Plaster side exposed to fire.	See Note 2	1 hr. 45 min.		1		1	$1^{3}/_{4}$
W-6-Me-2	$6^{5}/_{8}$″	On one side of 1″ magnesium oxysulfate wood fiberboard sheathing attached to steel studs (see Notes 1 and 2), 1″ air space, $3^{3}/_{4}$″ brick secured with metal ties to steel frame every fifth course; Inside facing of $^{7}/_{8}$″ 1:2 sanded gypsum plaster on metal lath secured directly to studs; Brick face exposed to fire.	See Note 2	4 hrs.		1		1	4
W-6-Me-3	$6^{5}/_{8}$″	On one side of 1″ magnesium oxysulfate wood fiberboard sheathing attached to steel studs (see Notes 1 and 2), 1″ air space, $3^{3}/_{4}$″ brick secured with metal ties to steel frame every fifth course; Inside facing of $^{7}/_{8}$″ vermiculite plaster on metal lath secured directly to studs; Plaster side exposed to fire.	See Note 2	2 hrs.		1		1	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Lightweight steel studs (minimum 3 inches deep) used. Stud spacing dependent on loading, but in each case, spacing is to be such that adequate rigidity is provided to the metal lath plaster base.
2. Load is such that stress developed in studs is not greater than 5120 psi calculated from net stud area.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gauge of steel studs was provided when known. The cross sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gauge of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

**TABLE 1.2.4—METAL FRAME WALLS
8″ TO LESS THAN 10″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-9-Me-1	$9^1/_{16}$″	On one side of $^1/_2$″ wood fiberboard sheathing next to studs, $^3/_4$″ air space formed with $^3/_4$″ × $1^5/_8$″ wood strips placed over the fiberboard and secured to the studs, paper backed wire lath nailed to strips $3^3/_4$″ brick veneer held in place by filling a $^3/_4$″ space between the brick and paper backed lath with mortar; Inside facing of $^3/_4$″ neat gypsum plaster on metal lath attached to $^5/_{16}$″ plywood strips secured to edges of steel studs; Rated as combustible because of the sheathing; See Notes 1 and 2; Plaster exposed.	See Note 2	1 hr. 45 min.		1		1	$1^3/_4$
W-9-Me-2	$9^1/_{16}$″	Same as above with brick exposed.	See Note 2	4 hrs.		1		1	4
W-8-Me-3	$8^1/_2$″	On one side of paper backed wire lath attached to studs and $3^3/_4$″ brick veneer held in place by filling a 1″ space between the brick and lath with mortar; Inside facing of 1″ paper-enclosed mineral wool blanket weighing .6 lb./ft.^{2} attached to studs, metal lath or paper backed wire lath laid over the blanket and attached to the studs, $^3/_4$″ sanded gypsum plaster 1:2 for the scratch coat and 1:3 for the brown coat; See Notes 1 and 2; Plaster face exposed.	See Note 2	4 hrs.		1		1	4
W-8-Me-4	$8^1/_2$″	Same as above with brick exposed.	See Note 2	5 hrs.		1		1	5

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Lightweight steel studs ≥ 3 inches in depth. Stud spacing dependent on loading, but in any case, the spacing is to be such that adequate rigidity is provided to the metal-lath plaster base.
2. Load is such that stress developed in studs is ≤ 5120 psi calculated from the net area of the stud.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gauge of steel studs was provided when known. The cross sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gauge of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

TABLE 1.3.1—WOOD FRAME WALLS
0″ TO LESS THAN 4″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-W-1	$3\frac{3}{4}$″	Solid wall: $2\frac{1}{4}$″ wood-wool slab core; $\frac{3}{4}$″ gypsum plaster each side.	N/A	2 hrs.			7	1, 6	2
W-3-W-2	$3\frac{7}{8}$″	2 × 4 stud wall; $\frac{3}{16}$″ thick cement asbestos board on both sides of wall.	360 psi net area	10 min.		1		2-5	$\frac{1}{6}$
W-3-W-3	$3\frac{7}{8}$″	Same as W-3-W-2 but stud cavities filled with 1 lb./ft.^{2} mineral wool batts.	360 psi net area	40 min.		1		2-5	$\frac{2}{3}$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Achieved “Grade C” fire resistance (British).
2. Nominal 2′4 wood studs of No. 1 common or better lumber set edgewise, 2′4 plates at top and bottom and blocking at mid height of wall.
3. All horizontal joints in facing material backed by 2′4 blocking in wall.
4. Load: 360 psi of net stud cross sectional area.
5. Facings secured with 6d casing nails. Nail holes predrilled and 0.02 inch to 0.03 inch smaller than nail diameter.
6. The wood-wool core is a pressed excelsior slab which possesses insulating properties similar to cellulosic insulation.

**FIGURE 1.3.2—WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK**

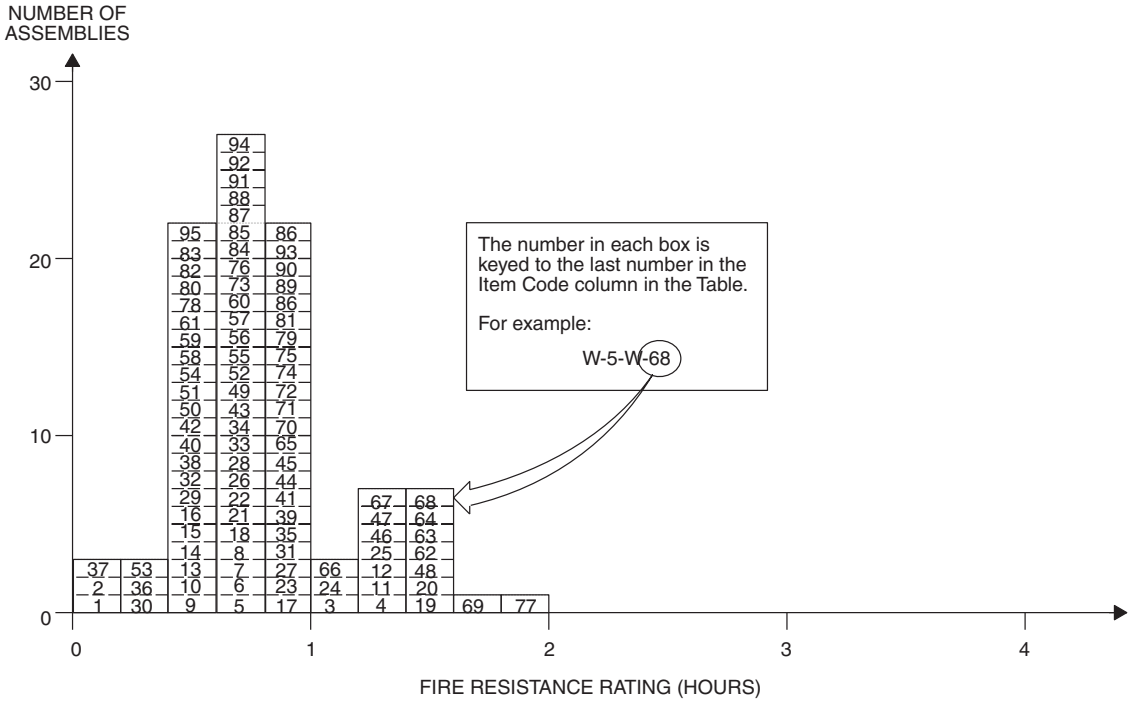


**TABLE 1.3.2—WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-W-1	4″	2″ × 4″ stud wall; $^3/_{16}$″ CAB; no insulation; Design A.	35 min.	10 min.			4	1-10	$^1/_6$
W-4-W-2	$4^1/_8$″	2″ × 4″ stud wall; $^3/_{16}$″ CAB; no insulation; Design A.	38 min.	9 min.			4	1-10	$^1/_6$
W-4-W-3	$4^3/_4$″	2″ × 4″ stud wall; $^3/_{16}$″ CAB and $^3/_8$″ gypsum board face (both sides); Design B.	62 min.	64 min.			4	1-10	1
W-5-W-4	5″	2″ × 4″ stud wall; $^3/_{16}$″ CAB and $^1/_2$″ gypsum board (both sides); Design B.	79 min.	Greater than 90 min.			4	1-10	1
W-4-W-5	$4^3/_4$″	2″ × 4″ stud wall; $^3/_{16}$″ CAB and $^3/_8$″ gypsum board (both sides); Design B.	45 min.	45 min.			4	1-12	—
W-5-W-6	5″	2″ × 4″ stud wall; $^3/_{16}$″ CAB and $^1/_2$″ gypsum board face (both sides); Design B.	45 min.	45 min.			4	1-10, 12, 13	—
W-4-W-7	4″	2″ × 4″ stud wall; $^3/_{16}$″ CAB face; $3^1/_2$″ mineral wool insulation; Design C.	40 min.	42 min.			4	1-10	$^2/_3$
W-4-W-8	4″	2″ × 4″ stud wall; $^3/_{16}$″ CAB face; $3^1/_2$″ mineral wool insulation; Design C.	46 min.	46 min.			4	1-10, 43	$^2/_3$
W-4-W-9	4″	2″ × 4″ stud wall; $^3/_{16}$″ CAB face; $3^1/_2$″ mineral wool insulation; Design C.	30 min.	30 min.			4	1-10, 12, 14	—

(Continued)

TABLE 1.3.2—WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-W-10	$4^{1}/_{8}$″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB face; $3^{1}/_{2}$″ mineral wool insulation; Design C.	—	30 min.			4	1-8, 12, 14	—
W-4-W-11	$4^{3}/_{4}$″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB face; $^{3}/_{8}$″ gypsum strips over studs; $5^{1}/_{2}$″ mineral wool insulation; Design D.	79 min.	79 min.			4	1-10	1
W-4-W-12	$4^{3}/_{4}$″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB face; $^{3}/_{8}$″ gypsum strips at stud edges; $7^{1}/_{2}$″ mineral wool insulation; Design D.	82 min.	82 min.			4	1-10	1
W-4-W-13	$4^{3}/_{4}$″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB face; $^{3}/_{8}$″ gypsum board strips over studs; $5^{1}/_{2}$″ mineral wool insulation; Design D.	30 min.	30 min.			4	1-12	—
W-4-W-14	$4^{3}/_{4}$″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB face; $^{3}/_{8}$″ gypsum board strips over studs; 7″ mineral wool insulation; Design D.	30 min.	30 min.			4	1-12	—
W-5-W-15	$5^{1}/_{2}$″	2″ × 4″ stud wall; Exposed face: CAB shingles over 1″ × 6″; Unexposed face: $^{1}/_{8}$″ CAB sheet; $^{7}/_{16}$″ fiberboard (wood); Design E.	34 min.	—			4	1-10	$^{1}/_{2}$
W-5-W-16	$5^{1}/_{2}$″	2″ × 4″ stud wall; Exposed face: $^{1}/_{8}$″ CAB sheet; $^{7}/_{16}$″ fiberboard; Unexposed face: CAB shingles over 1″ × 6″; Design E.	32 min.	33 min.			4	1-10	$^{1}/_{2}$
W-5-W-17	$5^{1}/_{2}$″	2″ × 4″ stud wall; Exposed face: CAB shingles over 1″ × 6″; Unexposed face: $^{1}/_{8}$″ CAB sheet; gypsum at stud edges; $3^{1}/_{2}$″ mineral wood insulation; Design F.	51 min.	—			4	1-10	$^{3}/_{4}$
W-5-W-18	$5^{1}/_{2}$″	2″ × 4″ stud wall; Exposed face: $^{1}/_{8}$″ CAB sheet; gypsum board at stud edges; Unexposed face: CAB shingles over 1″ × 6″; $3^{1}/_{2}$″ mineral wool insulation; Design F.	42 min.	—			4	1-10	$^{2}/_{3}$
W-5-W-19	$5^{5}/_{8}$″	2″ × 4″ stud wall; Exposed face: CAB shingles over 1″ × 6″; Unexposed face: $^{1}/_{8}$″ CAB sheet; gypsum board at stud edges; $5^{1}/_{2}$″ mineral wool insulation; Design G.	74 min.	85 min.			4	1-10	1
W-5-W-20	$5^{5}/_{8}$″	2″ × 4″ stud wall; Exposed face: $^{1}/_{8}$″ CAB sheet; gypsum board at $^{3}/_{16}$″ stud edges; $^{7}/_{16}$″ fiberboard; Unexposed face: CAB shingles over 1″ × 6″; $5^{1}/_{2}$″ mineral wool insulation; Design G.	79 min.	85 min.			4	1-10	$1^{1}/_{4}$
W-5-W-21	$5^{5}/_{8}$″	2″ × 4″ stud wall; Exposed face: CAB shingles 1″ × 6″ sheathing; Unexposed face: CAB sheet; gypsum board at stud edges; $5^{1}/_{2}$″ mineral wool insulation; Design G.	38 min.	38 min.			4	1-10, 12, 14	—

(Continued)

TABLE 1.3.2—WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-22	$5^5/_8$″	2″ × 4″ stud wall; Exposed face: CAB sheet; gypsum board at stud edges; Unexposed face: CAB shingles 1″ × 6″ sheathing; $5^1/_2$″ mineral wool insulation; Design G.	38 min.	38 min.			4	1-12	—
W-6-W-23	6″	2″ × 4″ stud wall; 16″ o.c.; $^1/_2$″ gypsum board each side; $^1/_2$″ gypsum plaster each side.	N/A	60 min.			7	15	1
W-6-W-24	6″	2″ × 4″ stud wall; 16″ o.c.; $^1/_2$″ gypsum board each side; $^1/_2$″ gypsum plaster each side.	N/A	68 min.			7	16	1
W-6-W-25	$6^7/_8$″	2″ × 4″ stud wall; 18″ o.c.; $^3/_4$″ gypsum plank each side; $^3/_{16}$″ gypsum plaster each side.	N/A	80 min.			7	15	$1^1/_3$
W-5-W-26	$5^1/_8$″	2″ × 4″ stud wall; 16″ o.c.; $^3/_8$″ gypsum board each side; $^3/_{16}$″ gypsum plaster each side.	N/A	37 min.			7	15	$^1/_2$
W-5-W-27	$5^3/_4$″	2″ × 4″ stud wall; 16″ o.c.; $^3/_8$″ gypsum lath each side; $^1/_2$″ gypsum plaster each side.	N/A	52 min.			7	15	$^3/_4$
W-5-W-28	5″	2″ × 4″ stud wall; 16″ o.c.; $^1/_2$″ gypsum board each side.	N/A	37 min.			7	16	$^1/_2$
W-5-W-29	5″	2″ × 4″ stud wall; $^1/_2$″ fiberboard both sides 14% M.C. with F.R. paint at 35 gm./ft.^{2}.	N/A	28 min.			7	15	$^1/_3$
W-4-W-30	$4^3/_4$″	2″ × 4″ stud wall; Fire side: $^1/_2$″ (wood) fiberboard; Back side: $^1/_4$″ CAB; 16" o.c.	N/A	17 min.			7	15, 16	$^1/_4$
W-5-W-31	$5^1/_8$″	2″ × 4″ stud wall; 16″ o.c.; $^1/_2$″ fiberboard insulation with $^1/_{32}$″ asbestos (both sides of each board).	N/A	50 min.			7	16	$^3/_4$
W-4-W-32	$4^1/_4$″	2″ × 4″ stud wall; $^3/_8$″ thick gypsum wallboard on both faces; insulated cavities.	See Note 23	25 min.		1		17, 18, 23	$^1/_3$
W-4-W-33	$4^1/_2$″	2″ × 4″ stud wall; $^1/_2$″ thick gypsum wallboard on both faces.	See Note 17	40 min.		1		17, 23	$^1/_3$
W-4-W-34	$4^1/_2$″	2″ × 4″ stud wall; $^1/_2$″ thick gypsum wallboard on both faces; insulated cavities.	See Note 17	45 min.		1		17, 18, 23	$^3/_4$
W-4-W-35	$4^1/_2$″	2″ × 4″ stud wall; $^1/_2$″ thick gypsum wallboard on both faces; insulated cavities.	N/A	1 hr.		1		17, 18, 24	1
W-4-W-36	$4^1/_2$″	2″ × 4″ stud wall; $^1/_2$″ thick, 1.1 lbs./ft.^{2} wood fiberboard sheathing on both faces.	See Note 23	15 min.		1		17, 23	$^1/_4$
W-4-W-37	$4^1/_2$″	2″ × 4″ stud wall; $^1/_2$″ thick, 0.7 lb./ft.^{2} wood fiberboard sheathing on both faces.	See Note 23	10 min.		1		17, 23	$^1/_6$
W-4-W-38	$4^1/_2$″	2″ × 4″ stud wall; $^1/_2$″ thick, flameproofed 1.6 lbs./ft.^{2} wood fiberboard sheathing on both faces.	See Note 23	30 min.		1		17, 23	$^1/_2$

(Continued)

TABLE 1.3.2—WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-W-39	4 1/2″	2″ × 4″ stud wall; 1/2″ thick gypsum wallboard on both faces; insulated cavities.	See Note 23	1 hr.		1		17, 18, 23	1
W-4-W-40	4 1/2″	2″ × 4″ stud wall; 1/2″ thick, 1:2; 1:3 gypsum plaster on wood lath on both faces.	See Note 23	30 min.		1		17, 21, 23	1/2
W-4-W-41	4 1/2″	2″ × 4″ stud wall; 1/2″, 1:2; 1:3 gypsum plaster on wood lath on both faces; insulated cavities.	See Note 23	1 hr.		1		17, 18, 21, 24	1
W-4-W-42	4 1/2″	2″ × 4″ stud wall; 1/2″, 1:5; 1:7.5 lime plaster on wood lath on both wall faces.	See Note 23	30 min.		1		17, 21, 23	1/2
W-4-W-43	4 1/2″	2″ × 4″ stud wall; 1/2″ thick 1:5; 1:7.5 lime plaster on wood lath on both faces; insulated cavities.	See Note 23	45 min.		1		17, 18, 21, 23	3/4
W-4-W-44	4 5/8″	2″ × 4″ stud wall; 3/16″ thick cement-asbestos over 3/8″ thick gypsum board on both faces.	See Note 23	1 hr.		1		23, 25, 26, 27	1
W-4-W-45	4 5/8″	2″ × 4″ stud wall; studs faced with 4″ wide strips of 3/8″ thick gypsum board; 3/16″ thick gypsum cement-asbestos board on both faces; insulated cavities.	See Note 23	1 hr.		1		23, 25, 27, 28	1
W-4-W-46	4 5/8″	Same as W-4-W-45 but nonload bearing.	N/A	1 hr. 15 min.		1		24, 28	1 1/4
W-4-W-47	4 7/8″	2″ × 4″ stud wall; 3/16″ thick cement-asbestos board over 1/2″ thick gypsum sheathing on both faces.	See Note 23	1 hr. 15 min.		1		23, 25, 26, 27	1 1/4
W-4-W-48	4 7/8″	Same as W-4-W-47 but nonload bearing.	N/A	1 hr. 30 min.		1		24, 27	1 1/2
W-5-W-49	5″	2″ × 4″ stud wall; Exterior face: 3/4″ wood sheathing; asbestos felt 14 lbs./100 ft.^{2} and 5/32″ cement-asbestos shingles; Interior face: 4″ wide strips of 3/8″ gypsum board over studs; wall faced with 3/16″ thick cement-asbestos board.	See Note 23	40 min.		1		18, 23, 25, 26, 29	2/3
W-5-W-50	5″	2″ × 4″ stud wall; Exterior face: as per W-5-W-49; Interior face: 9/16″ composite board consisting of 7/16″ thick wood fiberboard faced with 1/8″ thick cement-asbestos board; Exterior side exposed to fire.	See Note 23	30 min.		1		23, 25, 26, 30	1/2
W-5-W-51	5″	Same as W-5-W-50 but interior side exposed to fire.	See Note 23	30 min.		1		23, 25, 26	1/2
W-5-W-52	5″	Same as W-5-W-49 but exterior side exposed to fire.	See Note 23	45 min.		1		18, 23, 25, 26	3/4
W-5-W-53	5″	2″ × 4″ stud wall; 3/4″ thick T&G wood boards on both sides.	See Note 23	20 min.		1		17, 23	1/3

(Continued)

TABLE 1.3.2—WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-54	5″	Same as W-5-W-53 but with insulated cavities.	See Note 23	35 min.		1		17, 18, 23	1/2
W-5-W-55	5″	2″ × 4″ stud wall; 3/4″ thick T&G wood boards on both sides with 30 lbs./100 ft.^{2} asbestos; paper, between studs and boards.	See Note 23	45 min.		1		17, 23	3/4
W-5-W-56	5″	2″ × 4″ stud wall; 1/2″ thick, 1:2; 1:3 gypsum plaster on metal lath on both sides of wall.	See Note 23	45 min.		1		17, 21, 34	3/4
W-5-W-57	5″	2″ × 4″ stud wall; 3/4″ thick 2:1:8; 2:1:12 lime and Keene's cement plaster over metal lath on both sides of wall.	See Note 23	45 min.		1		17, 21, 23	1/2
W-5-W-58	5″	2″ × 4″ stud wall; 3/4″ thick 2:1:8; 2:1:10 lime portland cement plaster over metal lath on both sides of wall.	See Note 23	30 min.		1		17, 21, 23	1/2
W-5-W-59	5″	2″ × 4″ stud wall; 3/4″ thick 1:5; 1:7.5 lime plaster on metal lath on both sides of wall.	See Note 23	30 min.		1		17, 21, 23	1/2
W-5-W-60	5″	2″ × 4″ stud wall; 3/4″ thick 1:1/30:2; 1:1/30:3 portland cement, asbestos fiber plaster on metal lath on both sides of wall.	See Note 23	45 min.		1		17, 21, 23	3/4
W-5-W-61	5″	2″ × 4″ stud wall; 3/4″ thick 1:2; 1:3 portland cement plaster on metal lath on both sides of wall.	See Note 23	30 min.		1		17, 21, 23	1/2
W-5-W-62	5″	2″ × 4″ stud wall; 3/4″ thick neat gypsum plaster on metal lath on both sides of wall.	N/A	1 hr. 30 min.		1		17, 22, 24	1 1/2
W-5-W-63	5″	2″ × 4″ stud wall; 3/4″ thick neat gypsum plaster on metal lath on both sides of wall.	See Note 23	1 hr. 30 min.		1		17, 21, 23	1 1/2
W-5-W-64	5″	2″ × 4″ stud wall; 3/4″ thick 1:2; 1:2 gypsum plaster on metal lath on both sides of wall; insulated cavities.	See Note 23	1 hr. 30 min.		1		17, 18, 21, 23	1 1/2
W-5-W-65	5″	2″ × 4″ stud wall; same as W-5-W-64 but cavities not insulated.	See Note 23	1 hr.		1		17, 21, 23	1
W-5-W-66	5″	2″ × 4″ stud wall; 3/4″ thick 1:2; 1:3 gypsum plaster on metal lath on both sides of wall; insulated cavities.	See Note 23	1 hr. 15 min.		1		17, 18, 21, 23	1 1/4
W-5-W-67	5 1/16″	Same as W-5-W-49 except cavity insulation of 1.75 lbs./ft.^{2} mineral wool bats; rating applies when either wall side exposed to fire.	See Note 23	1 hr. 15 min.		1		23, 26, 25	1 1/4
W-5-W-68	5 1/4″	2″ × 4″ stud wall, 7/8″ thick 1:2; 1:3 gypsum plaster on metal lath on both sides of wall; insulated cavities.	See Note 23	1 hr. 30 min.		1		17, 18, 21, 23	1 1/2

(Continued)

TABLE 1.3.2—WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-69	$5^1/_4$″	2″ × 4″ stud wall; $^7/_8$″ thick neat gypsum plaster applied on metal lath on both sides of wall.	N/A	1 hr. 45 min.		1		17, 22, 24	$1^3/_4$
W-5-W-70	$5^1/_4$″	2″ × 4″ stud wall; $^1/_2$″ thick neat gypsum plaster on $^3/_8$″ plain gypsum lath on both sides of wall.	See Note 23	1 hr.		1		17, 22, 23	1
W-5-W-71	$5^1/_4$″	2″ × 4″ stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster on $^3/_8$″ thick plain gypsum lath with $1^3/_4$″ x $1^3/_4$″ metal lath pads nailed 8″ o.c. vertically and 16″ o.c. horizontally on both sides of wall.	See Note 23	1 hr.		1		17, 21, 23	1
W-5-W-72	$5^1/_4$″	2″ × 4″ stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster on $^3/_8$″ perforated gypsum lath, one $^3/_4$″ diameter hole or larger per 16″ square of lath surface, on both sides of wall.	See Note 23	1 hr.		1		17, 21, 23	1
W-5-W-73	$5^1/_4$″	2″ × 4″ stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster on $^3/_8$″ gypsum lath (plain, indented or perforated) on both sides of wall.	See Note 23	45 min.		1		17, 21, 23	$^3/_4$
W-5-W-74	$5^1/_4$″	2″ × 4″ stud wall; $^7/_8$″ thick of 1:2; 1:3 gypsum plaster over metal lath on both sides of wall.	See Note 23	1 hr.		1		17, 21, 23	1
W-5-W-75	$5^1/_4$″	2″ × 4″ stud wall; $^7/_8$″ thick of 1:$^1/_{30}$:2; 1:$^1/_{30}$:3 portland cement, asbestos plaster applied over metal lath on both sides of wall.	See Note 23	1 hr.		1		17, 21, 23	1
W-5-W-76	$5^1/_4$″	2″ × 4″ stud wall; $^7/_8$″ thick of 1:2; 1:3 portland cement plaster over metal lath on both sides of wall.	See Note 23	45 min.		1		17, 21, 23	$^3/_4$
W-5-W-77	$5^1/_2$″	2″ × 4″ stud wall; 1″ thick neat gypsum plaster over metal lath on both sides of wall; nonload bearing.	N/A	2 hrs.		1		17, 22, 24	2
W-5-W-78	$5^1/_2$″	2″ × 4″ stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster on $^1/_2$″ thick, 0.7 lb./ft.^{2} wood fiberboard on both sides of wall.	See Note 23	35 min.		1		17, 21, 23	$^1/_2$
W-4-W-79	$4^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	1 hr.			43	21, 31, 35, 38	1
W-4-W-80	$4^3/_4$″	Same as W-4-W-79 but uninsulated.	N/A	35 min.			43	21, 31, 35	$^1/_2$
W-4-W-81	$4^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 3:1:8; 3:1:12 lime, Keene's cement, sand plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	1 hr.			43	21, 31, 35, 40	1

(Continued)

**TABLE 1.3.2—WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK—continued**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-W-82	$4^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:6$^1/_4$; 1:6$^1/_4$ lime Keene's cement plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	30 min.			43	21, 31, 35, 40	$^1/_2$
W-4-W-83	$4^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:5; 1:7.5 lime plaster over wood lath on both sides of wall.	N/A	30 min.			43	21, 31, 35	$^1/_2$
W-5-W-84	$5^1/_8$″	2″ × 4″ wood stud wall; $^{11}/_{16}$″ thick of 1:5; 1:7.5 lime plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	45 min.			43	21, 31, 35, 39	$^1/_2$
W-5-W-85	$5^1/_4$″	2″ × 4″ wood stud wall; $^3/_4$″ thick of 1:5; 1:7 lime plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	40 min.			43	21, 31, 35, 40	$^2/_3$
W-5-W-86	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 2:1:12 lime, Keene's cement and sand scratch coat; $^1/_2$″ thick 2:1:18 lime, Keene's cement and sand brown coat over wood lath on both sides of wall; mineral wool insulation.	N/A	1 hr.			43	21, 31, 35, 40	1
W-5-W-87	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ plaster board on both sides of wall.	N/A	45 min.			43	21, 31	$^3/_4$
W-5-W-88	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ gypsum lath on both sides of wall.	N/A	45 min.			43	21, 31	$^3/_4$
W-5-W-89	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ gypsum lath on both sides of wall.	N/A	1 hr.			43	21, 31, 33	1
W-5-W-90	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick neat plaster over $^3/_8$″ thick gypsum lath on both sides of wall.	N/A	1 hr.			43	21, 22, 31	1
W-5-W-91	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ thick indented gypsum lath on both sides of wall.	N/A	45 min.			43	21, 31	$^3/_4$
W-5-W-92	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ thick perforated gypsum lath on both sides of wall.	N/A	45 min.			43	21, 31, 34	$^3/_4$
W-5-W-93	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ perforated gypsum lath on both sides of wall.	N/A	1 hr.			43	21, 31	1
W-5-W-94	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ thick perforated gypsum lath on both sides of wall.	N/A	45 min.			43	21, 31, 34	$^3/_4$

(Continued)

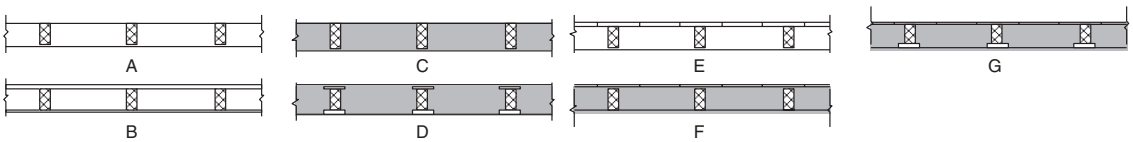
TABLE 1.3.2—WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-95	$5^1/_2$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^1/_2$″ thick wood fiberboard plaster base on both sides of wall.	N/A	35 min.			43	21, 31, 36	$^1/_2$
W-5-W-96	$5^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^7/_8$″ thick flameproofed wood fiberboard on both sides of wall.	N/A	1 hr.			43	21, 31, 37	1

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. All specimens 8 feet or 8 feet 8 inches by 10 feet, 4 inches, i.e. one-half of furnace size. See Note 42 for design cross section.
2. Specimens tested in tandem (two per exposure).
3. Test per ASA No. A2-1934 except where unloaded. Also, panels were of "half" size of furnace opening. Time value signifies a thermal failure time.
4. Two-inch by 4-inch studs: 16 inches on center.; where 10 feet 4 inches, blocking at 2-foot 4-inch height.
5. Facing 4 feet by 8 feet, cement-asbestos board sheets, $^3/_{16}$ inch thick.
6. Sheathing (diagonal): $^{25}/_{22}$ inch by $5^1/_2$ inch, 1 inch by 6 inches pine.
7. Facing shingles: 24 inches by 12 inches by $^5/_{32}$ inch where used.
8. Asbestos felt: asphalt sat between sheathing and shingles.
9. Load: 30,500 pounds or 360 psi/stud where load was tested.
10. Walls were tested beyond achievement of first test end point. A load-bearing time in excess of performance time indicates that although thermal criteria were exceeded, load-bearing ability continued.
11. Wall was rated for one hour combustible use in original source.
12. Hose steam test specimen. See table entry of similar design above for recommended rating.
13. Rated one and one-fourth hour load bearing. Rated one and one-half hour nonload bearing.
14. Failed hose stream.
15. Test terminated due to flame penetration.
16. Test terminated - local back face temperature rise.
17. Nominal 2-inch by 4-inch wood studs of No. 1 common or better lumber set edgewise. Two-inch by four-inch plates at top and bottom and blocking ad mid height of wall.
18. Cavity insulation consists of rock wool bats 1.0 lb./ft.^{2} of filled cavity area.
19. Cavity insulation consists of glass wool bats 0.6 lb./ft.^{2} of filled cavity area.
20. Cavity insulation consists of blown-in forck wool 2.0 lbs./ft.^{2} of filled cavity area
21. Mix proportions for plastered walls as follows: first ratio indicates scratch coat mix, weight of dry plaster: dry sand; second ratio indicates brown coat mix.
22. "Neat" plaster is taken to mean unsanded wood-fiber gypsum plaster.
23. Load: 360 psi of net stud cross sectional area.
24. Rated as nonload bearing.
25. Nominal 2-inch by 4-inch studs per Note 17, spaced at 16 inches on center.
26. Horizontal joints in facing material supported by 2-inch by 4-inch blocking within wall.
27. Facings secured with 6d casing nails. Nail holes predrilled and were 0.02 to 0.03 inch smaller than nail diameter.
28. Cavity insulation consists of mineral wool bats weighing 2 lbs./ft.^{2} of filled cavity area.
29. Interior wall face exposed to fire.
30. Exterior wall faced exposed to fire.
31. Nominal 2-inch by 4-inch studs of yellow pine or Douglas-fir spaced 16 inches on center in a single row.
32. Studs as in Note 31 except double row, with studs in rows staggered.
33. Six roofing nails with metal-lath pads around heats to each 16-inch by 48-inch lath.
34. Areas of holes less than $2^3/_4$ percent of area of lath.
35. Wood laths were nailed with either 3d or 4d nails, one nail to each bearing, and the end joining broken every seventh course.
36. One-half-inch thick fiberboard plaster base nailed with 3d or 4d common wire nails spaced 4 to 6 inches on center.
37. Seven-eighths-inch thick fiberboard plaster base nailed with 5d common wire nails spaced 4 to 6 inches on center.
38. Mineral wood bats 1.05 to 1.25 lbs./ft.^{2} with waterproofed-paper backing.
39. Blown-in mineral wool insulation, 2.2 lbs./ft.^{2}.
40. Mineral wool bats, 1.4 lbs./ft.^{2} with waterproofed-paper backing.
41. Mineral wood bats, 0.9 lb./ft.^{2}.
42. See wall design diagram, below.



43. Duplicate specimen of W-4-W-7, tested simultaneously with W-4-W-7 in 18-foot test furnace.

**TABLE 1.3.3—WOOD FRAME WALLS
6″ TO LESS THAN 8″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-W-1	$6^1/_4$″	2 × 4 stud wall; $^1/_2$″ thick, 1:2; 1:2 gypsum plaster on $^7/_8$″ flameproofed wood fiberboard weighing 2.8 lbs./ft.^{2} on both sides of wall.	See Note 3	1 hr.		1		1-3	1
W-6-W-2	$6^1/_2$″	2 × 4 stud wall; $^1/_2$″ thick, 1:3; 1:3 gypsum plaster on 1" thick magnesium oxysulfate wood fiberboard on both sides of wall.	See Note 3	45 min.		1		1-3	$^3/_4$
W-7-W-3	$7^1/_4$″	Double row of 2 × 4 studs, $^1/_2$″ thick of 1:2; 1:2 gypsum plaster applied over $^3/_8$″ thick perforated gypsum lath on both sides of wall; mineral wool insulation.	N/A	1 hr.			43	2, 4, 5	1
W-7-W-4	$7^1/_2$″	Double row of 2 × 4 studs, $^5/_8$″ thick of 1:2; 1:2 gypsum plaster applied over $^3/_8$″ thick perforated gypsum lath over laid with 2″ × 2″, 16 gage wire fabric, on both sides of wall.	N/A	1 hr. 15 min.			43	2, 4	$1^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2 .

Notes:

1. Nominal 2-inch by 4-inch wood studs of No. 1 common or better lumber set edgewise. Two-inch by 4-inch plates at top and bottom and blocking at mid height of wall.
2. Mix proportions for plastered walls as follows: first ratio indicates scratch coat mix, weight of dry plaster:dry sand; second ratio indicates brown coat mix.
3. Load: 360 psi of net stud cross sectional area.
4. Nominal 2-inch by 4-inch studs of yellow pine of Douglas-fir spaced 16 inches in a double row, with studs in rows staggered.
5. Mineral wool bats, 0.19 lb./ft.^{2}.

**TABLE 1.4.1—MISCELLANEOUS MATERIALS WALLS
0″ TO LESS THAN 4″ THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-Mi-1	$3^7/_8$″	Glass brick wall: (bricks $5^3/_4$″ × $5^3/_4$″ × $3^7/_8$″) $^1/_4$″ mortar bed, cement/lime/sand; mounted in brick (9″) wall with mastic and $^1/_2$″ asbestos rope.	N/A	1 hr.			7	1, 2	1
W-3-Mi-2	3″	Core: 2″ magnesium oxysulfate wood-fiber blocks; laid in portland cement-lime mortar; Facings: on both sides; see Note 3.	N/A	1 hr.		1		3	1
W-3-Mi-3	$3^7/_8$″	Core: 8″ × $4^7/_8$″ glass blocks $3^7/_8$″ thick weighing 4 lbs. each; laid in portland cement-lime mortar; horizontal mortar joints reinforced with metal lath.	N/A	15 min.		1			$^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN.

Notes:

1. No failure reached at 1 hour.
2. These glass blocks are assumed to be solid based on other test data available for similar but hollow units which show significantly reduced fire endurance.
3. Minimum of $^1/_2$ inch of 1:3 sanded gypsum plaster required to develop this rating.

TABLE 1.4.2—MISCELLANEOUS MATERIALS WALLS
4″ TO LESS THAN 6 ″THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-Mi-1	4″	Core: 3″ magnesium oxysulfate wood-fiber blocks; laid in portland cement mortar; Facings: both sides; see Note 1.	N/A	2 hrs.		1			2

For SI: 1 inch = 25.4 mm.

Notes:

1. One-half inch sanded gypsum plaster. Voids in hollow blocks to be not more than 30 percent.

FIGURE 1.5.1—FINISH RATINGS—INORGANIC MATERIALS

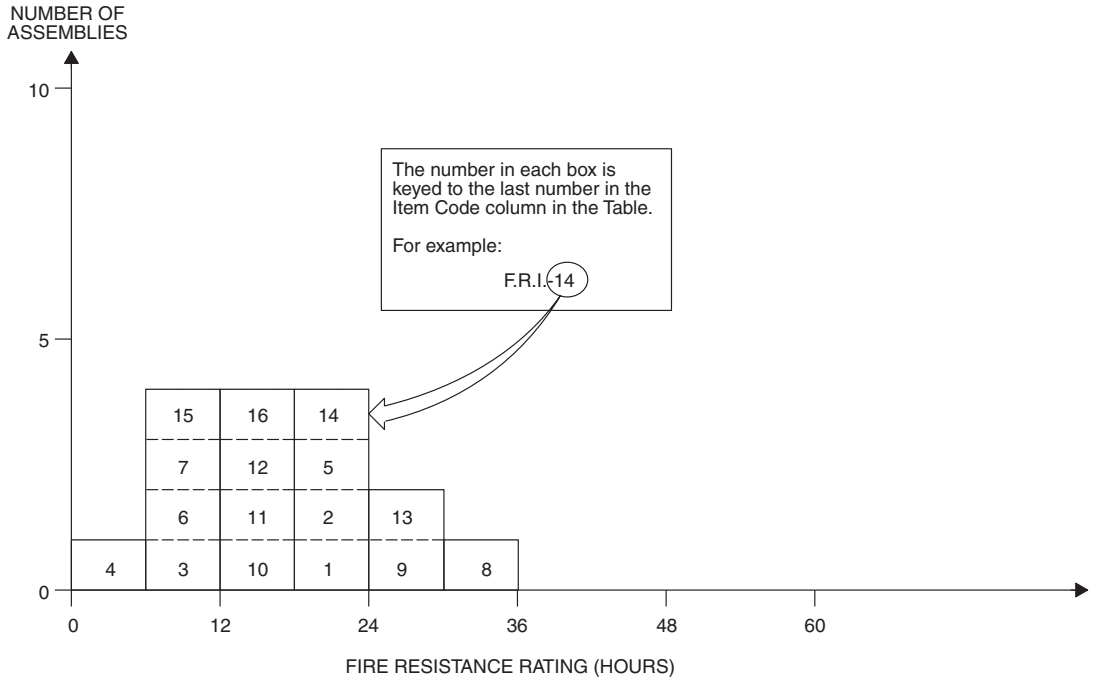


TABLE 1.5.1—FINISH RATINGS—INORGANIC MATERIALS

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE	REFERENCE NUMBER			NOTES	REC. F.R. (MIN.)
			FINISH RATING	PRE-BMS-92	BMS-92	POST-BMS-92		
F.R.-I-1	$^{9}/_{16}$″	$^{3}/_{8}$″ gypsum wallboard faced with $^{3}/_{16}$″ cement-asbestos board.	20 minutes		1		1, 2	15
F.R.-I-2	$^{11}/_{16}$″	$^{1}/_{2}$″ gypsum sheathing faced with $^{3}/_{16}$″ cement-asbestos board.	20 minutes		1		1, 2	20
F.R.-I-3	$^{3}/_{16}$″	$^{3}/_{16}$″ cement-asbestos board over uninsulated cavity.	10 minutes		1		1, 2	5
F.R.-I-4	$^{3}/_{16}$″	$^{3}/_{16}$″ cement-asbestos board over insulated cavities.	5 minutes		1		1, 2	5
F.R.-I-5	$^{3}/_{4}$″	$^{3}/_{4}$″ thick 1:2; 1:3 gypsum plaster over paper backed metal lath.	20 minutes		1		1, 2, 3	20
F.R.-I-6	$^{3}/_{4}$″	$^{3}/_{4}$″ thick portland cement plaster on metal lath.	10 minutes		1		1, 2	10
F.R.-I-7	$^{3}/_{4}$″	$^{3}/_{4}$″ thick 1:5; 1:7.5 lime plaster on metal lath.	10 minutes		1		1, 2	10
F.R.-I-8	1″	1″ thick neat gypsum plaster on metal lath.	35 minutes		1		1, 2, 4	35
F.R.-I-9	$^{3}/_{4}$″	$^{3}/_{4}$″ thick neat gypsum plaster on metal lath.	30 minutes		1		1, 2, 4	30
F.R.-I-10	$^{3}/_{4}$″	$^{3}/_{4}$″ thick 1:2; 1:2 gypsum plaster on metal lath.	15 minutes		1		1, 2, 3	15
F.R.-I-11	$^{1}/_{2}$″	Same as F.R.-1-7, except $^{1}/_{2}$″ thick on wood lath.	15 minutes		1		1, 2, 3	15
F.R.-I-12	$^{1}/_{2}$″	$^{1}/_{2}$″ thick 1:2; 1:3 gypsum plaster on wood lath.	15 minutes		1		1, 2, 3	15

(Continued)

TABLE 1.5.1—FINISH RATINGS—INORGANIC MATERIALS—continued

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE	REFERENCE NUMBER			NOTES	REC. F.R. (MIN.)
			FINISH RATING	PRE-BMS-92	BMS-92	POST-BMS-92		
F.R.-I-13	7/8″	1/2″ thick 1:2; 1:2 gypsum plaster on 3/8″ perforated gypsum lath.	30 minutes		1		1, 2, 3	30
F.R.-I-14	7/8″	1/2″ thick 1:2; 1:2 gypsum plaster on 3/8″ thick plain or indented gypsum plaster.	20 minutes		1		1, 2, 3	20
F.R.-I-15	3/8″	3/8″ gypsum wallboard.	10 minutes		1		1, 2	10
F.R.-I-16	1/2″	1/2″ gypsum wallboard.	5 minutes		1		1, 2	15

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

Notes:

1. The finish rating is the time required to obtain an average temperature rise of 250°F, or a single point rise of 325°F, at the interface between the material being rated and the substrate being protected.
2. Tested in accordance with the Standard Specifications for Fire Tests of Building Construction and Materials, ASA No. A2-1932.
3. Mix proportions for plasters as follows: first ratio, dry weight of plaster: dry weight of sand for scratch coat; second ratio, plaster: sand for brown coat.
4. Neat plaster means unsanded wood-fiber gypsum plaster.

General Note:

The finish rating of modern building materials can be found in the current literature.

TABLE 1.5.2—FINISH RATINGS—ORGANIC MATERIALS

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE	REFERENCE NUMBER			NOTES	REC. F.R. (MIN.)
			FINISH RATING	PRE-BMS-92	BMS-92	POST-BMS-92		
F.R.-O-1	9/16″	7/16″ wood fiberboard faced with 1/8″ cement-asbestos board.	15 minutes		1		1, 2	15
F.R.-O-2	29/32″	3/4″ wood sheathing, asbestos felt weighing 14 lbs./100 ft.^{2} and 5/32″ cement-asbestos shingles.	20 minutes		1		1, 2	20
F.R.-O-3	1 1/2″	1″ thick magnesium oxysulfate wood fiberboard faced with 1:3; 1:3 gypsum plaster, 1/2″ thick.	20 minutes		1		1, 2, 3	20
F.R.-O-4	1/2″	1/2″ thick wood fiberboard.	5 minutes		1		1, 2	5
F.R.-O-5	1/2″	1/2″ thick flameproofed wood fiberboard.	10 minutes		1		1, 2	10
F.R.-O-6	1″	1/2″ thick wood fiberboard faced with 1/2″ thick 1:2; 1:2 gypsum plaster.	15 minutes		1		1, 2, 3	30
F.R.-O-7	1 3/8″	7/8″ thick flameproofed wood fiberboard faced with 1/2″ thick 1:2; 1:2 gypsum plaster.	30 minutes		1		1, 2, 3	30
F.R.-O-8	1 1/4″	1 1/4″ thick plywood.	30 minutes			35		30

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square foot = 47.9 N/m^2, °C = [(°F) - 32]/1.8.

Notes:

1. The finish rating is the time required to obtain an average temperature rise of 250°F, or a single point rise of 325°F, at the interface between the material being rated and he substrate being protected.
2. Tested in accordance with the Standard Specifications for Fire Tests of Building Construction and Materials, ASA No. A2-1932.
3. Plaster ratios as follows: first ratio is for scratch coat, weight of dry plaster: weight of dry sand; second ratio is for the brown coat.

General Note:

The finish rating of thinner materials, particularly thinner woods, have not been listed because the possible effects of shrinkage, warpage and aging cannot be predicted.

SECTION II—COLUMNS

**TABLE 2.1.1—REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 0″ TO LESS THAN 6″**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-6-RC-1	6″	6″ × 6″ square columns; gravel aggregate concrete (4030 psi); Reinforcement: vertical, four $^{7}/_{8}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6" pitch; Cover: 1″.	34.7 tons	62 min.			7	1, 2	1
C-6-RC-2	6″	6″ × 6″ square columns; gravel aggregate concrete (4200 psi); Reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6" pitch; Cover: 1″.	21 tons	69 min.			7	1, 2	1

Notes:
1. Collapse.
2. British Test.

**FIGURE 2.1.2—REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10″ TO LESS THAN 12″**

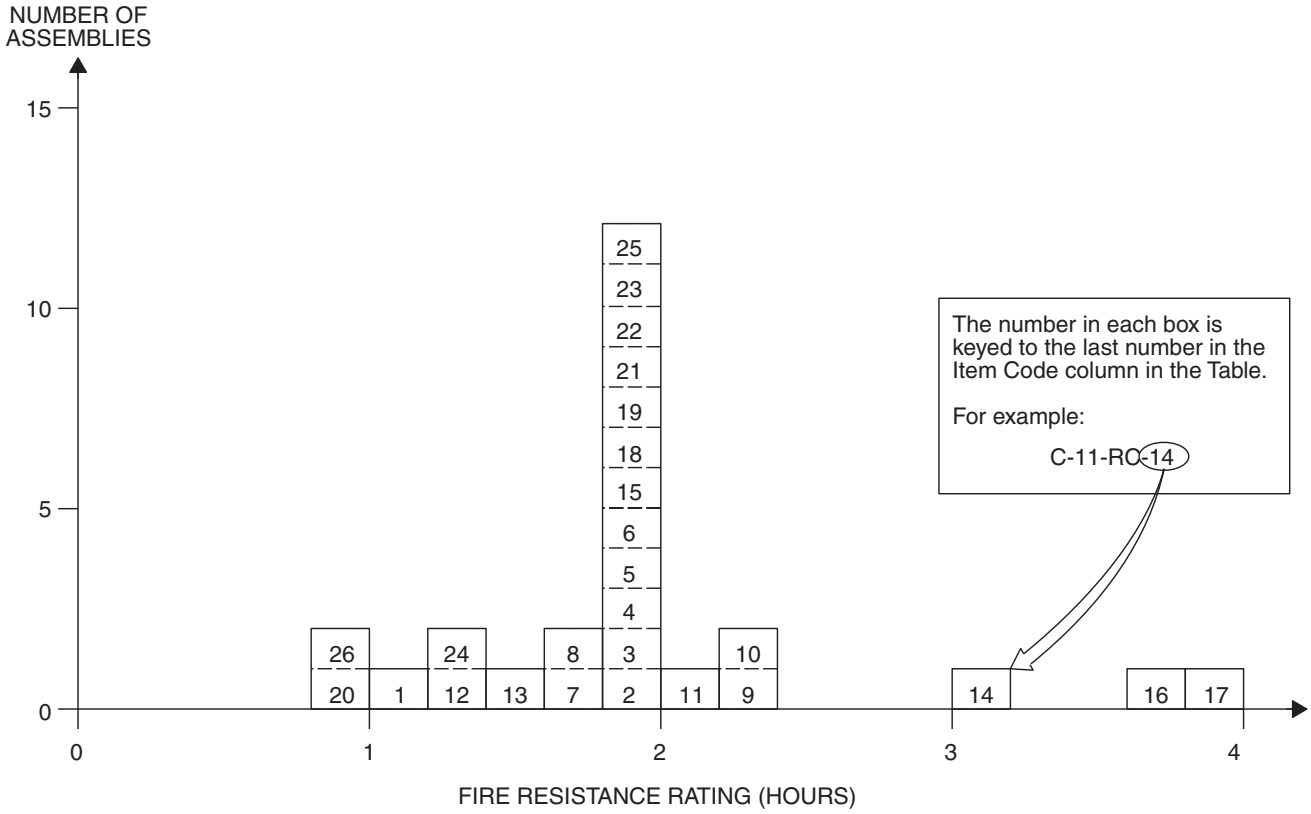


TABLE 2.1.2—REINFORCED CONCRETE COLUMNS MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-RC-1	10″	10″ square columns; aggregate concrete (4260 psi); Reinforcement: vertical, four $1^1/_4$″ rebars; horizontal, $^3/_8$″ ties at 6″ pitch; Cover: $1^1/_4$″.	92.2 tons	1 hr. 2 min.			7	1	1
C-10-RC-2	10″	10″ square columns; aggregate concrete (2325 psi); Reinforcement: vertical, four $^1/_2$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: 1″.	46.7 tons	1 hr. 52 min.			7	1	$1^3/_4$
C-10-RC-3	10″	10″ square columns; aggregate concrete (5370 psi); Reinforcement: vertical, four $^1/_2$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: 1″.	46.5 tons	2 hrs.			7	2, 3, 11	2
C-10-RC-4	10″	10″ square columns; aggregate concrete (5206 psi); Reinforcement: vertical, four $^1/_2$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: 1″.	46.5 tons	2 hrs.			7	2, 7	2
C-10-RC-5	10″	10″ square columns; aggregate concrete (5674 psi); Reinforcement: vertical, four $^1/_2$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: 1″.	46.7 tons	2 hrs.			7	1	2
C-10-RC-6	10″	10″ square columns; aggregate concrete (5150 psi); Reinforcement: vertical, four $1^1/_2$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: 1″.	66 tons	1 hr. 43 min.			7	1	$1^3/_4$
C-10-RC-7	10″	10″ square columns; aggregate concrete (5580 psi); Reinforcement: vertical, four $^1/_2$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: $1^1/_8$″.	62.5 tons	1 hr. 38 min.			7	1	$1^1/_2$
C-10-RC-8	10″	10″ square columns; aggregate concrete (4080 psi); Reinforcement: vertical, four $1^1/_8$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: $1^1/_8$″.	72.8 tons	1 hr. 48 min.			7	1	$1^3/_4$
C-10-RC-9	10″	10″ square columns; aggregate concrete (2510 psi); Reinforcement: vertical, four $^1/_2$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: 1″.	51 tons	2 hrs. 16 min.			7	1	$2^1/_4$
C-10-RC-10	10″	10″ square columns; aggregate concrete (2170 psi); Reinforcement: vertical, four $^1/_2$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: 1″.	45 tons	2 hrs. 14 min.			7	12	$2^1/_4$
C-10-RC-11	10″	10″ square columns; gravel aggregate concrete (4015 psi); Reinforcement: vertical, four $^1/_2$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: $1^1/_8$″.	46.5 tons	2 hrs. 6 min.			7	1	2

(Continued)

TABLE 2.1.2—REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10″ TO LESS THAN 12″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-RC-12	11″	11″ square columns; gravel aggregate concrete (4150 psi); Reinforcement: vertical, four $1^1/_4$″ rebars; horizontal, $^3/_8$″ ties at $7^1/_2$″ pitch; Cover: $1^1/_2$″.	61 tons	1 hr. 23 min.			7	1	$1^1/_4$
C-11-RC-13	11″	11″ square columns; gravel aggregate concrete (4380 psi); Reinforcement: vertical, four $1^1/_4$″ rebars; horizontal, $^3/_8$″ ties at $7^1/_2$″ pitch; Cover: $1^1/_2$″.	61 tons	1 hr. 26 min.			7	1	$1^1/_4$
C-11-RC-14	11″	11″ square columns; gravel aggregate concrete (4140 psi); Reinforcement: vertical, four $1^1/_4$″ rebars; horizontal, $^3/_8$″ ties at $7^1/_2$″ pitch; steel mesh around reinforcement; Cover: $1^1/_2$″.	61 tons	3 hrs. 9 min.			7	1	3
C-11-RC-15	11″	11″ square columns; slag aggregate concrete (3690 psi); Reinforcement: vertical, four $1^1/_4$″ rebars; horizontal, $^3/_8$″ ties at $7^1/_2$″ pitch; Cover: $1^1/_2$″.	91 tons	2 hrs.			7	2, 3, 4, 5	2
C-11-RC-16	11″	11″ square columns; limestone aggregate concrete (5230 psi); Reinforcement: vertical, four $1^1/_4$″ rebars; horizontal, $^3/_8$″ ties at $7^1/_2$″ pitch; Cover: $1^1/_2$″.	91.5 tons	3 hrs. 41 min.			7	1	$3^1/_2$
C-11-RC-17	11″	11″ square columns; limestone aggregate concrete (5530 psi); Reinforcement: vertical, four $1^1/_4$″ rebars; horizontal, $^3/_8$″ ties at $7^1/_2$″ pitch; Cover: $1^1/_2$″.	91.5 tons	3 hrs. 47 min.			7	1	$3^1/_2$
C-11-RC-18	11″	11″ square columns; limestone aggregate concrete (5280 psi); Reinforcement: vertical, four $1^1/_4$″ rebars; horizontal, $^3/_8$″ ties at $7^1/_2$″ pitch; Cover: $1^1/_2$″.	91.5 tons	2 hrs.			7	2, 3, 4, 6	2
C-11-RC-19	11″	11″ square columns; limestone aggregate concrete (4180 psi); Reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; Cover: $1^1/_2$″.	71.4 tons	2 hrs.			7	2, 7	2
C-11-RC-20	11″	11″ square columns; gravel concrete (4530 psi); Reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; Cover: $1^1/_2$″ with $^1/_2$″ plaster.	58.8 tons	2 hrs.			7	2, 3, 9	$1^1/_4$
C-11-RC-21	11″	11″ square columns; gravel concrete (3520 psi); Reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; Cover: $1^1/_2$″.	Variable	1 hr. 24 min.			7	1, 8	2

(Continued)

TABLE 2.1.2—REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10″ TO LESS THAN 12″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-RC-22	11″	11″ square columns; aggregate concrete (3710 psi); Reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; Cover: $1^1/_2$″.	58.8 tons	2 hrs.			7	2, 3, 10	2
C-11-RC-23	11″	11″ square columns; aggregate concrete (3190 psi); Reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; Cover: $1^1/_2$″.	58.8 tons	2 hrs.			7	2, 3, 10	2
C-11-RC-24	11″	11″ square columns; aggregate concrete (4860 psi); Reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; Cover: $1^1/_2$″.	86.1 tons	1 hr. 20 min.			7	1	$1^1/_3$
C-11-RC-25	11″	11″ square columns; aggregate concrete (4850 psi); Reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; Cover: $1^1/_2$″.	58.8 tons	1 hr. 59 min.			7	1	$1^3/_4$
C-11-RC-26	11″	11″ square columns; aggregate concrete (3834 psi); Reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^5/_{16}$″ ties at $4^1/_2$″ pitch; Cover: $1^1/_2$″.	71.4 tons	53 min.			7	1	$^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.
2. Passed 2 hour fire exposure.
3. Passed hose stream test.
4. Reloaded effectively after 48 hours but collapsed at load in excess of original test load.
5. Failing load was 150 tons.
6. Failing load was 112 tons.
7. Failed during hose stream test.
8. Range of load 58.8 tons (initial) to 92 tons (92 minutes) to 60 tons (80 minutes).
9. Collapsed at 44 tons in reload after 96 hours.
10. Withstood reload after 72 hours.
11. Collapsed on reload after 48 hours.

TABLE 2.1.3—REINFORCED CONCRETE COLUMNS MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-RC-1	12″	12″ square columns; gravel aggregate concrete (2647 psi); Reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^5/_{16}$″ ties at 4$^1/_2$″ pitch; Cover: 2″.	78.2 tons	38 min.		1	7	1	$^1/_2$
C-12-RC-2	12″	Reinforced columns with 1$^1/_2$″ concrete outside of reinforced steel; Gross diameter or side of column: 12″; Group I, Column A.	—	6 hrs.		1		2, 3	6
C-12-RC-3	12″	Description as per C-12-RC-2; Group I, Column B.	—	4 hrs.		1		2, 3	4
C-12-RC-4	12″	Description as per C-12-RC-2; Group II, Column A.	—	4 hrs.		1		2, 3	4
C-12-RC-5	12″	Description as per C-12-RC-2; Group II, Column B.	—	2 hrs. 30 min.		1		2, 3	2$^1/_2$
C-12-RC-6	12″	Description as per C-12-RC-2; Group III, Column A.	—	3 hrs.		1		2, 3	3
C-12-RC-7	12″	Description as per C-12-RC-2; Group III, Column B.	—	2 hrs.		1		2, 3	2
C-12-RC-8	12″	Description as per C-12-RC-2; Group IV, Column A.	—	2 hrs.		1		2, 3	2
C-12-RC-9	12″	Description as per C-12-RC-2; Group IV, Column B.	—	1 hr. 30 min.		1		2, 3	1$^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2.

Notes:

1. Failure mode - unspecified structural.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
3. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.

   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.

   Column B: working loads are assumed as carried by the gross area of the column.

TABLE 2.1.4—REINFORCED CONCRETE COLUMNS MINIMUM DIMENSION 14″ TO LESS THAN 16″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-RC-1	14″	14″ square columns; gravel aggregate concrete (4295 psi); Reinforcement: vertical four $^3/_4$″ rebars; horizontal: $^1/_4$″ ties at 9″ pitch; Cover: $1^1/_2$″.	86 tons	1 hr. 22 min.			7	1	$1^1/_4$
C-14-RC-2	14″	Reinforced concrete columns with $1^1/_2$″ concrete outside reinforcing steel; Gross diameter or side of column: 12″; Group I, Column A.	—	7 hrs.		1		2, 3	7
C-14-RC-3	14″	Description as per C-14-RC-2; Group II, Column B.	—	5 hrs.		1		2, 3	5
C-14-RC-4	14″	Description as per C-14-RC-2; Group III, Column A.	—	5 hrs.		1		2, 3	5
C-14-RC-5	14″	Description as per C-14-RC-2; Group IV, Column B.	—	3 hrs. 30 min.		1		2, 3	$3^1/_2$
C-14-RC-6	14″	Description as per C-14-RC-2; Group III, Column A.	—	4 hrs.		1		2, 3	4
C-14-RC-7	14″	Description as per C-14-RC-2; Group III, Column B.	—	2 hrs. 30 min.		1		2, 3	$2^1/_2$
C-14-RC-8	14″	Description as per C-14-RC-2; Group IV, Column A.	—	2 hrs. 30 min.		1		2, 3	$2^1/_2$
C-14-RC-9	14″	Description as per C-14-RC-2; Group IV, Column B.	—	1 hr. 30 min.		1		2, 3	$1^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2.

Notes:

1. Failure mode - main rebars buckled between links at various points.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
3. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.

   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.

   Column B: working loads are assumed as carried by the gross area of the column.

**FIGURE 2.1.5—REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 16″ TO LESS THAN 18″**

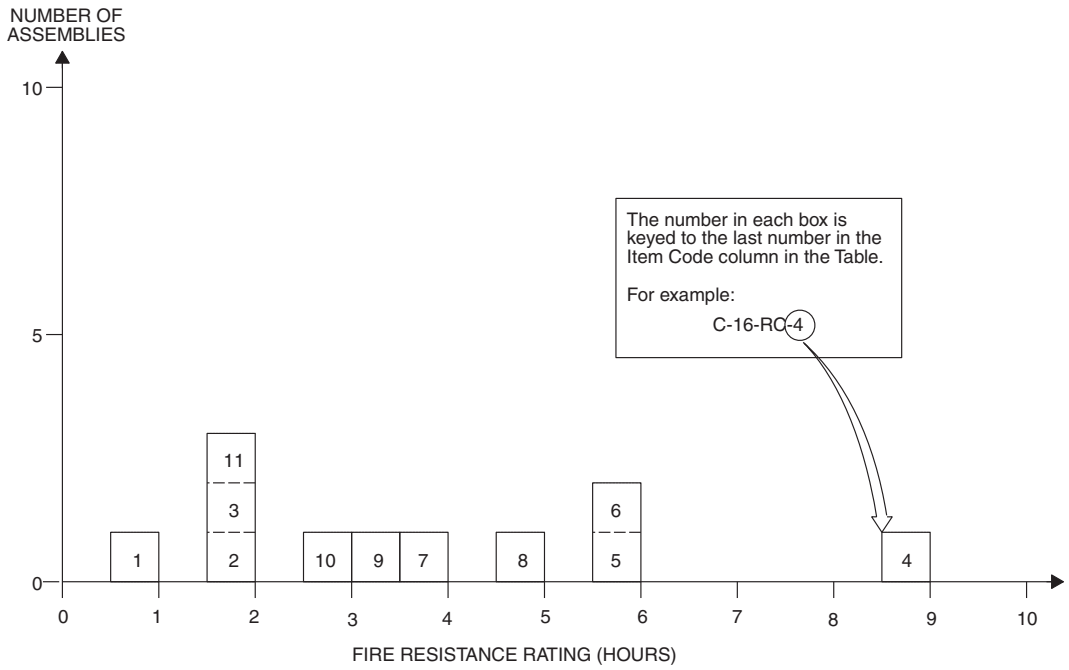


**TABLE 2.1.5—REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 16″ TO LESS THAN 18″**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-RC-1	16″	16″ square columns; gravel aggregate concrete (4550 psi); Reinforcement: vertical, eight $1^3/_8$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch $1^3/_8$″ below column surface and $^5/_{16}$″ ties at 6″ pitch linking center rebars of each face forming a smaller square in column cross section.	237 tons	1 hr			7	1, 2, 3	1
C-16-RC-2	16″	16″ square columns; gravel aggregate concrete (3360 psi); Reinforcement: vertical, eight $1^3/_8$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; Cover: $1^3/_8$″.	210 tons	2 hrs.			7	2, 4, 5, 6	2
C-16-RC-3	16″	16″ square columns; gravel aggregate concrete (3980 psi); Reinforcement: vertical, four $^7/_8$″ rebars; horizontal, $^3/_8$″ ties at 6″ pitch; Cover: 1″.	123.5 tons	2 hrs.			7	2, 4, 7	2
C-16-RC-4	16″	Reinforced concrete columns with $1^1/_2$″ concrete outside reinforcing steel; Gross diameter or side of column: 16″; Group I, Column A.	—	9 hrs.		1		8, 9	9
C-16-RC-5	16″	Description as per C-16-RC-4; Group I, Column B.	—	6 hrs.		1		8, 9	6

(Continued)

TABLE 2.1.5—REINFORCED CONCRETE COLUMNS MINIMUM DIMENSION 16″ TO LESS THAN 18″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-RC-6	16″	Description as per C-16-RC-4; Group II, Column A.	—	6 hrs.		1		8, 9	6
C-16-RC-7	16″	Description as per C-16-RC-4; Group II, Column B.	—	4 hrs.		1		8, 9	4
C-16-RC-8	16″	Description as per C-16-RC-4; Group III, Column A.	—	5 hrs.		1		8, 9	5
C-16-RC-9	16″	Description as per C-16-RC-4; Group III, Column B.	—	3 hrs. 30 min.		1		8, 9	$3^1/_2$
C-16-RC-10	16″	Description as per C-16-RC-4; Group IV, Column A.	—	3 hrs.		1		8, 9	3
C-16-RC-11	16″	Description as per C-16-RC-4; Group IV, Column B.	—	2 hrs.		1		8, 9	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2.

Notes:

1. Column passed 1-hour fire test.
2. Column passed hose stream test.
3. No reload specified.
4. Column passed 2-hour fire test.
5. Column reloaded successfully after 24 hours.
6. Reinforcing details same as C-16-RC-1.
7. Column passed reload after 72 hours.
8. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./$yd.^2$, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./$yd.^2$, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
9. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.

   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.

   Column B: working loads are assumed as carried by the gross area of the column.

TABLE 2.1.6—REINFORCED CONCRETE COLUMNS MINIMUM DIMENSION 18″ TO LESS THAN 20″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-18-RC-1	18″	Reinforced concrete columns with $1^1/_2$″ concrete outside reinforced steel; Gross diameter or side of column: 18″; Group I, Column A.	—	11 hrs.		1		1, 2	11
C-18-RC-2	18″	Description as per C-18-RC-1; Group I, Column B.	—	8 hrs.		1		1, 2	8
C-18-RC-3	18″	Description as per C-18-RC-1; Group II, Column A.	—	7 hrs.		1		1, 2	7
C-18-RC-4	18″	Description as per C-18-RC-1; Group II, Column B.	—	5 hrs.		1		1, 2	5
C-18-RC-5	18″	Description as per C-18-RC-1; Group III, Column A.	—	6 hrs.		1		1, 2	6
C-18-RC-6	18″	Description as per C-18-RC-1; Group III, Column B.	—	4 hrs.		1		1, 2	4
C-18-RC-7	18″	Description as per C-18-RC-1; Group IV, Column A.	—	3 hrs. 30 min.		1		1, 2	$3^1/_2$
C-18-RC-8	18″	Description as per C-18-RC-1; Group IV, Column B.	—	2 hrs. 30 min.		1		1, 2	$2^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound per square yard = 5.3 N/m^2.

Notes:

1. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./$yd.^2$, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./$yd.^2$, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint and, tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

2. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.

   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.

   Column B: working loads are assumed as carried by the gross area of the column.

**FIGURE 2.1.7—REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 20″ TO LESS THAN 22″**

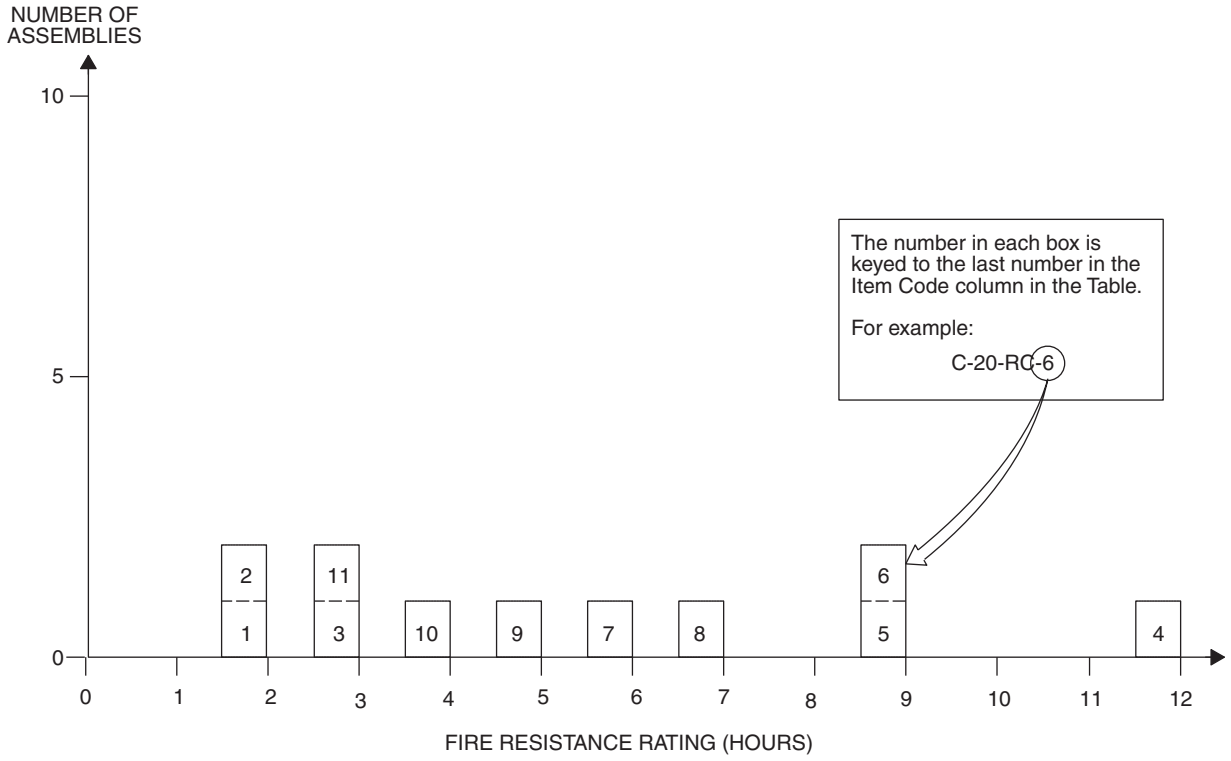


**TABLE 2.1.7—REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 20″ TO LESS THAN 22″**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-RC-1	20″	20″ square columns; gravel aggregate concrete (6690 psi); Reinforcement: vertical, four $1^3/_4$″ rebars; horizontal, $^3/_8$″ wire at 6″ pitch; Cover $1^3/_4$″.	367 tons	2 hrs.			7	1, 2, 3	2
C-20-RC-2	20″	20″ square columns; gravel aggregate concrete (4330 psi); Reinforcement: vertical, four $1^3/_4$″ rebars; horizontal, $^3/_8$″ ties at 6″ pitch; Cover $1^3/_4$″.	327 tons	2 hrs.			7	1, 2, 4	2
C-20-RC-3	$20^1/_4$″	20″ square columns; gravel aggregate concrete (4230 psi); Reinforcement: vertical, four $1^1/_8$″ rebars; horizontal, $^3/_8$″ wire at 5″ pitch; Cover $1^1/_8$″.	199 tons	2 hrs. 56 min.			7	5	$2^3/_4$
C-20-RC-4	20″	Reinforced concrete columns with $1^1/_2$″ concrete outside of reinforcing steel; Gross diameter or side of column: 20″; Group I, Column A.	—	12 hrs.		1		6, 7	12
C-20-RC-5	20″	Description as per C-20-RC-4; Group I, Column B.	—	9 hrs.		1		6, 7	9
C-20-RC-6	20″	Description as per C-20-RC-4; Group II, Column A.	—	9 hrs.		1		6, 7	9

(Continued)

TABLE 2.1.7—REINFORCED CONCRETE COLUMNS MINIMUM DIMENSION 20″ TO LESS THAN 22″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-RC-7	20″	Description as per C-20-RC-4; Group II, Column B.	—	6 hrs		1		6, 7	6
C-20-RC-8	20″	Description as per C-20-RC-4; Group III, Column A.	—	7 hrs.		1		6, 7	7
C-20-RC-9	20″	Description as per C-20-RC-4; Group III, Column B.	—	5 hrs.		1		6, 7	5
C-20-RC-10	20″	Description as per C-20-RC-4; Group IV, Column A.	—	4 hrs.		1		6, 7	4
C-20-RC-11	20″	Description as per C-20-RC-4; Group IV, Column B.	—	3 hrs.		1		6, 7	3

For SI: 1 inch = 25.4 mm, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Passed 2-hour fire test.
2. Passed hose stream test.
3. Failed during reload at 300 tons.
4. Passed reload after 72 hours.
5. Failure mode - collapse.
6. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
7. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.

   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.

   Column B: working loads are assumed as carried by the gross area of the column.

TABLE 2.1.8—HEXAGONAL REINFORCED CONCRETE COLUMNS MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-HRC-1	12″	12″ hexagonal columns; gravel aggregate concrete (4420 psi); Reinforcement: vertical, eight $^1/_2$″ rebars; horizontal, $^5/_{16}$″ helical winding at 1$^1/_2$″ pitch; Cover: $^1/_2$″.	88 tons	58 min.			7	1	$^3/_4$
C-12-HRC-2	12″	12″ hexagonal columns; gravel aggregate concrete (3460 psi); Reinforcement: vertical, eight $^1/_2$″ rebars; horizontal, $^5/_{16}$″ helical winding at 1$^1/_2$″ pitch; Cover: $^1/_2$″.	78.7 tons	1 hr.			7	2	1

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.
2. Test stopped at 1 hour.

TABLE 2.1.9—HEXAGONAL REINFORCED CONCRETE COLUMNS MINIMUM DIMENSION 14″ TO LESS THAN 16″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-HRC-1	14″	14″ hexagonal columns; gravel aggregate concrete (4970 psi); Reinforcement: vertical, eight $^1/_2$″ rebars; horizontal, $^5/_{16}$″ helical winding on 2″ pitch; Cover: $^1/_2$″.	90 tons	2 hrs.			7	1, 2, 3	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Withstood 2-hour fire test.
2. Withstood hose stream test.
3. Withstood reload after 48 hours.

TABLE 2.1.10—HEXAGONAL REINFORCED CONCRETE COLUMNS DIAMETER — 16″ TO LESS THAN 18″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-HRC-1	16″	16″ hexagonal columns; gravel concrete (6320 psi); Reinforcement: vertical, eight $^5/_8$″ rebars; horizontal, $^5/_{16}$″ helical winding on $^3/_4$″ pitch; Cover: $^1/_2$″.	140 tons	1 hr. 55 min.			7	1	$1^3/_4$
C-16-HRC-2	16″	16″ hexagonal columns; gravel aggregate concrete (5580 psi); Reinforcement: vertical, eight $^5/_8$″ rebars; horizontal, $^5/_{16}$″ helical winding on $1^3/_4$″ pitch; Cover: $^1/_2$″	124 tons	2 hrs.			7	2	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.
2. Failed on furnace removal.

TABLE 2.1.11—HEXAGONAL REINFORCED CONCRETE COLUMNS DIAMETER — 20″ TO LESS THAN 22″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-HRC-1	20″	20″ hexagonal columns; gravel concrete (6080 psi); Reinforcement: vertical, $^3/_4$″ rebars; horizontal, $^5/_6$″ helical winding on $1^3/_4$″ pitch; Cover: $^1/_2$″.	211 tons	2 hrs.			7	1	2
C-20-HRC-2	20″	20″ hexagonal columns; gravel concrete (5080 psi); Reinforcement: vertical, $^3/_4$″ rebars; horizontal, $^5/_{16}$″ wire on $1^3/_4$″ pitch; Cover: $^1/_2$″.	184 tons	2 hrs. 15 min.			7	2, 3, 4	$2^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Column collapsed on furnace removal.
2. Passed $2^1/_4$-hour fire test.
3. Passed hose stream test.
4. Withstood reload after 48 hours.

TABLE 2.2—ROUND CAST IRON COLUMNS

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-CI-1	7″ O.D.	Column: .6″ minimum metal thickness; unprotected.	—	30 min.		1			1/2
C-7-CI-2	7″ O.D.	Column: .6″ minimum metal thickness concrete filled, outside unprotected.	—	45 min.		1			3/4
C-11-CI-3	11″ O.D.	Column: .6″ minimum metal thickness; Protection: 1 1/2″ portland cement plaster on high ribbed metal lath, 1/2″ broken air space.	—	3 hrs.		1			3
C-11-CI-4	11″ O.D.	Column: .6″ minimum metal thickness; Protection: 2″ concrete other than siliceous aggregate.	—	2 hrs. 30 min.		1			2 1/2
C-12-CI-5	12.5″ O.D.	Column: 7″ O.D. .6″ minimum metal thickness; Protection: 2″ porous hollow tile, 3/4″ mortar between tile and column, outside wire ties.	—	3 hrs.		1			3
C-7-CI-6	7.6″ O.D.	Column: 7″ I.D., 3/10″ minimum metal thickness, concrete filled unprotected.	—	30 min.		1			1/2
C-8-CI-7	8.6″ O.D.	Column: 8″ I.D., 3/10″ minimum metal thickness; concrete filled reinforced with four 3 1/2″ × 3/8″ angles, in fill; unprotected outside.	—	1 hr.		1			1

For SI: 1 inch = 25.4 mm.

FIGURE 2.3—STEEL COLUMNS—GYPSUM ENCASEMENTS

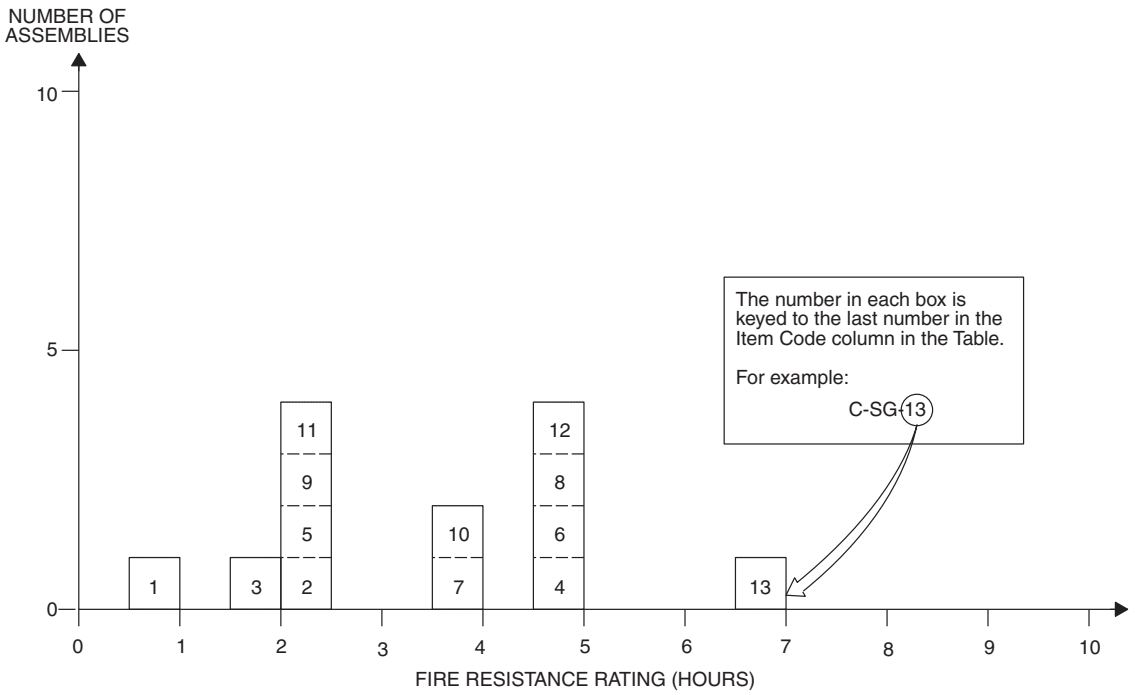


TABLE 2.3—STEEL COLUMNS—GYPSUM ENCASEMENTS

ITEM CODE	MINIMUM AREA OF SOLID MATERIAL	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-SG-1	—	Steel protected with $^3/_4$″ 1:3 sanded gypsum or 1″ 1:2$^1/_2$ portland cement plaster on wire or lath; one layer.	—	1 hr.		1			1
C-SG-2	—	Same as C-SG-1; two layers.	—	2 hrs. 30 min.		1			2$^1/_2$
C-SG-3	130 in.^{2}	2″ solid blocks with wire mesh in horizontal joints; 1″ mortar on flange; reentrant space filled with block and mortar.	—	2 hrs.		1			2
C-SG-4	150 in.^{2}	Same as C-130-SG-3 with $^1/_2$″ sanded gypsum plaster.	—	5 hrs.		1			5
C-SG-5	130 in.^{2}	2″ solid blocks with wire mesh in horizontal joints; 1″ mortar on flange; reentrant space filled with gypsum concrete.	—	2 hrs. 30 min.		1			2$^1/_2$
C-SG-6	150 in.^{2}	Same as C-130-SG-5 with $^1/_2$″ sanded gypsum plaster.	—	5 hrs.		1			5
C-SG-7	300 in.^{2}	4″ solid blocks with wire mesh in horizontal joints; 1″ mortar on flange; reentrant space filled with block and mortar.	—	4 hrs.		1			4
C-SG-8	300 in.^{2}	Same as C-300-SG-7 with reentrant space filled with gypsum concrete.	—	5 hrs.		1			5

TABLE 2.3—STEEL COLUMNS—GYPSUM ENCASEMENTS—continued

ITEM CODE	MINIMUM AREA OF SOLID MATERIAL	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-SG-9	85 in.^{2}	2″ solid blocks with cramps at horizontal joints; mortar on flange only at horizontal joints; reentrant space not filled.	—	2 hrs. 30 min.		1			$2^1/_2$
C-SG-10	105 in.^{2}	Same as C-85-SG-9 with $^1/_2$″ sanded gypsum plaster.	—	4 hrs.		1			4
C-SG-11	95 in.^{2}	3″ hollow blocks with cramps at horizontal joints; mortar on flange only at horizontal joints; reentrant space not filled.	—	2 hrs. 30 min.		1			$2^1/_2$
C-SG-12	120 in.^{2}	Same as C-95-SG-11 with $^1/_2$″ sanded gypsum plaster.	—	5 hrs.		1			5
C-SG-13	130 in.^{2}	2″ neat fibered gypsum reentrant space filled poured solid and reinforced with 4″ × 4″ wire mesh $^1/_2$″ sanded gypsum plaster.	—	7 hrs.		1			7

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm^2.

TABLE 2.4—TIMBER COLUMNS
MINIMUM DIMENSION

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-TC-1	11″	With unprotected steel plate cap.	—	30 min.		1		1, 2	$^1/_2$
C-11-TC-2	11″	With unprotected cast iron cap and pintle.	—	45 min.		1		1, 2	$^3/_4$
C-11-TC-3	11″	With concrete or protected steel or cast iron cap.	—	1 hr. 15 min.		1		1, 2	$1^1/_4$
C-11-TC-4	11″	With $^3/_8$″ gypsum wallboard over column and over cast iron or steel cap.	—	1 hr. 15 min.		1		1, 2	$1^1/_4$
C-11-TC-5	11″	With 1″ portland cement plaster on wire lath over column and over cast iron or steel cap; $^3/_4$″ air space.	—	2 hrs.		1		1, 2	2

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm^2.

Notes:

1. Minimum area: 120 square inches.
2. Type of wood: long leaf pine or Douglas fir.

TABLE 2.5.1.1—STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION LESS THAN 6″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-5-SC-1	5″	5″ × 6″ outer dimensions; 4″ × 3″ × 10 lbs. “H” beam; Protection: gravel concrete (4900 psi) 6″ × 4″ - 13 SWG mesh.	12 tons	1 hr. 29 min.			7	1	$1^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.

TABLE 2.5.1.2—STEEL COLUMNS—CONCRETE ENCASEMENTS 6″ TO LESS THAN 8″ THICK

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SC-1	7″	7″ × 8″ column; 4″ × 3″ × 10 lbs. “H” beam; Protection: brick filled concrete (6220 psi); 6″ × 4″ mesh - 13 SWG; 1″ below column surface.	12 tons	2 hrs. 46 min.			7	1	3
C-7-SC-2	7″	7″ × 8″ column; 4″ × 3″ × 10 lbs. “H” beam; Protection: gravel concrete (5140 psi); 6″ × 4″ 13 SWG mesh 1″ below surface.	12 tons	3 hrs. 1 min.			7	1	$2^3/_4$
C-7-SC-3	7″	7″ × 8″ column; 4″ × 3″ × 10 lbs. “H” beam; Protection: concrete (4540 psi); 6″ × 4″ - 13 SWG mesh; 1″ below column surface.	12 tons	3 hrs. 9 min.			7	1	3
C-7-SC-4	7″	7″ × 8″ column; 4″ × 3″ × 10 lbs. “H” beam; Protection: gravel concrete (5520 psi); 4″ × 4″ mesh; 16 SWG.	12 tons	2 hrs. 50 min.			7	1	$2^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.

FIGURE 2.5.1.3—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 8″ TO LESS THAN 10″

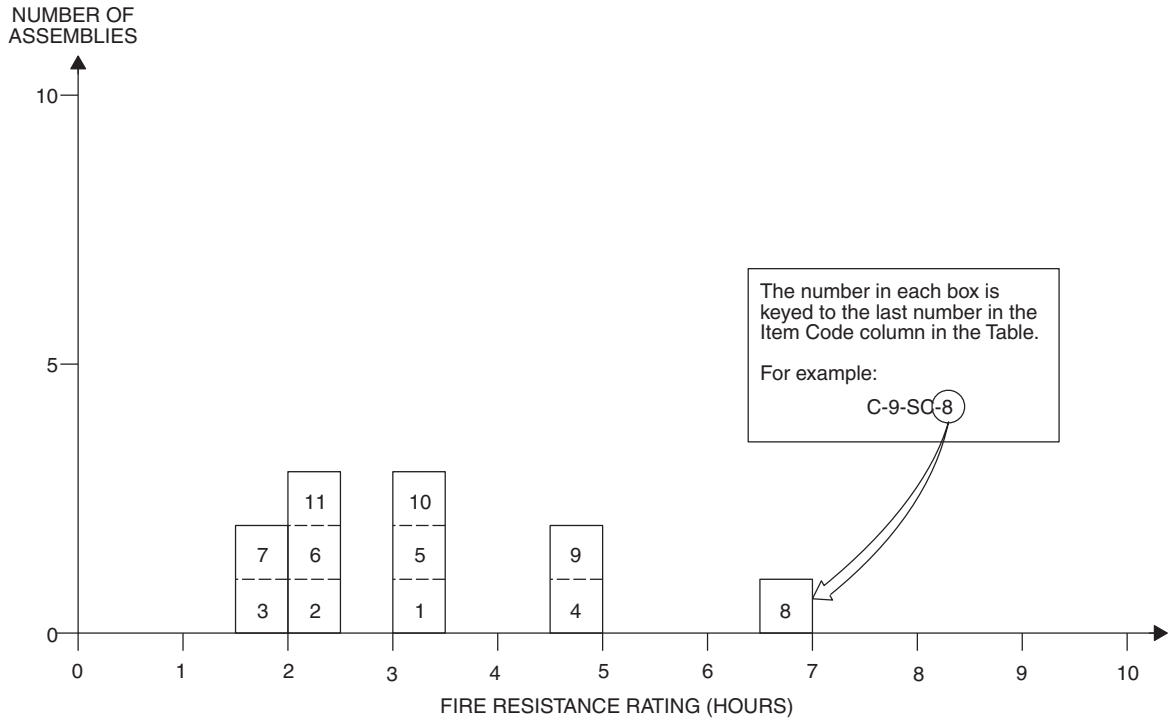


TABLE 2.5.1.3—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 8″ TO LESS THAN 10″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SC-1	$8^1/_2$″	$8^1/_2$″ × 10″ column; 6″ × $4^1/_2$″ × 20 lbs. “H” beam; Protection: gravel concrete (5140 psi); 6″ × 4″ - 13 SWG mesh.	39 tons	3 hrs. 8 min.			7	1	3
C-8-SC-2	8″	8″ × 10″ column; 8″ × 6″ × 35 lbs. “I” beam; Protection: gravel concrete (4240 psi); 6″ × 4″ - 13 SWG mesh; $^1/_2$″ cover.	90 tons	2 hrs. 1 min.			7	1	2
C-8-SC-3	8″	8″ × 10″ concrete encased column; 8″ × 6″ × 35 lbs. “H” beam; protection: aggregate concrete (3750 psi); 4″ mesh - 16 SWG reinforcing $^1/_2$″ below column surface.	90 tons	1 hr. 58 min.			7	1	$1^3/_4$
C-8-SC-4	8″	6″ × 6″ steel column; 2″ outside protection; Group I.	—	5 hrs.		1		2	5
C-8-SC-5	8″	6″ × 6″ steel column; 2″ outside protection; Group II.	—	3 hrs. 30 min.		1		2	$3^1/_2$
C-8-SC-6	8″	6″ × 6″ steel column; 2″ outside protection; Group III.	—	2 hrs. 30 min.		1		2	$2^1/_2$
C-8-SC-7	8″	6″ × 6″ steel column; 2″ outside protection; Group IV.	—	1 hr. 45 min.		1		2	$1^3/_4$

(Continued)

TABLE 2.5.1.3—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 8″ TO LESS THAN 10″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-9-SC-8	9″	6″ × 6″ steel column; 3″ outside protection; Group I.	—	7 hrs.		1		2	7
C-9-SC-9	9″	6″ × 6″ steel column; 3" outside protection; Group II.	—	5 hrs.		1		2	5
C-9-SC-10	9″	6″ × 6″ steel column; 3″ outside protection; Group III.	—	3 hrs. 30 min.		1		2	$3^1/_2$
C-9-SC-11	9″	6″ × 6″ steel column; 3″ outside protection; Group IV.	—	2 hrs. 30 min.		1		2	$2^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

FIGURE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 10″ TO LESS THAN 12″

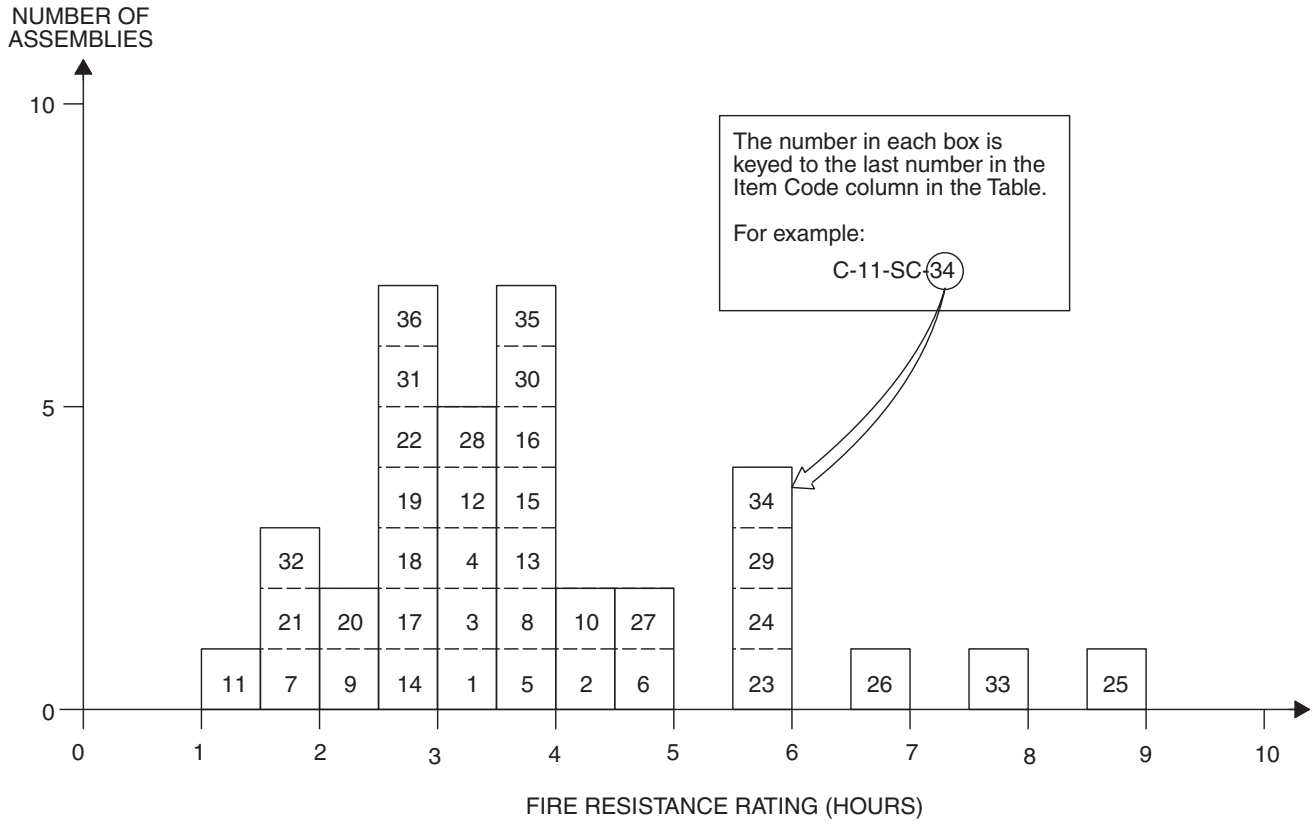


TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-1	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: gravel aggregate concrete (3640 psi); Mesh 6″ × 4″ 13 SWG, 1″ below column surface.	90 tons	3 hrs. 7 min.			7	1,2	3
C-10-SC-2	10″	10″ × 16″ column; 8″ × 6″ × 35 lbs. “H” beam; Protection: clay brick concrete (3630 psi); 6″ × 4″ mesh; 13 SWG, 1" below column surface.	90 tons	4 hrs. 6 min.			7	2	4
C-10-SC-3	10″	10″ × 12″ column; 8″ × 6″ × 35 lbs. “H” beam; Protection: crushed stone and sand concrete (3930 psi); 6″ × 4″ - 13 SWG mesh; 1″ below column surface.	90 tons	3 hrs. 17 min.			7	2	$3^1/_4$
C-10-SC-4	10″	10″ × 12″ column; 8″ × 6″ × 35 lbs. “H” beam; Protection: crushed basalt and sand concrete (4350 psi); 6″ × 4″ - 13 SWG mesh; 1″ below column surface.	90 tons	3 hrs. 22 min.			7	2	$3^1/_3$

(Continued)

TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 10″ TO LESS THAN 12″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-5	10″	10″ × 12″ column; 8″ × 6″ × 35 lbs. "H" beam; Protection: gravel aggregate concrete (5570 psi); 6″ × 4″ mesh; 13 SWG.	90 tons	3 hrs. 39 min.			7	2	$3^1/_2$
C-10-SC-6	10″	10″ × 16″ column; 8″ × 6″ × 35 lbs. "I" beam; Protection: gravel concrete (4950 psi); mesh; 6″ × 4″ 13 SWG 1″ below column surface.	90 tons	4 hrs. 32 min.			7	2	$4^1/_2$
C-10-SC-7	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. "H" beam; Protection: aggregate concrete (1370 psi); 6″ × 4″ mesh; 13 SWG reinforcing 1" below column surface.	90 tons	2 hrs.			7	3, 4	2
C-10-SC-8	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. "H" column; Protection: aggregate concrete (4000 psi); 13 SWG iron wire loosely around column at 6″ pitch about 2″ beneath column surface.	86 tons	3 hrs. 36 min.			7	2	$3^1/_2$
C-10-SC-9	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. "H" beam; Protection: aggregate concrete (3290 psi); 2″ cover minimum.	86 tons	2 hrs. 8 min.			7	2	2
C-10-SC-10	10″	10″ × 14″ concrete encased steel column; 8″ × 6″ × 35 lbs. "H" column; Protection: crushed brick filled concrete (5310 psi); 6″ × 4″ mesh; 13 SWG reinforcement 1″ below column surface.	90 tons	4 hrs. 28 min.			7	2	$4^1/_3$
C-10-SC-11	10″	10″ × 14″ concrete encased column; 8″ × 6″ 35 lbs. "H" beam; Protection: aggregate concrete (342 psi); 6″ × 4″ mesh; 13 SWG reinforcement 1″ below surface.	90 tons	1 hr. 2 min.			7	2	1
C-10-SC-12	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. "H" beam; Protection: aggregate concrete (4480 psi); four $^3/_8$″ vertical bars at "H" beam edges with $^3/_{16}$″ spacers at beam surface at 3′ pitch and $^3/_{16}$″ binders at 10″ pitch; 2″ concrete cover.	90 tons	3 hrs. 2 min.			7	2	3

(Continued)

TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 10″ TO LESS THAN 12″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-13	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: aggregate concrete (5070 psi); 6″ × 4″ mesh; 13 SWG reinforcing at 6″ beam sides wrapped and held by wire ties across (open) 8″ beam face; reinforcements wrapped in 6″ × 4″ mesh; 13 SWG throughout; $^1/_2$″ cover to column surface.	90 tons	3 hrs. 59 min.			7	2	$3^3/_4$
C-10-SC-14	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: aggregate concrete (4410 psi); 6″ × 4″ mesh; 13 SWG reinforcement $1^1/_4$″ below column surface; $^1/_2$″ limestone cement plaster with $^3/_8$″ gypsum plaster finish.	90 tons	2 hrs. 50 min.			7	2	$2^3/_4$
C-10-SC-15	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: crushed clay brick filled concrete (4260 psi); 6″ × 4″ mesh; 13 SWG reinforcing 1″ below column surface.	90 tons	3 hrs. 54 min.			7	2	$3^3/_4$
C-10-SC-16	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: limestone aggregate concrete (4350 psi); 6″ × 4″ mesh; 13 SWG reinforcing 1″ below column surface.	90 tons	3 hrs. 54 min.			7	2	$3^3/_4$
C-10-SC-17	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: limestone aggregate concrete (5300 psi); 6″ × 4″; 13 SWG wire mesh 1″ below column surface.	90 tons	3 hrs.			7	4, 5	3
C-10-SC-18	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: limestone aggregate concrete (4800 psi) with 6″ × 4″; 13 SWG mesh reinforcement 1″ below surface.	90 tons	3 hrs.			7	4, 5	3
C-10-SC-19	10″	10″ × 14″ concrete encased steel column; 12″ × 8″ × 65 lbs. “H” beam; Protection: aggregate concrete (3900 psi); 4″ mesh; 16 SWG reinforcing $^1/_2$″ below column surface.	118 tons	2 hrs. 42 min.			7	2	2
C-10-SC-20	10″	10″ × 14″ concrete encased steel column; 12″ × 8″ × 65 lbs. “H” beam; Protection: aggregate concrete (4930 psi); 4″ mesh; 16 SWG reinforcing $^1/_2$″ below column surface.	177 tons	2 hrs. 8 min.			7	2	2

(Continued)

TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 10″ TO LESS THAN 12″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-21	$10^3/_8$″	$10^3/_8$″ × $12^3/_8$″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: aggregate concrete (835 psi) with 6″ × 4″ mesh; 13 SWG reinforcing $1^3/_{16}$″ below column surface; $^3/_{16}$″ gypsum plaster finish.	90 tons	2 hrs.			7	3, 4	2
C-11-SC-22	11″	11″ × 13″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: “open texture” brick filled concrete (890 psi) with 6″ × 4″ mesh; 13 SWG reinforcing $1^1/_2$″ below column surface; $^3/_8$″ lime cement plaster; $^1/_8$″ gypsum plaster finish.	90 tons	3 hrs.			7	6, 7	3
C-11-SC-23	11″	11″ × 12″ column; 4″ × 3″ × 10 lbs. “H” beam; gravel concrete (4550 psi); 6″ × 4″ - 13 SWG mesh reinforcing; 1″ below column surface.	12 tons	6 hrs.			7	7, 8	6
C-11-SC-24	11″	11″ × 12″ column; 4″ × 3″ × 10 lbs. “H” beam; Protection: gravel aggregate concrete (3830 psi); with 4″ × 4″ mesh; 16 SWG, 1″ below column surface.	16 tons	5 hrs. 32 min.			7	2	$5^1/_2$
C-10-SC-25	10″	6″ × 6″ steel column with 4″ outside protection; Group I.	—	9 hrs.		1		9	9
C-10-SC-26	10″	Description as per C-SC-25; Group II.	—	7 hrs.		1		9	7
C-10-SC-27	10″	Description as per C-10-SC-25; Group III.	—	5 hrs.		1		9	5
C-10-SC-28	10″	Description as per C-10-SC-25; Group IV.	—	3 hrs. 30 min.		1		9	$3^1/_2$
C-10-SC-29	10″	8″ × 8″ steel column with 2″ outside protection; Group I.	—	6 hrs.		1		9	6
C-10-SC-30	10″	Description as per C-10-SC-29; Group II.	—	4 hrs.		1		9	4
C-10-SC-31	10″	Description as per C-10-SC-29; Group III.	—	3 hrs.		1		9	3
C-10-SC-32	10″	Description as per C-10-SC-29; Group IV.	—	2 hrs.		1		9	2
C-11-SC-33	11″	8″ × 8″ steel column with 3″ outside protection; Group I.	—	8 hrs.		1		9	8
C-11-SC-34	11″	Description as per C-10-SC-33; Group II.	—	6 hrs.		1		9	6
C-11-SC-35	11″	Description as per C-10-SC-33; Group III.	—	4 hrs.		1		9	4

(Continued)

TABLE 2.5.1.4—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 10″ TO LESS THAN 12″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-SC-36	11″	Description as per C-10-SC-33; Group IV.	—	3 hrs.		1		9	3

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Tested under total restraint load to prevent expansion - minimum load 90 tons.
2. Failure mode - collapse.
3. Passed 2-hour fire test (Grade "C," British).
4. Passed hose stream test.
5. Column tested and passed 3-hour grade fire resistance (British).
6. Column passed 3-hour fire test.
7. Column collapsed during hose stream testing.
8. Column passed 6-hour fire test.
9. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

FIGURE 2.5.1.5—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 12″ TO LESS THAN 14″

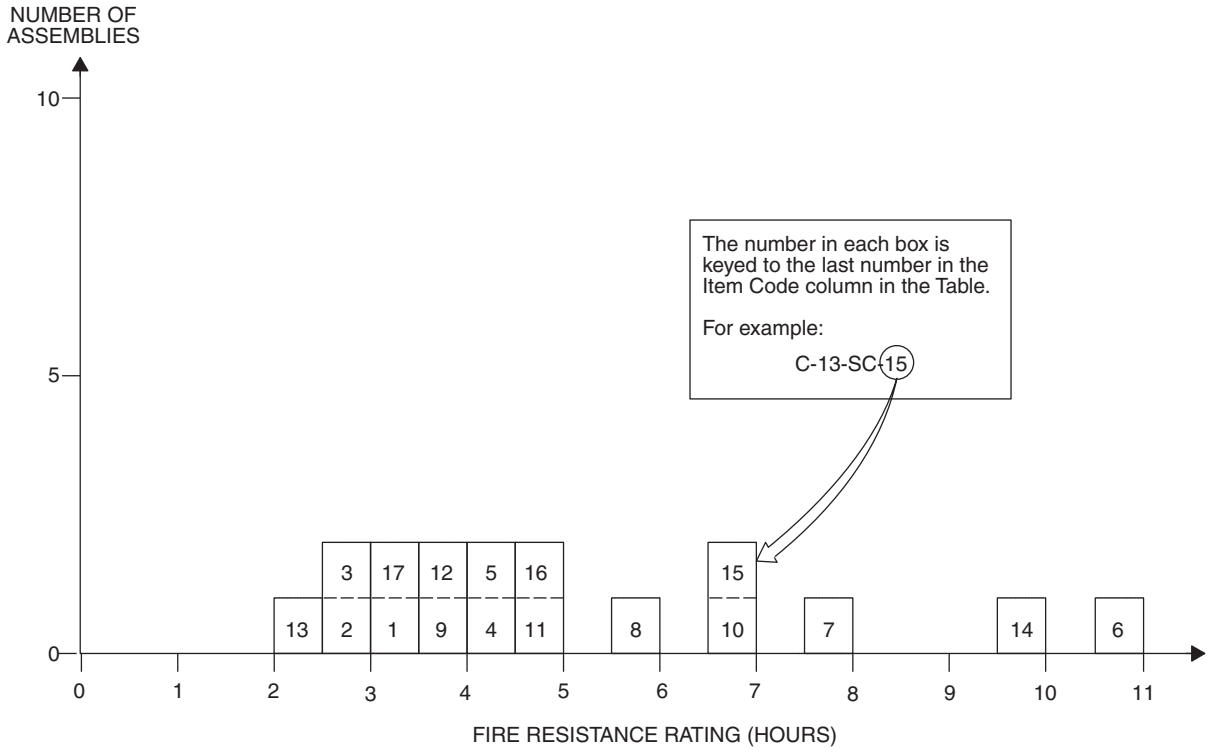


TABLE 2.5.1.5—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SC-1	12″	12″ × 14″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” beam; Protection: aggregate concrete (4150 psi) with 4″ mesh; 16 SWG reinforcing 1″ below column surface.	120 tons	3 hrs. 24 min.			7	1	$3^1/_3$
C-12-SC-2	12″	12″ × 16″ concrete encased column; 8″ × 6″ × 35 lbs. “H” beam; Protection: aggregate concrete (4300 psi) with 4″ mesh; 16 SWG reinforcing 1″ below column surface.	90 tons	2 hrs. 52 min.			7	1	$2^3/_4$
C-12-SC-3	12″	12″ × 16″ concrete encased steel column; 12″ × 8″ × 65 lbs. “H” column; Protection: gravel aggregate concrete (3550 psi) with 4″ mesh; 16 SWG reinforcement 1″ below column surface.	177 tons	2 hrs. 31 min.			7	1	$2^1/_2$
C-12-SC-4	12″	12″ × 16″ concrete encased column; 12″ × 8″ × 65 lbs. “H” beam; Protection: aggregate concrete (3450 psi) with 4″ mesh; 16 SWG reinforcement 1″ below column surface.	118 tons	4 hrs. 4 min.			7	1	4

(Continued)

TABLE 2.5.1.5—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 12″ TO LESS THAN 14″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SC-5	$12^1/_2$″	$12^1/_2$″ × 14″ column; 6″ × $4^1/_2$″ × 20 lbs. “H” beam; Protection: gravel aggregate concrete (3750 psi) with 4″ × 4″ mesh; 16 SWG reinforcing 1″ below column surface.	52 tons	4 hrs. 29 min.			7	1	$4^1/_3$
C-12-SC-6	12″	8″ × 8″ steel column; 2″ outside protection; Group I.	—	11 hrs.			1	2	11
C-12-SC-7	12″	Description as per C-12-SC-6; Group II.	—	8 hrs.		1		2	8
C-12-SC-8	12″	Description as per C-12-SC-6; Group III.	—	6 hrs.		1		2	6
C-12-SC-9	12″	Description as per C-12-SC-6; Group IV.	—	4 hrs.		1		2	4
C-12-SC-10	12″	10″ × 10″ steel column; 2″ outside protection; Group I.	—	7 hrs.		1		2	7
C-12-SC-11	12″	Description as per C-12-SC-10; Group II.	—	5 hrs.		1		2	5
C-12-SC-12	12″	Description as per C-12-SC-10; Group III.	—	4 hrs.		1		2	4
C-12-SC-13	12″	Description as per C-12-SC-10; Group IV.	—	2 hrs. 30 min.		1		2	$2^1/_2$
C-13-SC-14	13″	10″ × 10″ steel column; 3″ outside protection; Group I.	—	10 hrs.		1		2	10
C-13-SC-15	13″	Description as per C-12-SC-14; Group II.	—	7 hrs.		1		2	7
C-13-SC-16	13″	Description as per C-12-SC-14; Group III.	—	5 hrs.		1		2	5
C-13-SC-17	13″	Description as per C-12-SC-14; Group IV.	—	3 hrs. 30 min.		1		2	$3^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./$yd.^2$, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./$yd.^2$, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

FIGURE 2.5.1.6—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 14″ TO LESS THAN 16″

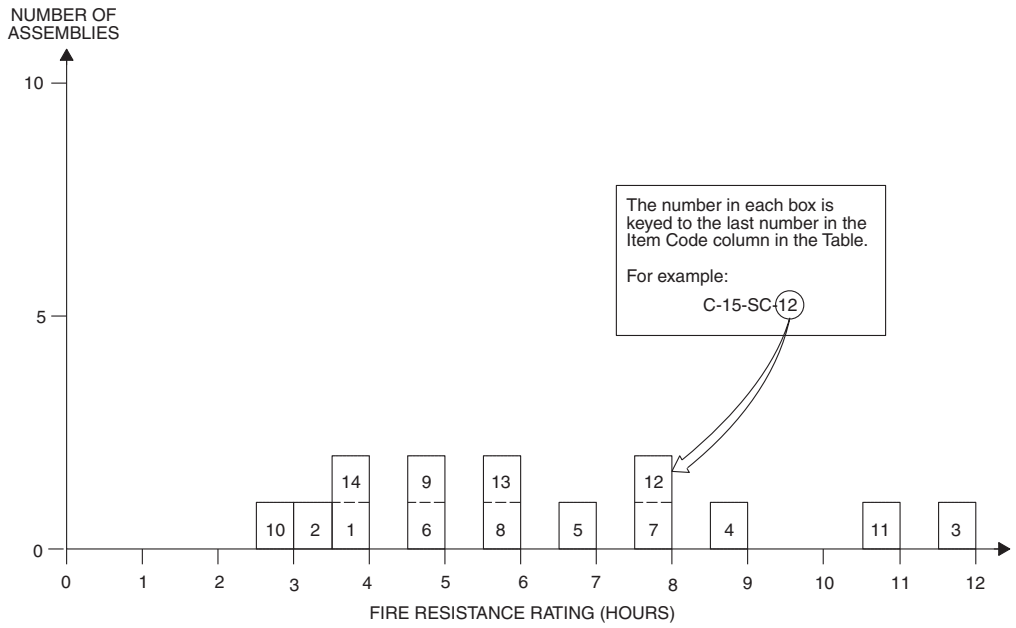


TABLE 2.5.1.6—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 14″ TO LESS THAN 16″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-SC-1	14″	24″ × 16″ concrete encased steel column; 8″ × 6″ × 35 lbs. “H” column; Protection: aggregate concrete (4240 psi); 4″ mesh - 16 SWG reinforcing 1″ below column surface.	90 tons	3 hrs. 40 min.			7	1	3
C-14-SC-2	14″	14″ × 18″ concrete encased steel column; 12″ × 8″ × 65 lbs. “H” beam; Protection: gravel aggregate concrete (4000 psi) with 4″ - 16 SWG wire mesh reinforcement 1″ below column surface.	177 tons	3 hrs. 20 min.			7	1	3
C-14-SC-3	14″	10″ × 10″ steel column; 4″ outside protection; Group I.	—	12 hrs.		1		2	12
C-14-SC-4	14″	Description as per C-14-SC-3; Group II.	—	9 hrs.		1		2	9
C-14-SC-5	14″	Description as per C-14-SC-3; Group III.	—	7 hrs.		1		2	7
C-14-SC-6	14″	Description as per C-14-SC-3; Group IV.	—	5 hrs.		1		2	5
C-14-SC-7	14″	12″ × 12″ steel column; 2″ outside protection; Group I.	—	8 hrs.		1		2	8
C-14-SC-8	14″	Description as per C-14-SC-7; Group II.	—	6 hrs.		1		2	6

(Continued)

TABLE 2.5.1.6—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 14″ TO LESS THAN 16″—continued

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-SC-9	14″	Description as per C-14-SC-7; Group III.	—	5 hrs.		1		2	5
C-14-SC-10	14″	Description as per C-14-SC-7; Group IV	—	3 hrs.		1		2	3
C-15-SC-11	15″	12″ × 12″ steel column; 3″ outside protection; Group I.	—	11 hrs.		1		2	11
C-15-SC-12	15″	Description as per C-15-SC-11; Group II.	—	8 hrs.		1		2	8
C-15-SC-13	15″	Description as per C-15-SC-11; Group III.	—	6 hrs.		1		2	6
C-15-SC-14	15″	Description as per C-15-SC-11; Group IV.	—	4 hrs.		1		2	4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

TABLE 2.5.1.7—STEEL COLUMNS—CONCRETE ENCASEMENTS MINIMUM DIMENSION 16″ TO LESS THAN 18″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-SC-13	16″	12″ × 12″ steel column; 4″ outside protection; Group I.	—	14 hrs.		1		1	14
C-16-SC-2	16″	Description as per C-16-SC-1; Group II.	—	10 hrs.		1		1	10
C-16-SC-3	16″	Description as per C-16-SC-1; Group III.	—	8 hrs.		1		1	8
C-16-SC-4	16″	Description as per C-16-SC-1; Group IV.	—	5 hrs.		1		1	5

For SI: 1 inch = 25.4 mm.

Notes:

1. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.^{2}, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

TABLE 2.5.2.1—STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SB-1	$10^1/_2$″	$10^1/_2$″ × 13″ brick encased steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection. Fill of broken brick and mortar; 2″ brick on edge; joints broken in alternate courses; cement-sand grout; 13 SWG wire reinforcement in every third horizontal joint.	90 tons	3 hrs. 6 min.			7	1	3
C-10-SB-2	$10^1/_2$″	$10^1/_2$″ × 13″ brick encased steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 2″ brick; joints broken in alternate courses; cement-sand grout; 13 SWG iron wire reinforcement in alternate horizontal joints.	90 tons	2 hrs.			7	2, 3, 4	2
C-10-SB-3	10″	10″ × 12″ block encased columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 2″ foamed slag concrete blocks; 13 SWG wire at each horizontal joint; mortar at each joint.	90 tons	2 hrs.			7	5	2
C-10-SB-4	$10^1/_2$″	$10^1/_2$″ × 12″ block encased steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: gravel aggregate concrete fill (unconsolidated) 2″ thick hollow clay tiles with mortar at edges.	86 tons	56 min.			7	1	$^3/_4$
C-10-SB-5	$10^1/_2$″	$10^1/_2$″ × 12″ block encased steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 2″ hollow clay tiles with mortar at edges.	86 tons	22 min.			7	1	$^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.
2. Passed 2-hour fire test (Grade “C” - British).
3. Passed hose stream test.
4. Passed reload test.
5. Passed 2-hour fire exposure but collapsed immediately following hose stream test.

TABLE 2.5.2.2—STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SB-1	12″	12″ × 15″ brick encased steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: $2^5/_8$″ thick brick; joints broken in alternate courses; cement-sand grout; fill of broken brick and mortar.	90 tons	1 hr. 49 min.			7	1	$1^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode – collapse.

TABLE 2.5.2.3—STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS MINIMUM DIMENSION 14″ TO LESS THAN 16″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-15-SB-1	15″	15″ × 17″ brick encased steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: $4^1/_2$″ thick brick; joints broken in alternate courses; cement-sand grout; fill of broken brick and mortar.	45 tons	6 hrs.			7	1	6
C-15-SB-2	15″	15″ × 17″ brick encased steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection. Fill of broken brick and mortar; $4^1/_2$″ brick; joints broken in alternate courses; cement-sand grout.	86 tons	6 hrs.			7	2, 3, 4	6
C-15-SB-3	15″	15″ × 18″ brick encased steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: $4^1/_2$″ brick work; joints alternating; cement-sand grout.	90 tons	4 hrs.			7	5, 6	4
C-15-SB-4	14″	14″ × 16″ block encased steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 4″ thick foam slag concrete blocks; 13 SWG wire reinforcement in each horizontal joint; mortar in joints.	90 tons	5 hrs. 52 min.			7	7	$4^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Only a nominal load was applied to specimen.
2. Passed 6-hour fire test (Grade “A” - British).
3. Passed (6 minute) hose stream test.
4. Reload not specified.
5. Passed 4-hour fire exposure.
6. Failed by collapse between first and second minute of hose stream exposure.
7. Mode of failure - collapse.

TABLE 2.5.3.1—STEEL COLUMNS—PLASTER ENCASEMENTS MINIMUM DIMENSION 6″ TO LESS THAN 8″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SP-1	$7^1/_2$″	$7^1/_2 \times 9^1/_2$″ plaster protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 24 SWG wire metal lath; $1^1/_4$″ lime plaster.	90 tons	57 min.			7	1	$^3/_4$
C-7-SP-2	$7^7/_8$″	$7^7/_8$″ × 10″ plaster protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: $^3/_8$″ gypsum bal wire wound with 16 SWG wire helically wound at 4″ pitch; $^1/_2$″ gypsum plaster.	90 tons	1 hr. 13 min.			7	1	1
C-7-SP-3	$7^1/_4$″	$7^1/_4$″ × $9^3/_8$″ plaster protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: $^3/_8$″ gypsum board; wire helically wound 16 SWG at 4″ pitch; $^1/_4$″ gypsum plaster finish.	90 tons	1 hr. 14 min.			7	1	1

Notes:

1. Failure mode – collapse.

TABLE 2.5.3.2—STEEL COLUMNS—PLASTER ENCASEMENTS MINIMUM DIMENSION 8″ TO LESS THAN 10″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SP-1	8″	8″ × 10″ plaster protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 24 SWG wire lath; 1″ gypsum plaster.	86 tons	1 hr. 23 min.			7	1	$1^1/_4$
C-8-SP-2	$8^1/_2$″	$8^1/_2$″ × $10^1/_2$″ plaster protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 24 SWG metal lath wrap; $1^1/_4$″ gypsum plaster.	90 tons	1 hr. 36 min.			7	1	$1^1/_2$
C-9-SP-3	9″	9″ × 11″ plaster protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 24 SWG metal lath wrap; $^1/_8$″ M.S. ties at 12″ pitch wire netting $1^1/_2$″ × 22 SWG between first and second plaster coats; $1^1/_2$″ gypsum plaster.	90 tons	1 hr. 33 min.			7	1	$1^1/_2$
C-8-SP-4	$8^3/_4$″	$8^3/_4$″ × $10^3/_4$″ plaster protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: $^3/_4$″ gypsum board; wire wound spirally (#16 SWG) at $1^1/_2$″ pitch; $^1/_2$″ gypsum plaster.	90 tons	2 hrs.			7	2, 3, 4	2

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.
2. Passed 2 hour fire exposure test (Grade “C” - British).
3. Passed hose stream test.

TABLE 2.5.4.1—STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS MINIMUM DIMENSION 6″ TO LESS THAN 8″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SM-1	$7^5/_8$″	$7^5/_8$″ × $9^1/_2$″ (asbestos plaster) protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 20 gage $^1/_2$″ metal lath; $^9/_{16}$″ asbestos plaster (minimum).	90 tons	1 hr. 52 min.			7	1	$1^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode - collapse.

TABLE 2.5.4.2—STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS MINIMUM DIMENSION 8″ TO LESS THAN 10″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-9-SM-1	$9^5/_8$″	$9^5/_8$″ × $11^3/_8$″ asbestos slab and cement plaster protected columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: 1″ asbestos slab; wire wound; $^5/_8$″ plaster.	90 tons	2 hrs.			7	1, 2	2

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Passed 2 hour fire exposure test.
2. Collapsed during hose stream test.

TABLE 2.5.4.3—STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-SM-1	$11^1/_2$″	$11^1/_2$″ × $13^1/_2$″ wood wool and plaster protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: wood-wool-cement paste as fill and to 2″ cover over beam; $^3/_4$″ gypsum plaster finish.	90 tons	2 hrs.			7	1, 2, 3	2
C-10-SM-1	10″	10″ × 12″ asbestos protected steel columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: sprayed on asbestos paste to 2″ cover over column.	90 tons	4 hrs.			7	2, 3, 4	4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Passed 2 hour fire exposure (Grade “C” - British).
2. Passed hose stream test.
3. Passed reload test.
4. Passed 4 hour fire exposure test.

TABLE 2.5.4.4—STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SM-1	12″	12″ × $14^1/_4$″ cement and asbestos protected columns; 8″ × 6″ × 35 lbs. “H” beam; Protection: fill of asbestos packing pieces 1″ thick 1' 3″ o.c.; cover of 2″ molded asbestos inner layer; 1″ molded asbestos outer layer; held in position by 16 SWG nichrome wire ties; wash of refractory cement on outer surface.	86 tons	4 hrs. 43 min.			7	1, 2, 3	$4^2/_3$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Passed 4 hour fire exposure (Grade “B” - British).
2. Passed hose stream test.
3. Passed reload test.

SECTION III—FLOOR/CEILING ASSEMBLIES

FIGURE 3.1—FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

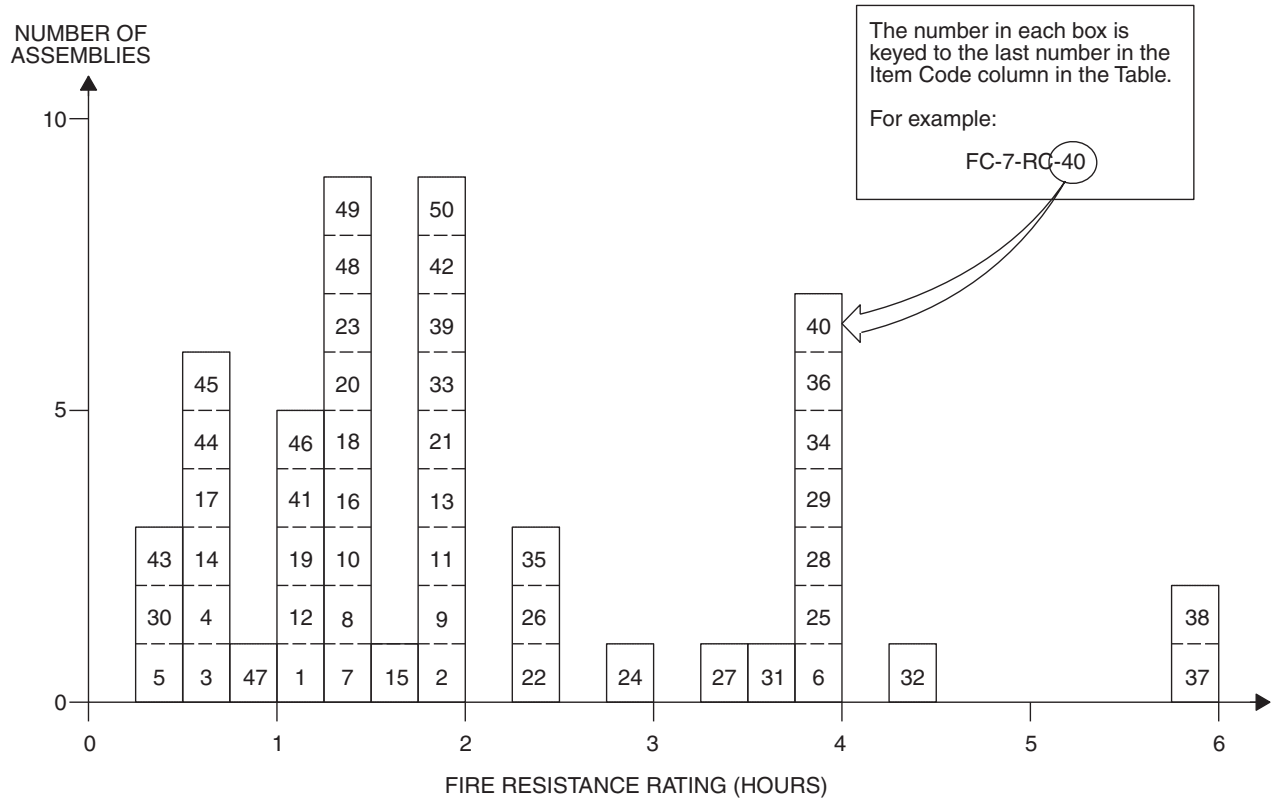


TABLE 3.1—FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-3-RC-1	$3\frac{3}{4}''$	$3\frac{3}{4}''$ thick floor; $3\frac{1}{4}''$ (5475 psi) concrete deck; $\frac{1}{2}''$ plaster under deck; $\frac{3}{8}''$ main reinforcement bars at $5\frac{1}{2}''$ pitch with $\frac{7}{8}''$ concrete cover; $\frac{3}{8}''$ main reinforcement bars at $4\frac{1}{2}''$ pitch perpendicular with $\frac{1}{2}''$ concrete cover; 13′1″ span restrained.	195 psf	24 min.			7	1, 2	1
F/C-3-RC-2	$3\frac{1}{4}''$	$3\frac{1}{4}''$ deep (3540 psi) concrete deck; $\frac{3}{8}''$ main reinforcement bars at $5\frac{1}{2}''$ pitch with $\frac{7}{8}''$ cover; $\frac{3}{8}''$ main reinforcement bars at $4\frac{1}{2}''$ pitch perpendicular with $\frac{1}{2}''$ cover; 13′1″ span restrained.	195 psf	2 hrs.			7	1, 3, 4	$1\frac{3}{4}$
F/C-3-RC-3	$3\frac{1}{4}''$	$3\frac{1}{4}''$ deep (4175 psi) concrete deck; $\frac{3}{8}''$ main reinforcement bars at $5\frac{1}{2}''$ pitch with $\frac{7}{8}''$ cover; $\frac{3}{8}''$ main reinforcement bars at $4\frac{1}{2}''$ pitch perpendicular with $\frac{1}{2}''$ cover; 13′1″ span restrained.	195 psf	31 min.			7	1, 5	$\frac{1}{2}$

(Continued)

TABLE 3.1—FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE—continued

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-3-RC-4	3 1/4″	3 1/4″ deep (4355 psi) concrete deck; 3/8″ main reinforcement bars at 5 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 4 1/2″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	195 psf	41 min.			7	1, 5, 6	1/2
F/C-3-RC-5	3 1/4″	3 1/4″ thick (3800 psi) concrete deck; 3/8″ main reinforcement bars at 5 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 4 1/2″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	195 psf	1 hr. 5 min.			7	1, 5	1/4
F/C-4-RC-6	4 1/4″	4 1/4″ thick; 3 1/4″ (4000 psi) concrete deck; 1″ sprayed asbestos lower surface; 3/8″ main reinforcement bars at 5 7/8″ pitch with 7/8″ concrete cover; 3/8″ main reinforcement bars at 4 1/2″ pitch perpendicular with 1/2″ concrete cover; 13′1″ span restrained.	195 psf	4 hrs.			7	1, 7	4
F/C-4-RC-7	4″	4″ (5025 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 3/4″ cover; 3/8″ main reinforcement bars at 3 3/4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	140 psf	1 hr. 16 min.			7	1, 2	1 1/4
F/C-4-RC-8	4″	4″ thick (4905 psi) deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 3/4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	100 psf	1 hr. 23 min.			7	1, 2	1 1/3
F/C-4-RC-9	4″	4″ deep (4370 psi); 1/4″ reinforcement bars at 6″ pitch with 3/4″ cover; 1/4″ main reinforcement bars at 4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	150 psf	2 hrs.			7	1, 3	2
F/C-4-RC-10	4″	4″ thick (5140 psi) deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 3/4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	140 psf	1 hr. 16 min.			7	1, 5	1 1/4
F/C-4-RC-11	4″	4″ thick (4000 psi) concrete deck; 3″ × 1 1/2″ × 4 lbs. R.S.J.; 2′6″ C.R.S.; flush with top surface; 4″ × 6″ x 13 SWG mesh reinforcement 1″ from bottom of slab; 6′6″ span restrained.	150 psf	2 hrs.			7	1, 3	2
F/C-4-RC-12	4″	4″ deep (2380 psi) concrete deck; 3″ × 1 1/2″ × 4 lbs. R.S.J.; 2′6″ C.R.S.; flush with top surface; 4″ × 6″ x 13 SWG mesh reinforcement 1″ from bottom surface; 6′6″ span restrained.	150 psf	1 hr. 3 min.			7	1, 2	1

(Continued)

TABLE 3.1—FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE—continued

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-4-RC-13	4 1/2″	4 1/2″ thick (5200 psi) deck; 1/4″ reinforcement bars at 7 1/4″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 3/4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	140 psf	2 hrs.			7	1, 3	2
F/C-4-RC-14	4 1/2″	4 1/2″ deep (2525 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 3/8″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	150 psf	42 min.			7	1, 5	2/3
F/C-4-RC-15	4 1/2″	4 1/2″ deep (4830 psi) concrete deck; 1 1/2″ × No. 15 gauge wire mesh; 3/8″ reinforcement bars at 15″ pitch with 1″ cover; 1/2″ main reinforcement bars at 6″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	1 hr. 32 min.			7	1, 8	1 1/2
F/C-4-RC-16	4 1/2″	4 1/2″ deep (4595 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	1 hr. 20 min.			7	1, 8	1 1/3
F/C-4-RC-17	4 1/2″	4 1/2″ deep (3625 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	35 min.			7	1, 8	1/2
F/C-4-RC-18	4 1/2″	4 1/2″ deep (4410 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	85 psf	1 hr. 27 min.			7	1, 8	1 1/3
F/C-4-RC-19	4 1/2″	4 1/2″ deep (4850 psi) deck; 3/8″ reinforcement bars at 15″ pitch with 1″ cover; 1/2″ main reinforcement bars at 6″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	2 hrs. 15 min.			7	1, 9	1 1/4
F/C-4-RC-20	4 1/2″	4 1/2″ deep (3610 psi) deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	1 hr. 22 min.			7	1, 8	1 1/3
F/C-5-RC-21	5″	5″ deep; 4 1/2″ (5830 psi) concrete deck; 1/2″ plaster finish bottom of slab; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	69 psf	2 hrs.			7	1, 3	2

(Continued)

TABLE 3.1—FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE—continued

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-5-RC-22	5″	4 1/2″ (5290 psi) concrete deck; 1/2″ plaster finish bottom of slab; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	No load	2 hrs. 28 min.			7	1, 10, 11	2 1/4
F/C-5-RC-23	5″	5″ (3020 psi) concrete deck; 3″ × 1 1/2″ × 4 lbs. R.S.J.; 2' C.R.S. with 1″ cover on bottom and top flanges; 8′ span restrained.	172 psf	1 hr. 24 min.			7	1, 2, 12	1 1/2
F/C-5-RC-24	5 1/2″	5″ (5180 psi) concrete deck; 1/2″ retarded plaster underneath slab; 1/4″ reinforcement bars at 7 1/2″ pitch with 1 3/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1″ cover; 12′ span simply supported.	60 psf	2 hrs. 48 min.			7	1, 10	2 3/4
F/C-6-RC-25	6″	6″ deep (4800 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 7/8″ cover; 13′1″ span restrained.	195 psf	4 hrs.			7	1, 7	4
F/C-6-RC-26	6″	6″ (4650 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	195 psf	2 hrs. 23 min.			7	1, 2	2 1/4
F/C-6-RC-27	6″	6″ deep (6050 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch 7/8″ cover; 3/8″ reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	195 psf	3 hrs. 30 min.			7	1, 10	3 1/2
F/C-6-RC-28	6″	6″ deep (5180 psi) concrete deck; 1/4″ reinforcement bars at 8″ pitch 3/4″ cover; 1/4″ reinforcement bars at 5 1/2″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	150 psf	4 hrs.			7	1, 7	4
F/C-6-RC-29	6″	6″ thick (4180 psi) concrete deck; 4″ × 3″ × 10 lbs. R.S.J.; 2′6″ C.R.S. with 1″ cover on both top and bottom flanges; 13′1″ span restrained.	160 psf	3 hrs. 48 min.			7	1, 10	3 3/4
F/C-6-RC-30	6″	6″ thick (3720 psi) concrete deck; 4″ × 3″ × 10 lbs. R.S.J.; 2′6″ C.R.S. with 1″ cover on both top and bottom flanges; 12′ span simply supported.	115 psf	29 min.			7	1, 5, 13	1/4
F/C-6-RC-31	6″	6″ deep (3450 psi) concrete deck; 4″ × 1 3/4″ × 5 lbs. R.S.J.; 2′6″ C.R.S. with 1″ cover on both top and bottom flanges; 12′ span simply supported.	25 psf	3 hrs. 35 min.			7	1, 2	3 1/2

(Continued)

TABLE 3.1—FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE—continued

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-6-RC-32	6″	6″ deep (4460 psi) concrete deck; 4″ × $1^3/_4$″ × 5 lbs. R.S.J.; 2′ C.R.S.; with 1″ cover on both top and bottom flanges; 12′ span simply supported.	60 psf	4 hrs. 30 min.			7	1, 10	$4^1/_2$
F/C-6-RC-33	6″	6″ deep (4360 psi) concrete deck; 4″ × $1^3/_4$″ × 5 lbs. R.S.J.; 2′ C.R.S.; with 1″ cover on both top and bottom flanges; 13′1″ span restrained.	60 psf	2 hrs.			7	1, 3	2
F/C-6-RC-34	$6^1/_4$″	$6^1/_4$″ thick; $4^3/_4$″ (5120 psi) concrete core; 1″ T&G board flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs. R.S.J.; 3′ C.R.S. flush with top surface concrete; 12′ span simply supported; 2″ × 1′3″ clinker concrete insert.	100 psf	4 hrs.			7	1, 7	4
F/C-6-RC-35	$6^1/_4$″	$4^3/_4$″ (3600 psi) concrete core; 1″ T&G board flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs. R.S.J.; 3′ C.R.S.; flush with top surface concrete; 12′ span simply supported; 2″ × 1′3″ clinker concrete insert.	100 psf	2 hrs. 30 min.			7	1, 5	$2^1/_2$
F/C-6-RC-36	$6^1/_4$″	$4^3/_4$″ (2800 psi) concrete core; 1″ T&G board flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs. R.S.J.; 3′ C.R.S.; flush with top surface concrete; 12″ span simply supported; 2″ × 1′3″ clinker concrete insert.	80 psf	4 hrs.			7	1, 7	4
F/C-7-RC-37	7″	(3640 psi) concrete deck; $^1/_4$″ reinforcement bars at 6″ pitch with $1^1/_2$″ cover; $^1/_4$″ reinforcement bars at 5″ pitch perpendicular with $1^1/_2$″ cover; 13′1″ span restrained.	169 psf	6 hrs.			7	1, 14	6
F/C-7-RC-38	7″	(4060 psi) concrete deck; 4″ × 3″ × 10 lbs. R.S.J.; 2′6″ C.R.S. with $1^1/_2$″ cover on both top and bottom flanges; 4″ × 6″ × 13 SWG mesh reinforcement $1^1/_2$″ from bottom of slab; 13′1″ span restrained.	175 psf	6 hrs.			7	1, 14	6
F/C-7-RC-39	$7^1/_4$″	$5^3/_4$″ (4010 psi) concrete core; 1″ T&G board flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs. R.S.J.; 2′6″ C.R.S.; 1″ down from top surface of concrete; 12′ simply supported span; 2″ × 1′3″ clinker concrete insert.	95 psf	2 hrs.			7	1, 3	2
F/C-7-RC-40	$7^1/_4$″	$5^3/_4$″ (3220 psi) concrete core; 1″ T&G flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs. R.S.J.; 2′6″ C.R.S.; 1″ down from top surface of concrete; 12′ simply supported span; 2″ × 1′3″ clinker concrete insert.	95 psf	4 hrs.			7	1, 7	4

(Continued)

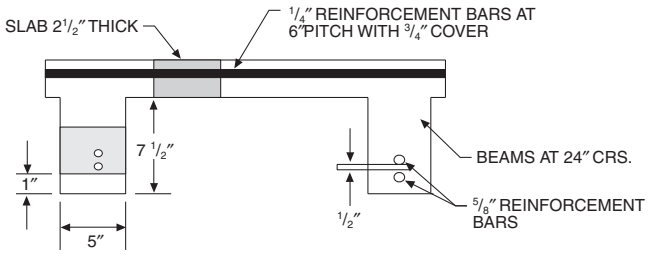
TABLE 3.1—FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE—continued

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-7-RC-41	10″ (2 1/4″ Slab)	Ribbed floor, see Note 15 for details; slab 2 1/2″ deep (3020 psi); 1/4″ reinforcement bars at 6″ pitch with 3/4″ cover; beams 7 1/2″ deep × 5″ wide; 24″ C.R.S.; 5/8″ reinforcement bars two rows 1/2″ vertically apart with 1″ cover; 13′1″ span restricted.	195 psf	1 hr. 4 min.			7	1, 2, 15	1
F/C-5-RC-42	5 1/2″	Composite ribbed concrete slab assembly; see Note 17 for details.	See Note 16	2 hrs.			43	16, 17	2
F/C-3-RC-43	3″	2500 psi concrete; 5/8″ cover; fully restrained at test.	See Note 16	30 min.			43	16	1/2
F/C-3-RC-44	3″	2000 psi concrete; 5/8″ cover; free or partial restraint at test.	See Note 16	45 min.			43	16	3/4
F/C-4-RC-45	4″	2500 psi concrete; 5/8″ cover; fully restrained at test.	See Note 16	40 min.			43	16	2/3
F/C-4-RC-46	4″	2000 psi concrete; 3/4″ cover; free or partial restraint at test.	See Note 16	1 hr. 15 min.			43	16	1 1/4
F/C-5-RC-47	5″	2500 psi concrete; 3/4″ cover; fully restrained at test.	See Note 16	1 hr.			43	16	1
F/C-5-RC-48	5″	2000 psi concrete; 3/4″ cover; free or partial restraint at test.	See Note 16	1 hr. 30 min.			43	16	1 1/2
F/C-6-RC-49	6″	2500 psi concrete; 1″ cover; fully restrained at test.	See Note 16	1 hr. 30 min.			43	16	1 1/2
F/C-6-RC-50	6″	2000 psi concrete; 1″ cover; free or partial restraint at test.	See Note 16	2 hrs.			43	16	2

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. British test.
2. Failure mode - local back face temperature rise.
3. Tested for Grade “C” (2 hour) fire resistance.
4. Collapse imminent following hose stream.
5. Failure mode - flame thru.
6. Void formed with explosive force and report.
7. Achieved Grade “B” (4 hour) fire resistance (British).
8. Failure mode - collapse.
9. Test was run to 2 hours, but specimen was partially supported by the furnace at 1 1/4 hours.
10. Failure mode - average back face temperature.
11. Recommended endurance for nonload bearing performance only.
12. Floor maintained load bearing ability to 2 hours at which point test was terminated.
13. Test was run to 3 hours at which time failure mode 2 (above) was reached in spite of crack formation at 29 minutes.
14. Tested for Grade “A” (6 hour) fire resistance.
15.



16. Load unspecified.
17. Total assembly thickness 5 1/2 inches. Three-inch thick blocks of molded excelsior bonded with portland cement used as inserts with 2 1/2-inch cover (concrete) above blocks and 3/4-inch gypsum plaster below. Nine-inch wide ribs containing reinforcing steel of unspecified size interrupted 20-inch wide segments of slab composite (i.e., plaster, excelsior blocks, concrete cover).

FIGURE 3.2—FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

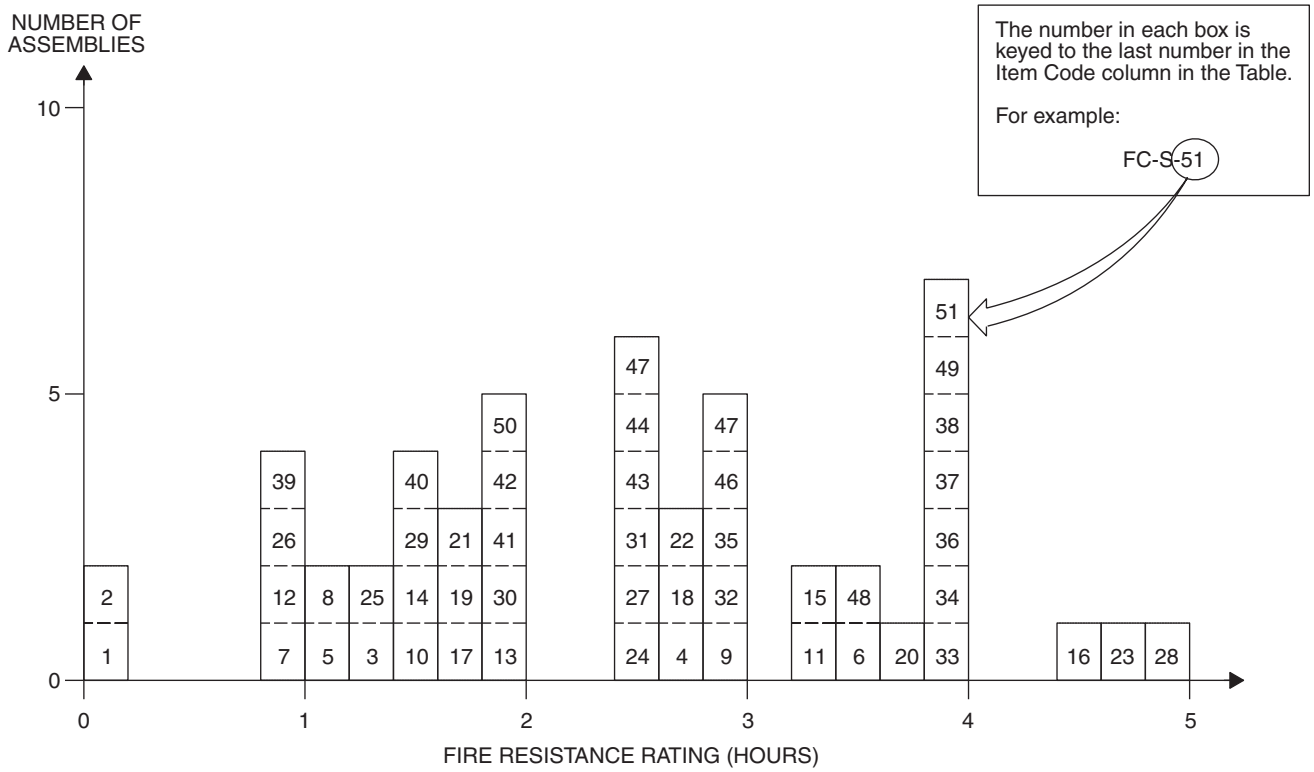


TABLE 3.2—FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-1	0″	- 10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 2″ concrete; Membrane: none.	145 psf	7 min.			3	1, 2, 3, 8	0
F/C-S-2	0″	- 10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 2″ concrete; Membrane: none	145 psf	7 min.			3	1, 2, 3, 8	0
F/C-S-3	$^1/_2$″	- 10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 2" concrete 1:2:4; Membrane: furring 12″ o.c.; Clips A, B, G; No extra reinforcement; $^1/_2$″ plaster - 1.5:2.5.	145 psf	1 hr. 15 min.			3	2, 3, 8	$1^1/_4$
F/C-S-4	$^1/_2$″	- 10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 2″ concrete 1:2:4; Membrane: furring 16″ o.c.; Clips D, E, F, G; Diagonal wire reinforcement; $^1/_2$″ plaster - 1.5:2.5.	145 psf	2 hrs. 46 min.			3	3, 8	$2^3/_4$
F/C-S-5	$^1/_2$″	- 10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 2″ concrete 1:2:4; Membrane: furring 16″ o.c.; Clips A, B, G; No extra reinforcement; $^1/_2$″ plaster - 1.5:2.5.	145 psf	1 hr. 4 min.			3	2, 3, 8	1

(Continued)

TABLE 3.2—FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-6	1/2″	10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 2″ concrete 1:2:4; Membrane: furring 16″ o.c.; Clips D, E, F, G; Hexagonal mesh reinforcement; 1/2″ plaster.	145 psf	3 hrs. 28 min.			3	2, 3, 8	2 1/3
F/C-S-7	1/2″	10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 4 lbs. rib lath; 6″ × 6″ - 10 × 10 ga. reinforcement; 2″ deck gravel concrete; Membrane: furring 16″ o.c.; Clips C, E; Reinforcement: none; 1/2″ plaster - 1.5:2.5 mill mix.	N/A	55 min.			3	5, 8	3/4
F/C-S-8	1/2″	Spec. 9′ × 4′4″; S.J. 103 bar joists - 18″ o.c.; Deck: 4 lbs. rib lath base; 6″ × 6″ - 10 × 10 ga. reinforcement; 2″ deck 1:2:4 gravel concrete; Membrane: furring, 3/4″ C.R.S., 16″ o.c.; Clips C, E; Reinforcement: none; 1/2″ plaster - 1.5:2.5 mill mix.	300 psf	1 hr. 10 min.			3	2, 3, 8	1
F/C-S-9	5/8″	10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 2″ concrete 1:2:4; Membrane: furring 12″ o.c.; Clips A, B, G; Extra “A” clips reinforcement; 5/8″ plaster - 1.5:2; 1.5:3.	145 psf	3 hrs.			3	6, 8	3
F/C-S-10	5/8″	18′ × 13′6″; Joists, S.J. 103 - 24″ o.c.; Deck: 4 lbs. rib lath; 6″ × 6″ - 10 × 10 ga. reinforcement; 2″ deck 1:2:3.5 gravel concrete; Membrane: furring, spacing 16″ o.c.; Clips C, E; Reinforcement: none; 5/8″ plaster - 1.5:2.5 mill mix.	145 psf	1 hr. 25 min.			3	2, 3, 8	1 1/3
F/C-S-11	5/8″	10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 2″ concrete 1:2:4; Membrane: furring 12″ o.c.; Clips D, E, F, G; Diagonal wire reinforcement; 5/8″ plaster - 1.5:2; 0.5:3.	145 psf	3 hrs. 15 min.			3	2, 4, 8	3 1/4
F/C-S-12	5/8″	10′ × 13′6″; Joists, S.J. 103 - 24″ o.c.; Deck: 3.4 lbs. rib lath; 6″ × 6″ - 10 × 10 ga. reinforcement; 2″ deck 1:2:4 gravel concrete; Membrane: furring 16″ o.c.; Clips D, E, F, G; Reinforcement: none; 5/8″ plaster - 1.5:2.5.	145 psf	1 hr.			3	7, 8	1
F/C-S-13	3/4″	Spec. 9′ × 4′4″; S.J. 103 - 18″ o.c.; Deck: 4 lbs. rib lath; 6″ × 6″ - 10 × 10 ga. reinforcement; 2″ deck 1:2:4 gravel concrete; Membrane: furring, 3/4″ C.R.S., 16″ o.c.; Clips C, E; Reinforcement: none; 3/4″ plaster - 1.5:2.5 mill mix.	300 psf	1 hr. 56 min.			3	3, 8	1 3/4

(Continued)

TABLE 3.2—FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-14	7/8″	Floor finish: 1″ concrete; plate cont. weld; 4″ - 7.7 lbs. “I” beams; Ceiling: 1/4″ rods 12″ o.c.; 7/8″ gypsum sand plaster.	105 psf	1 hr. 35 min.			6	2, 4, 9, 10	1 1/2
F/C-S-15	1″	Floor finish: 1 1/2″ L.W. concrete; 1/2″ limestone cement; plate cont. weld; 5″ - 10 lbs. “I” beams; Ceiling: 1/4″ rods 12″ o.c. tack welded to beams metal lath; 1″ P. C. plaster.	165 psf	3 hrs. 20 min.			6	4, 9, 11	
F/C-S-16	1″	10′ × 13′6″; S.J. 103 - 24″ o.c.; Deck: 2″ concrete 1:2:4; Membrane: furring 12″ o.c.; Clips D, E, F, G; Hexagonal mesh reinforcement; 1″ thick plaster - 1.5:2; 1.5:3.	145 psf	4 hrs. 26 min.			3	2, 4, 8	4 1/3
F/C-S-17	1″	10′ × 13′6″; Joists - S.J. 103 - 24″ o.c.; Deck: 3.4 lbs. rib lath; 6″ × 6″ - 10 × 10 ga. reinforcement; 2″ deck 1:2:4 gravel concrete; Membrane: furring 16″ o.c.; Clips D, E, F, G; 1″ plaster.	145 psf	1 hr. 42 min.			3	2, 4, 8	1 2/3
F/C-S-18	1 1/8″	10′ × 13′6″; S. J. 103 - 24″ o.c.; Deck: 2″ concrete 1:2:4; Membrane: furring 12″ o.c.; Clips C, E, F, G; Diagonal wire reinforcement; 1 1/8″ plaster.	145 psf	2 hrs. 44 min.			3	2, 4, 8	2 2/3
F/C-S-19	1 1/8″	10′ × 13′6″; Joists - S.J. 103 - 24″ o.c.; Deck: 1 1/2″ gypsum concrete over; 1/2″ gypsum board; Membrane: furring 12″ o.c.; Clips D, E, F, G; 1 1/8″ plaster - 1.5:2; 1.5:3.	145 psf	1 hr. 40 min.			3	2, 3, 8	1 2/3
F/C-S-20	1 1/8″	2 1/2″ cinder concrete; 1/2″ topping; plate 6″ welds 12″ o.c.; 5″ - 18.9 lbs. “H” center; 5″ - 10 lbs. “I” ends; 1″ channels 18″ o.c.; 1 1/8″ gypsum sand plaster.	150 psf	3 hrs 43 min.			6	2, 4, 9, 11	3 2/3
F/C-S-21	1 1/4″	10′ × 13′6″; Joists - S.J. 103 - 24″ o.c.; Deck: 1 1/2″ gypsum concrete over; 1/2″ gypsum board base; Membrane: furring 12″ o.c.; Clips D, E, F, G; 1 1/4″ plaster - 1.5:2; 1.5:3.	145 psf	1 hr. 48 min.			3	2, 3, 8	1 2/3
F/C-S-22	1 1/4″	Floor finish: 1 1/2″ limestone concrete; 1/2″ sand cement topping; plate to beams 3 1/2″; 12″ o.c. welded; 5″ - 10 lbs. “I” beams; 1″ channels 18″ o.c.; 1 1/4″ wood fiber gypsum sand plaster on metal lath.	292 psf	2 hrs. 45 min.			6	2, 4, 9, 10	2 3/4
F/C-S-23	1 1/2″	2 1/2″ L.W. (gas exp.) concrete; Deck: 1/2″ topping; plate 6 1/4″ welds 12″ o.c.; Beams: 5″ - 18.9 lbs. “H” center; 5″ - 10 lbs. “I” ends; Membrane: 1″ channels 18″ o.c.; 1 1/2″ gypsum sand plaster.	150 psf	4 hrs. 42 min.			6	2, 4, 9	4 2/3

(Continued)

TABLE 3.2—FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-24	1 1/2″	Floor finish: 1 1/2″ limestone concrete; 1/2″ cement topping; plate 3 1/2″ - 12″ o.c. welded; 5″ - 10 lbs. “I” beams; Ceiling: 1″ channels 18″ o.c.; 1 1/2″ gypsum plaster.	292 psf	2 hrs. 34 min.			6	2, 4, 9, 10	2 1/2
F/C-S-25	1 1/2″	Floor finish: 1 1/2″ gravel concrete on exp. metal; plate cont. weld; 4″ - 7.7 lbs. “I” beams; Ceiling: 1/4″ rods 12″ o.c. welded to beams; 1 1/2″ fiber gypsum sand plaster.	70 psf	1 hr. 24 min.			6	2, 4, 9, 10	1 1/3
F/C-S-26	2 1/2″	Floor finish: bare plate; 6 1/4″ welding - 12″ o.c.; 5″ - 18.9 lbs. “H” girders (inner); 5″ - 10 lbs “I” girders (two outer); 1″ channels 18″ o.c.; 2″ reinforced gypsum tile; 1/2″ gypsum sand plaster.	122 psf	1 hr.			6	7, 9, 11	1
F/C-S-27	2 1/2″	Floor finish: 2″ gravel concrete; plate to beams 3 1/2″ - 12″ o.c. welded; 4″ - 7.7 lbs. “I” beams; 2″ gypsum ceiling tiles; 1/2″ 1:3 gypsum sand plaster.	105 psf	2 hrs. 31 min.			6	2, 4, 9, 10	2 1/2
F/C-S-28	2 1/2″	Floor finish: 1 1/2″ gravel concrete; 1/2″ gypsum asphalt; plate continuous weld; 4″ - 7.7 lbs. “I” beams; 12″ - 31.8 lbs. “I” beams - girder at 5′ from one end; 1″ channels 18″ o.c.; 2″ reinforcement gypsum tile; 1/2″ 1:3 gypsum sand plaster.	200 psf	4 hrs. 55 min.			6	2, 4, 9, 11	4 2/3
F/C-S-29	3/4″	Floor: 2″ reinforced concrete or 2″ precast reinforced gypsum tile; Ceiling: 3/4″ portland cement-sand plaster 1:2 for scratch coat and 1:3 for brown coat with 15 lbs. hydrated lime and 3 lbs. of short asbestos fiber bag per cement or 3/4″ sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.	See Note 12	1 hr. 30 min.		1		12, 13, 14	1 1/2
F/C-S-30	3/4″	Floor: 2 1/4″ reinforced concrete or 2″ reinforced gypsum tile; the latter with 1/4″ mortar finish; Ceiling: 3/4″ sanded gypsum plaster; 1:2 for scratch coat and 1:3 for brown coat.	See Note 12	2 hrs.		1		12, 13, 14	2
F/C-S-31	3/4″	Floor: 2 1/2″ reinforced concrete or 2″ reinforced gypsum tile; the latter with 1/4″ mortar finish; Ceiling: 1″ neat gypsum plaster or 3/4″ gypsum-vermiculite plaster, ratio of gypsum to fine vermiculite 2:1 to 3:1.	See Note 12	2 hrs. 30 min.		1		12, 13, 14	2 1/2

(Continued)

TABLE 3.2—FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-32	3/4″	Floor: 2 1/2″ reinforced concrete or 2″ reinforced gypsum tile; the latter with 1/2″ mortar finish; Ceiling: 1″ neat gypsum plaster or 3/4″ gypsum-vermiculite plaster, ratio of gypsum to fine vermiculite 2:1 to 3:1.	See Note 12	3 hrs.		1		12, 13, 14	3
F/C-S-33	1″	Floor: 2 1/2″ reinforced concrete or 2″ reinforced gypsum slabs; the latter with 1/2″ mortar finish; Ceiling: 1″ gypsum-vermiculite plaster applied on metal lath and ratio 2:1 to 3:1 gypsum to vermiculite by weight.	See Note 12	4 hrs.		1		12, 13, 14	4
F/C-S-34	2 1/2″	Floor: 2″ reinforced concrete or 2″ precast reinforced portland cement concrete or gypsum slabs; precast slabs to be finished with 1/4″ mortar top coat; Ceiling: 2″ precast reinforced gypsum tile, anchored into beams with metal ties or clips and covered with 1/2″ 1:3 sanded gypsum plaster.	See Note 12	4 hrs.		1		12, 13, 14	4
F/C-S-35	1″	Floor: 1:3:6 portland cement, sand and gravel concrete applied directly to the top of steel units and 1 1/2″ thick at top of cells, plus 1/2″ 1:2 1/2″ cement-sand finish, total thickness at top of cells, 2″; Ceiling: 1″ neat gypsum plaster, back of lath 2″ or more from underside of cellular steel.	See Note 15	3 hrs.		1		15, 16, 17, 18	3
F/C-S-36	1″	Floor: same as F/C-S-35; Ceiling: 1″ gypsum-vermiculite plaster (ratio of gypsum to vermiculite 2:1 to 3:1), the back of lath 2″ or more from under-side of cellular steel.	See Note 15	4 hrs.		1		15, 16, 17, 18	4
F/C-S-37	1″	Floor: same as F/C-S-35; Ceiling: 1″ neat gypsum plaster; back of lath 9″ or more from underside of cellular steel.	See Note 15	4 hrs.		1		15, 16, 17, 18	4
F/C-S-38	1″	Floor: same as F/C-S-35; Ceiling: 1″ gypsum-vermiculite plaster (ratio of gypsum to vermiculite 2:1 to 3:1), the back of lath being 9″ or more from underside of cellular steel.	See Note 15	5 hrs.		1		15, 16, 7, 18	5
F/C-S-39	3/4″	Floor: asbestos paper 14 lbs./100 ft.^{2} cemented to steel deck with waterproof linoleum cement, wood screeds and 7/8″ wood floor; Ceiling: 3/4″ sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.	See Note 19	1 hr.		1		19, 20, 21, 22	1

(Continued)

TABLE 3.2—FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-40	3/4″	Floor: 1 1/2″, 1:2:4 portland cement concrete; Ceiling: 3/4″ sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.	See Note 19	1 hr. 30 min.		1		19, 20, 21, 22	1 1/2
F/C-S-41	3/4″	Floor: 2″, 1:2:4 portland cement concrete; Ceiling: 3/4″ sanded gypsum plaster, 1:2 for scratch coat and 1:3 for brown coat.	See Note 19	2 hrs.		1		19, 20, 21, 22	2
F/C-S-42	1″	Floor: 2″, 1:2:4 portland cement concrete; Ceiling: 1″ portland cement-sand plaster with 10 lbs. of hydrated lime for @ bag of cement 1:2 for scratch coat and 1:2 1/2″ for brown coat.	See Note 19	2 hrs.		1		19, 20, 21, 22	2
F/C-S-43	1 1/2″	Floor: 2″, 1:2:4 portland cement concrete; Ceiling: 1 1/2″, 1:2 sanded gypsum plaster on ribbed metal lath.	See Note 19	2 hrs. 30 min.		1		19, 20, 21, 22	2 1/2
F/C-S-44	1 1/8″	Floor: 2″, 1:2:4 portland cement concrete; Ceiling: 1 1/8″, 1:1 sanded gypsum plaster.	See Note 19	2 hrs. 30 min.		1		19, 20, 21, 22	2 1/2
F/C-S-45	1″	Floor: 2 1/2″, 1:2:4 portland cement concrete; Ceiling: 1″, 1:2 sanded gypsum plaster.	See Note 19	2 hrs. 30 min.		1		19, 20, 21, 22	2 1/2
F/C-S-46	3/4″	Floor: 2 1/2″, 1:2:4 portland cement concrete; Ceiling: 1″ neat gypsum plaster or 3/4″ gypsum-vermiculite plaster, ratio of gypsum to vermiculite 2:1 to 3:1.	See Note 19	3 hrs.		1		19, 20, 21, 22	3
F/C-S-47	1 1/8″	Floor: 2 1/2″, 1:2:4 portland cement, sand and cinder concrete plus 1/2″, 1:2 1/2″ cement-sand finish; total thickness 3″; Ceiling: 1 1/8″, 1:1 sanded gypsum plaster.	See Note 19	3 hrs.		1		19, 20, 21, 22	3
F/C-S-48	1 1/8″	Floor: 2 1/2″, gas expanded portland cement-sand concrete plus 1/2″, 1:2.5 cement-sand finish; total thickness 3″; Ceiling: 1 1/8″, 1:1 sanded gypsum plaster.	See Note 19	3 hrs. 30 min.		1		19, 20, 21, 22	3 1/2
F/C-S-49	1″	Floor: 2 1/2″, 1:2:4 portland cement concrete; Ceiling: 1″ gypsum-vermiculite plaster; ratio of gypsum to vermiculite 2:1 to 3:1.	See Note 19	4 hrs.		1		19, 20, 21, 22	4
F/C-S-50	2 1/2″	Floor: 2″, 1:2:4 portland cement concrete; Ceiling: 2″ interlocking gypsum tile supported on upper face of lower flanges of beams, 1/2″ 1:3 sanded gypsum plaster.	See Note 19	2 hrs.		1		19, 20, 21, 22	2

(Continued)

TABLE 3.2—FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-51	$2^1/_2$″	Floor: 2″, 1:2:4 portland cement concrete; Ceiling: 2″ precast metal reinforced gypsum tile, $^1/_2$″ 1:3 sanded gypsum plaster (tile clipped to channels which are clipped to lower flanges of beams).	See Note 19	4 hrs.		1		19, 20, 21, 22	4

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. No protective membrane over structural steel.
2. Performance time indicates first endpoint reached only several tests were continued to points where other failures occurred.
3. Load failure.
4. Thermal failure.
5. This is an estimated time to load bearing failure. The same joist and deck specimen was used for a later test with different membrane protection.
6. Test stopped at 3 hours to reuse specimen; no endpoint reached.
7. Test stopped at 1 hour to reuse specimen; no endpoint reached.
8. All plaster used = gypsum.
9. Specimen size - 18 feet by $13^1/_2$ inches. Floor deck - base material - $^1/_4$-inch by 18-foot steel plate welded to "I" beams.
10. "I" beams - 24 inches o.c.
11. "I" beams - 48 inches o.c.
12. Apply to open web joists, pressed steel joists or rolled steel beams, which are not stressed beyond 18,000 lbs./in.^{2} in flexure for open-web pressed or light rolled joists, and 20,000 lbs./in.^{2} for American standard or heavier rolled beams.
13. Ratio of weight of portland cement to fine and coarse aggregates combined for floor slabs shall not be less than $1:6^1/_2$.
14. Plaster for ceiling shall be applied on metal lath which shall be tied to supports to give the equivalent of single No. 18 gage steel wires 5 inches o.c.
15. Load: maximum fiber stress in steel not to exceed 16,000 psi.
16. Prefabricated units 2 feet wide with length equal to the span, composed of two pieces of No. 18 gage formed steel welded together to give four longitudinal cells.
17. Depth not less than 3 inches and distance between cells no less than 2 inches.
18. Ceiling: metal lath tied to furring channels secured to runner channels hung from cellular steel.
19. Load: rolled steel supporting beams and steel plate base shall not be stressed beyond 20,000 psi in flexure. Formed steel (with wide upper flange) construction shall not be stressed beyond 16,000 psi.
20. Some type of expanded metal or woven wire shall be embedded to prevent cracking in concrete flooring.
21. Ceiling plaster shall be metal lath wired to rods or channels which are clipped or welded to steel construction. Lath shall be no smaller than 18 gage steel wire and not more than 7 inches o.c.
22. The securing rods or channels shall be at least as effective as single $^3/_{16}$-inch rods with 1-inch of their length bent over the lower flanges of beams with the rods or channels tied to this clip with 14 gage iron wire.

FIGURE 3.3—FLOOR/CEILING ASSEMBLIES—WOOD JOIST

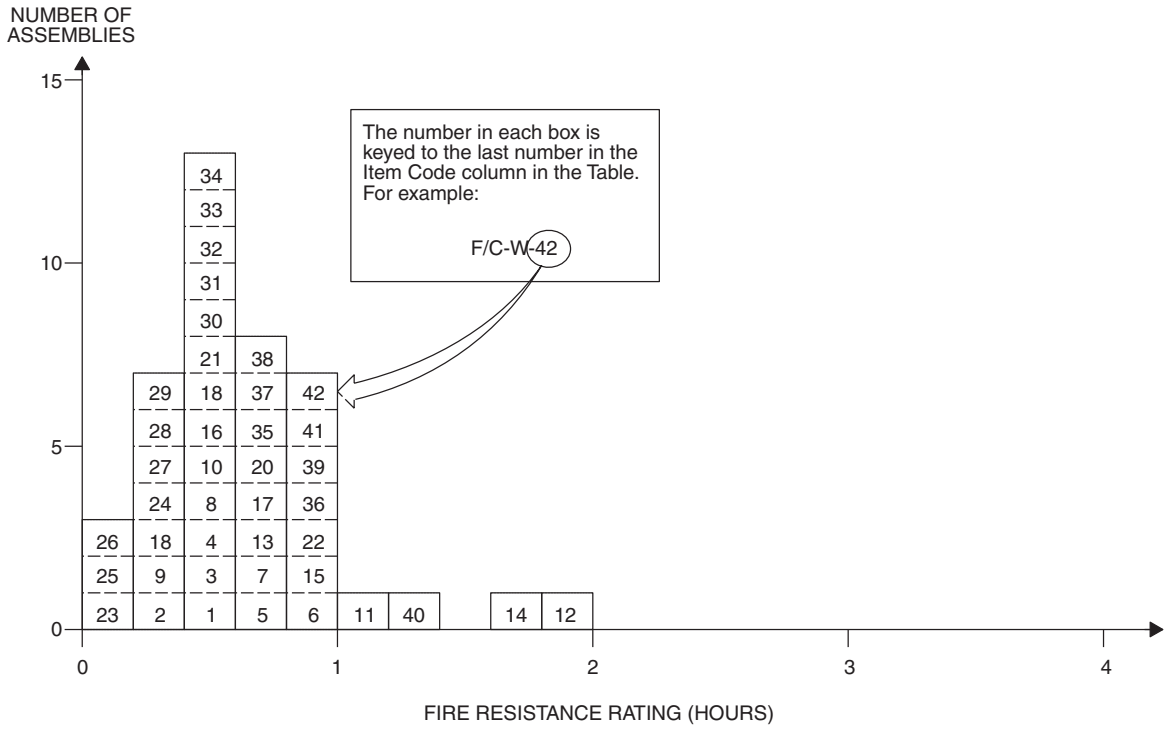


TABLE 3.3—FLOOR/CEILING ASSEMBLIES—WOOD JOIST

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-1	$^3/_8$″	12′ clear span - 2″ × 9″ wood joists; 18″ o.c.; Deck: 1″ T&G; Filler: 3″ of ashes on $^1/_2$″ boards nailed to joist sides 2″ from bottom; 2″ air space; Membrane: $^3/_8$″ gypsum board.	60 psf	36 min.			7	1, 2	$^1/_2$
F/C-W-2	$^1/_2$″	12′ clear span - 2″ × 7″ joists; 15″ o.c.; Deck: 1″ nominal lumber; Membrane: $^1/_2$″ fiber board.	60 psf	22 min.			7	1, 2, 3	$^1/_4$
F/C-W-3	$^1/_2$″	12′ clear span - 2″ × 7″ wood joists; 16″ o.c.; 2″ × 1$^1/_2$″ bridging at center; Deck: 1″ T&G; Membrane: $^1/_2$″ fiber board; 2 coats “distemper” paint.	30 psf	28 min.			7	1, 3, 15	$^1/_3$
F/C-W-4	$^3/_{16}$″	12′ clear span - 2″ × 7″ wood joists; 16″ o.c.; 2″ × 1$^1/_2$″ bridging at center span; Deck: 1″ nominal lumber; Membrane: $^1/_2$″ fiber board under $^3/_{16}$″ gypsum plaster.	30 psf	32 min.			7	1, 2	$^1/_2$
F/C-W-5	$^5/_8$″	As per previous F/C-W-4 except membrane is $^5/_8$″ lime plaster.	70 psf	48 min.			7	1, 2	$^3/_4$
F/C-W-6	$^5/_8$″	As per previous F/C-W-5 except membrane is $^5/_8$″ gypsum plaster on 22 gage $^3/_8$″ metal lath.	70 psf	49 min.			7	1, 2	$^3/_4$

(Continued)

TABLE 3.3—FLOOR/CEILING ASSEMBLIES—WOOD JOIST—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-7	1/2″	As per previous F/C-W-6 except membrane is 1/2″ fiber board under 1/2″ gypsum plaster.	60 psf	43 min.			7	1, 2, 3	2/3
F/C-W-8	1/2″	As per previous F/C-W-7 except membrane is 1/2″ gypsum board.	60 psf	33 min.			7	1, 2, 3	1/2
F/C-W-9	9/16″	12′ clear span - 2″ × 7″ wood joists; 15″ o.c.; 2″ × 1 1/2″ bridging at center; Deck: 1″ nominal lumber; Membrane: 3/8″ gypsum board; 3/16″ gypsum plaster.	60 psf	24 min.			7	1, 2, 3	1/3
F/C-W-10	5/8″	As per F/C-W-9 except membrane is 5/8″ gypsum plaster on wood lath.	60 psf	27 min.			7	1, 2, 3	1/3
F/C-W-11	7/8″	12′ clear span - 2″ × 9″ wood joists; 15″ o.c.; 2″ × 1 1/2″ bridging at center span; Deck: 1″ T&G; Membrane: original ceiling joists have 3/8″ plaster on wood lath; 4″ metal hangers attached below joists creating 15″ chases filled with mineral wool and closed with 7/8″ plaster (gypsum) on 3/8″ S.W.M. metal lath to form new ceiling surface.	75 psf	1 hr. 10 min.			7	1, 2	1
F/C-W-12	7/8″	12′ clear span - 2″ × 9″ wood joists; 15″ o.c.; 2″ × 1 1/2″ bridging at center; Deck: 1″ T&G; Membrane: 3″ mineral wood below joists; 3″ hangers to channel below joists; 7/8″ gypsum plaster on metal lath attached to channels.	75 psf	2 hrs.			7	1, 4	2
F/C-W-13	7/8″	12′ clear span - 2″ × 9″ wood joists; 16″ o.c.; 2″ × 1 1/2″ bridging at center span; Deck: 1″ T&G on 1″ bottoms on 3/4″ glass wool strips on 3/4″ gypsum board nailed to joists; Membrane: 3/4″ glass wool strips on joists; 3/8″ perforated gypsum lath; 1/2″ gypsum plaster.	60 psf	41 min.			7	1, 3	2/3
F/C-W-14	7/8″	12′ clear span - 2″ × 9″ wood joists; 15″ o.c.; Deck: 1″ T&G; Membrane: 3″ foam concrete in cavity on 1/2″ boards nailed to joists; wood lath nailed to 1″ × 1 1/4″ straps 14 o.c. across joists; 7/8″ gypsum plaster.	60 psf	1 hr. 40 min.			7	1, 5	1 2/3
F/C-W-15	7/8″	12′ clear span - 2″ × 9″ wood joists; 18″ o.c.; Deck: 1″ T&G; Membrane: 2″ foam concrete on 1/2″ boards nailed to joist sides 2″ from joist bottom; 2″ air space; 1″ × 1 1/4″ wood straps 14″ o.c. across joists; 7/8″ lime plaster on wood lath.	60 psf	53 min.			7	1, 2	3/4

(Continued)

TABLE 3.3—FLOOR/CEILING ASSEMBLIES—WOOD JOIST—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-16	7/8″	12′ clear span - 2″ × 9″ wood joists; Deck: 1″ T&G; Membrane: 3″ ashes on 1/2″ boards nailed to joist sides 2″ from joist bottom; 2″ air space; 1″ × 1 1/4″ wood straps 14″ o.c.; 7/8″ gypsum plaster on wood lath.	60 psf	28 min.			7	1, 2	1/3
F/C-W-17	7/8″	As per previous F/C-W-16 but with lime plaster mix.	60 psf	41 min.			7	1, 2	2/3
F/C-W-18	7/8″	12′ clear span - 2″ × 9″ wood joists; 18″ o.c.; 2″ × 1 1/2″ bridging at center; Deck: 1″ T&G; Membrane: 7/8″ gypsum plster on wood lath.	60 psf	36 min.			7	1, 2	1/2
F/C-W-19	7/8″	As per previous F/C-W-18 except with lime plaster membrane and deck is 1″ nominal boards (plain edge).	60 psf	19 min.			7	1, 2	1/4
F/C-W-20	7/8″	As per F/C-W-19, except deck is 1″ T&G boards.	60 psf	43 min.			7	1, 2	2/3
F/C-W-21	1″	12′ clear span - 2″ × 9″ wood joists; 16″ o.c.; 2″ × 1 1/2″ bridging at center; Deck: 1″ T&G; Membrane: 3/8″ gypsum base board; 5/8″ gypsum plaster.	70 psf	29 min.			7	1, 2	1/3
F/C-W-22	1 1/8″	12′ clear span - 2″ × 9″ wood joists; 16″ o.c.; 2″ × 2″ wood bridging at center; Deck: 1″ T&G; Membrane: hangers, channel with 3/8″ gypsum baseboard affixed under 3/4″ gypsum plaster.	60 psf	1 hr.			7	1, 2, 3	1
F/C-W-23	3/8″	Deck: 1″ nominal lumber; Joists: 2″ × 7″; 15″ o.c.; Membrane: 3/8″ plasterboard with plaster skim coat.	60 psf	11 1/2 min.			12	2, 6	1/6
F/C-W-24	1/2″	Deck: 1″ T&G lumber; Joists: 2″ × 9″; 16″ o.c.; Membrane: 1/2″ plasterboard.	60 psf	18 min.			12	2, 7	1/4
F/C-W-25	1/2″	Deck: 1″ T&G lumber; Joists: 2″ × 7″; 16″ o.c.; Membrane: 1/2″ fiber insulation board.	30 psf	8 min.			12	2, 8	2/15
F/C-W-26	1/2″	Deck: 1″ nominal lumber; Joists: 2″ × 7″; 15″ o.c.; Membrane: 1/2″ fiber insulation board.	60 psf	8 min.			12	2, 9	2/15
F/C-W-27	5/8″	Deck: 1″ nominal lumber; Joists: 2″ × 7″; 15″ o.c.; Membrane: 5/8″ gypsum plaster on wood lath.	60 psf	17 min.			12	2, 10	1/4
F/C-W-28	5/8″	Deck: 1″ T&G lumber; Joists: 2″ × 9″; 16″ o.c.; Membrane: 1/2″ fiber insulation board; 1/2″ plaster.	60 psf	20 min.			12	2, 11	1/3
F/C-W-29	No Membrane	Exposed wood joists.	See Note 13	15 min.		1		1, 12, 13, 14	1/4

(Continued)

TABLE 3.3—FLOOR/CEILING ASSEMBLIES—WOOD JOIST—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-30	3/8″	Gypsum wallboard: 3/8″ or 1/2″ with 1 1/2″ No. 15 gage nails with 3/16″ heads spaced 6″ centers with asbestos paper applied with paperhangers' paste and finished with casein paint.	See Note 13	25 min.		1		1, 12, 13, 14	1/2
F/C-W-31	1/2″	Gypsum wallboard: 1/2″ with 1 3/4″ No. 12 gage nails with 1/2″ heads, 6″ o.c., and finished with casein paint.	See Note 13	25 min.		1		1, 12, 13, 14	1/2
F/C-W-32	1/2″	Gypsum wallboard: 1/2″ with 1 1/2″ No. 12 gage nails with 1/2″ heads, 18″ o.c., with asbestos paper applied with paperhangers' paste and secured with 1 1/2″ No. 15 gage nails with 3/16″ heads and finished with casein paint; combined nail spacing 6″ o.c.	See Note 13	30 min.		1		1, 12, 13, 14	1/2
F/C-W-33	3/8″	Gypsum wallboard: two layers 3/8″ secured with 1 1/2″ No. 15 gage nails with 3/8″ heads, 6″ o.c.	See Note 13	30 min.		1		1, 12, 13, 14	1/2
F/C-W-34	1/2″	Perforated gypsum lath: 3/8″, plastered with 1 1/8″ No. 13 gage nails with 5/16″ heads, 4″ o.c.; 1/2″ sanded gypsum plaster.	See Note 13	30 min.		1		1, 12, 13, 14	1/2
F/C-W-35	1/2″	Same as F/C-W-34, except with 1 1/8″ No. 13 gage nails with 3/8″ heads, 4″ o.c.	See Note 13	45 min.		1		1, 12, 13, 14	3/4
F/C-W-36	1/2″	Perforated gypsum lath: 3/8″, nailed with 1 1/8″ No. 13 gage nails with 3/8″ heads, 4″ o.c.; joints covered with 3″ strips of metal lath with 1 3/4″ No. 12 nails with 1/2″ heads, 5″ o.c.; 1/2″ sanded gypsum plaster.	See Note 13	1 hr.		1		1, 12, 13, 14	1
F/C-W-37	1/2″	Gypsum lath: 3/8″ and lower layer of 3/8″ perforated gypsum lath nailed with 1 3/4″ No. 13 nails with 5/16″ heads, 4″ o.c.; 1/2″ sanded gypsum plaster or 1/2″ portland cement plaster.	See Note 13	45 min.		1		1, 12, 13, 14	3/4
F/C-W-38	3/4″	Metal lath: nailed with 1 1/4″ No. 11 nails with 3/8″ heads or 6d common driven 1″ and bent over, 6″ o.c.; 3/4″ sanded gypsum plaster.	See Note 13	45 min.		1		1, 12, 13, 14	3/4
F/C-W-39	3/4″	Same as F/C-W-38, except nailed with 1 1/2″ No. 11 barbed roof nails with 7/16″ heads, 6″ o.c.	See Note 13	1 hr.		1		1, 12, 13, 14	1

(Continued)

TABLE 3.3—FLOOR/CEILING ASSEMBLIES—WOOD JOIST—continued

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-40	$^3/_4$″	Same as F/C-W-38, except with lath nailed to joists with additional supports for lath 27″ o.c.; attached to alternate joists and consisting of two nails driven $1^1/_4$″, 2″ above bottom on opposite sides of the joists, one loop of No. 18 wire slipped over each nail; the ends twisted together below lath.	See Note 13	1 hr. 15 min.		1		1, 12, 13, 14	$1^1/_4$
F/C-W-41	$^3/_4$″	Metal lath: nailed with $1^1/_2$″ No. 11 barbed roof nails with $^7/_{16}$″ heads, 6 o.c., with $^3/_4$″ portland cement plaster for scratch coat and 1:3 for brown coat, 3 lbs. of asbestos fiber and 15 lbs. of hydrated lime/94 lbs. bag of cement.	See Note 13	1 hr.		1		1, 12, 13, 14	1
F/C-W-42	$^3/_4$″	Metal lath: nailed with 8d, No. $11^1/_2$ gage barbed box nails, $2^1/_2$″ driven, $1^1/_4$″ on slant and bent over, 6″ o.c.; $^3/_4$″ sanded gypsum plaster, 1:2 for scratch coat and 1:3 for below coat.	See Note 13	1 hr.		1		1, 12, 13, 14	1

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. Thickness indicates thickness of first membrane protection on ceiling surface.
2. Failure mode - flame thru.
3. Failure mode - collapse.
4. No endpoint reached at termination of test.
5. Failure imminent - test terminated.
6. Joist failure - 11.5 minutes; flame thru - 13.0 minutes; collapse - 24 minutes.
7. Joist failure - 17 minutes; flame thru - 18 minutes; collapse - 33 minutes.
8. Joist failure - 18 minutes; flame thru - 8 minutes; collapse - 30 minutes.
9. Joist failure - 12 minutes; flame thru - 8 minutes; collapse - 22 minutes.
10. Joist failure - 11 minutes; flame thru - 17 minutes; collapse - 27 minutes.
11. Joist failure - 17 minutes; flame thru - 20 minutes; collapse - 43 minutes.
12. Joists: 2-inch by 10-inch southern pine or Douglas fir; No. 1 common or better. Subfloor: $^3/_4$-inch wood sheating diaphragm of asbestos paper, and finish of tongue-and-groove wood flooring.
13. Loadings: not more than 1,000 psi maximum fiber stress in joists.
14. Perforations in gypsum lath are to be not less than $^3/_4$-inch diameter with one perforation for not more than 16/in.^{2} diameter.
15. "Distemper" is a British term for a water-based paint such as white wash or calcimine.

FIGURE 3.4—FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE

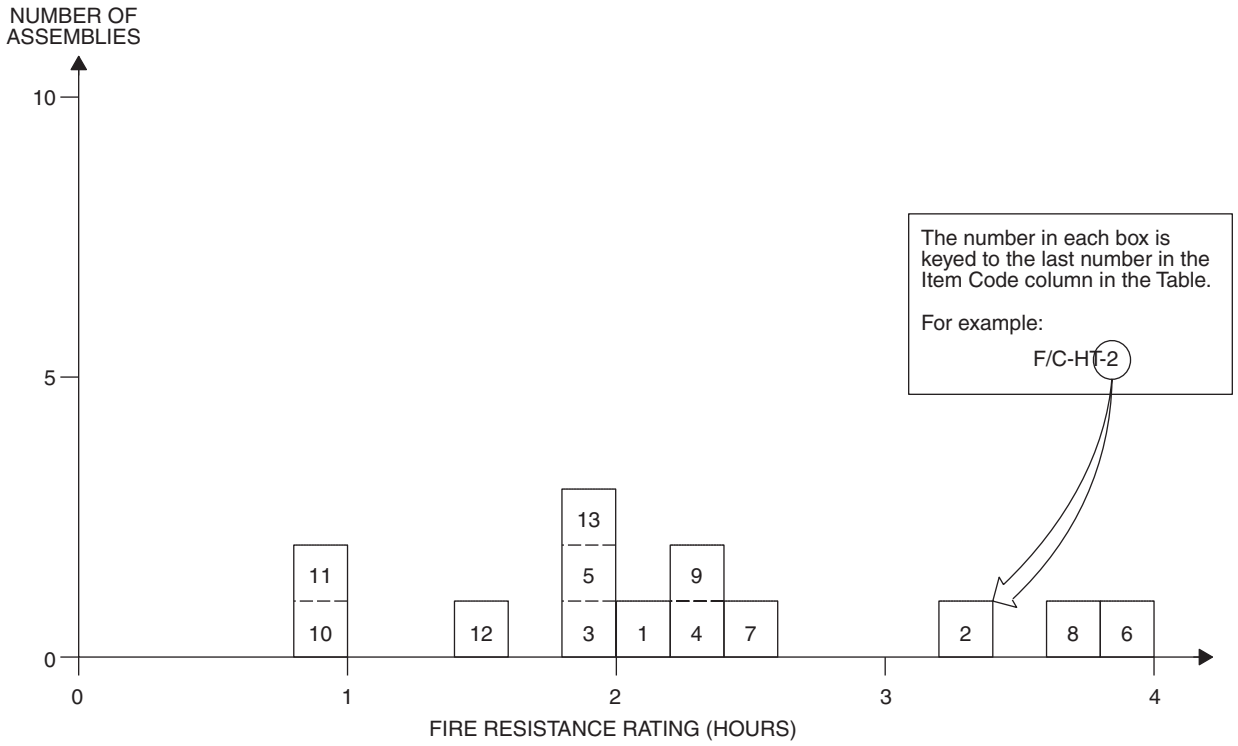


TABLE 3.4—FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-HT-1	6″	Cover: $1^1/_2$″ concrete (6080 psi); three cell hollow clay tiles, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles including two $^1/_2$″ rebars with $^3/_4$″ concrete cover; $^1/_2$″ plaster cover, lower.	75 psf	2 hrs. 7 min.			7	1, 2, 3	2
F/C-HT-2	6″	Cover: $1^1/_2$″ concrete (5840 psi); three cell hollow clay tiles, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles including two $^1/_2$″ rebars each with $^1/_2$″ concrete cover and $^5/_8$″ filler tiles between hollow tiles; $^1/_2$″ plaster cover, lower.	61 psf	3 hrs. 23 min.			7	3, 4, 6	$3^1/_3$
F/C-HT-3	6″	Cover: $1^1/_2$″ concrete (6280 psi); three cell hollow clay tiles, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles including two $^1/_2$″ rebars with $^1/_2$″ cover; $^1/_2$″ plaster cover, lower.	122 psf	2 hrs.			7	1, 3, 5, 8	2
F/C-HT-4	6″	Cover: $1^1/_2$″ concrete (6280 psi); three cell hollow clay tiles, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles including two $^1/_2$″ rebars with $^3/_4$″ cover; $^1/_2$″ plaster cover, lower.	115 psf	2 hrs. 23 min.			7	1, 3, 7	$2^1/_3$

(Continued)

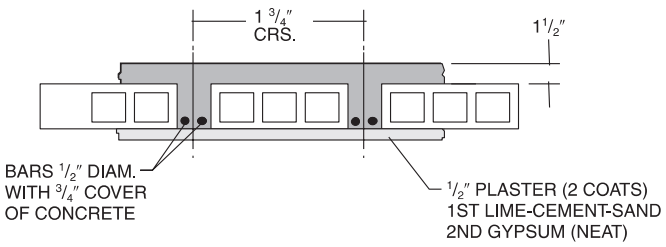
TABLE 3.4—FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE—continued

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-HT-5	6″	Cover: $1^1/_2$″ concrete (6470 psi); three cell hollow clay tiles, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles including two $^1/_2$″ rebars with $^1/_2$″ cover; $^1/_2$″ plaster cover, lower.	122 psf	2 hrs.			7	1, 3, 5, 8	2
F/C-HT-6	8″	Floor cover: $1^1/_2$″ gravel cement (4300 psi); three cell, 12″ × 12″ × 6″; $3^1/_2$″ space between tiles including two $^1/_2$″ rebars with 1″ cover from concrete bottom; $^1/_2$″ plaster cover, lower.	165 psf	4 hrs.			7	1, 3, 9, 10	4
F/C-HT-7	9″ (nom.)	Deck: $^7/_8$″ T&G on 2″ × $1^1/_2$″ bottoms (18″ o.c.) $1^1/_2$″ concrete cover (4600 psi); three cell hollow clay tiles, 12″ × 12″ × 4″; 3″ concrete between tiles including one $^3/_4$″ rebar $^3/_4$″ from tile bottom; $^3/_4$″ plaster cover.	95 psf	2 hrs. 26 min.			7	4, 11, 12, 13	$2^1/_3$
F/C-HT-8	9″ (nom.)	Deck: $^7/_8$″ T&G on 2″ × $1^1/_2$″ bottoms (18″ o.c.) $1^1/_2$″ concrete cover (3850 psi); three cell hollow clay tiles, 12″ × 12″ × 4″; 3″ concrete between tiles including one $^3/_4$″ rebar $^3/_4$″ from tile bottoms; $^1/_2$″ plaster cover.	95 psf	3 hrs. 28 min.			7	4, 11, 12, 13	
F/C-HT-9	9″ (nom.)	Deck: $^7/_8$″ T&G on 2″ × $1^1/_2$″ bottoms (18″ o.c.) $1^1/_2$″ concrete cover (4200 psi); three cell hollow clay tiles, 12″ × 12″ × 4″; 3″ concrete between tiles including one $^3/_4$″ rebar $^3/_4$″ from tile bottoms; $^1/_2$″ plaster cover.	95 psf	2 hrs. 14 min.			7	3, 5, 8, 11	
F/C-HT-10	$5^1/_2$″	Fire clay tile (4″ thick); $1^1/_2$″ concrete cover; for general details, see Note 15.	See Note 14	1 hr.			43	15	1
F/C-HT-11	8″	Fire clay tile (6″ thick); 2″ cover.	See Note 14	1 hr.			43	15	1
F/C-HT-12	$5^1/_2$″	Fire clay tile (4″ thick); $1^1/_2$″ cover; $^5/_8$″ gypsum plaster, lower.	See Note 14	1 hr. 30 min.			43	15	$1^1/_2$
F/C-HT-13	8″	Fire clay tile (6″ thick); 2″ cover; $^5/_8$″ gypsum plaster, lower.	See Note 14	2 hrs.			43	15	$1^1/_2$

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

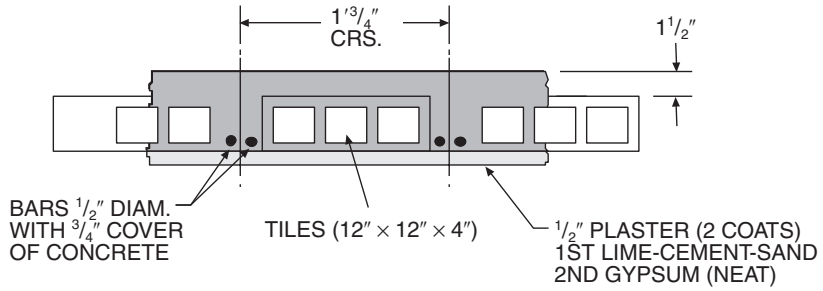
1. A generalized cross section of this floor type follows:



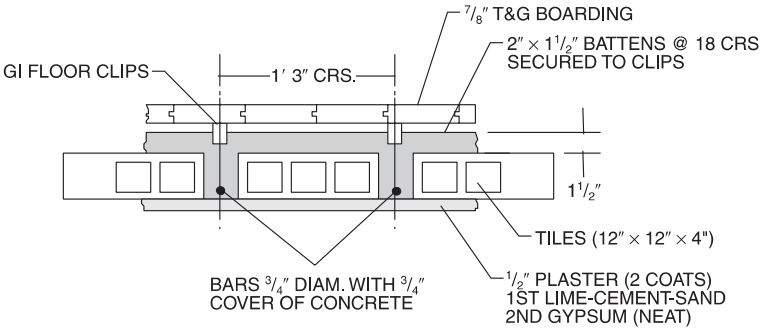
2. Failure mode - structural.
3. Plaster: base coat - lime-cement-sand; top coat - gypsum (neat).

TABLE 3.4—FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE—continued

4. Failure mode - collapse.
5. Test stopped before any endpoints were reached.
6. A generalized cross section of this floor type follows:



7. Failure mode - thermal - back face temperature rise.
8. Passed hose stream test.
9. Failed hose stream test.
10. Test stopped at 4 hours before any endpoints were reached.
11. A generalized cross section of this floor type follows:



12. Plaster: base coat - retarded hemihydrate gypsum-sand; second coat - neat gypsum.
13. Concrete in Item 7 is P.C. based but with crushed brick aggregates while in Item 8 river sand and river gravels are used with the P.C.
14. Load - unspecified.
15. The 12-inch by 12-inch fire-clay tiles were laid end to end in rows spaced $2^1/_2$ inches or 4 inches apart. The reinforcing steel was placed between these rows and the concrete cast around them and over the tile to form the structural floor.

SECTION IV—BEAMS

TABLE 4.1.1—REINFORCED CONCRETE BEAMS
DEPTH 10″ TO LESS THAN 12″

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-11-RC-1	11″	24″ wide × 11″ deep reinforced concrete "T" beam (3290 psi); Details: see Note 5 figure.	8.8 tons	4 hrs. 2min.			7	1, 2, 14	4
B-10-RC-2	10″	24″ wide × 10″ deep reinforced concrete "T" beam (4370 psi); Details: see Note 6 figure.	8.8 tons	1 hr. 53 min.			7	1, 3	$1^3/_4$
B-10-RC-3	$10^1/_2$″	24″ wide × $10^1/_2$″ deep reinforced concrete "T" beam (4450 psi); Details: see Note 7 figure.	8.8 tons	2 hrs. 40 min.			7	1, 3	$2^2/_3$
B-11-RC-4	11″	24″ wide × 11″ deep reinforced concrete "T" beam (2400 psi); Details: see Note 8 figure.	8.8 tons	3 hrs. 32 min.			7	1, 3, 14	$3^1/_2$
B-11-RC-5	11″	24″ wide × 11″ deep reinforced concrete "T" beam (4250 psi); Details: see Note 9 figure.	8.8 tons	3 hrs. 3 min.			7	1, 3, 14	3
B-11-RC-6	11″	Concrete flange: 4″ deep × 2′ wide (4895 psi) concrete; Concrete beam: 7″ deep × $6^1/_2$″ wide beam; "I" beam reinforcement; 10″ × $4^1/_2$″ × 25 lbs. R.S.J.; 1″ cover on flanges; Flange reinforcement: $^3/_8$″ diameter bars at 6″ pitch parallel to "T"; $^1/_4$″ diameter bars perpendicular to "T"; Beam reinforcement: 4″ × 6″ wire mesh No. 13 SWG; Span: 11' restrained; Details: see Note 10 figure.	10 tons	6 hrs.			7	1, 4	6
B-11-RC-7	11″	Concrete flange: 6″ deep × 1′$6^1/_2$″ wide (3525 psi) concrete; Concrete beam: 5″ deep × 8″ wide precast concrete blocks $8^3/_4$″ long; "I" beam reinforcement; 7″ × 4″ × 16 lbs. R.S.J.; 2″ cover on bottom; $1^1/_2$″ cover on top; Flange reinforcement: two rows $^1/_2$″ diameter rods parallel to "T"; Beam reinforcement: $^1/_8$″ wire mesh perpendicular to 1″; Span: 1′3″ simply supported; Details: see Note 11 figure.	3.9 tons	4 hrs.			7	1, 2	4
B-11-RC-8	11″	Concrete flange: 4″ deep × 2′ wide (3525 psi) concrete; Concrete beam 7″ deep × $4^1/_2$″ wide; (scaled from drawing); "I" beam reinforcement; 10″ × $4^1/_2$″ × 25 lbs. R.S.J.; no concrete cover on bottom; Flange reinforcement: $^3/_8$″ diameter bars at 6 pitch parallel to "T"; $^1/_4$″ diameter bars perpendicular to "T"; Span: 11′ restricted.	10 tons	4 hrs.			7	1, 2, 12	4

(Continued)

TABLE 4.1.1—REINFORCED CONCRETE BEAMS DEPTH 10″ TO LESS THAN 12″—continued

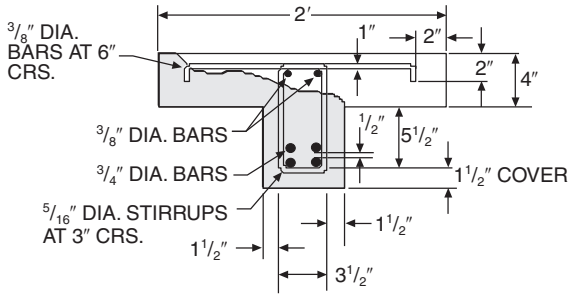
ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-11-RC-9	$11\frac{1}{2}$″	24″ wide × $11\frac{1}{2}$″ deep reinforced concrete "T" beam (4390 psi); Details: see Note 12 figure.	8.8 tons	3 hrs. 24 min.			7	1, 3	$3\frac{1}{3}$

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Load concentrated at mid span.
2. Achieved 4 hour performance (Class "B," British).
3. Failure mode – collapse.
4. Achieved 6 hour performance (Class "A," British).

5.



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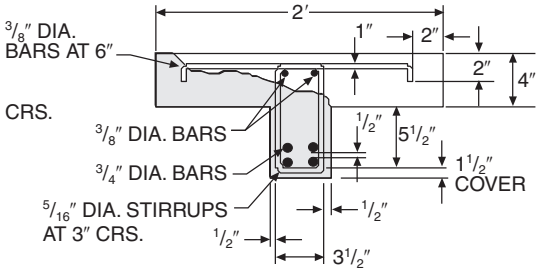

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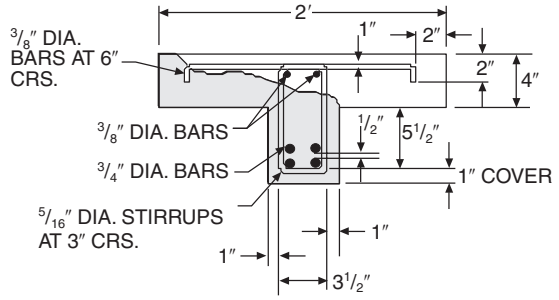

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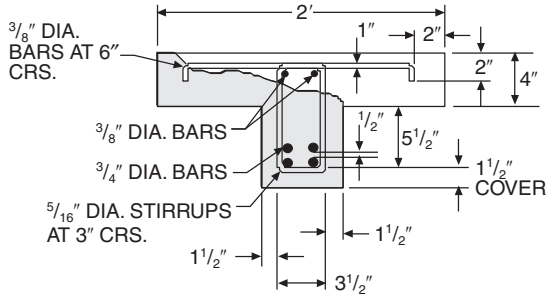

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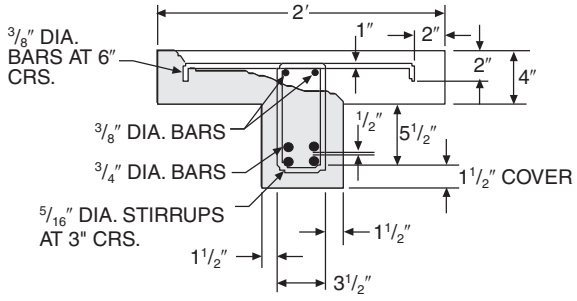

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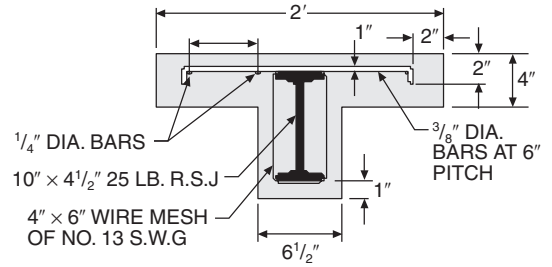
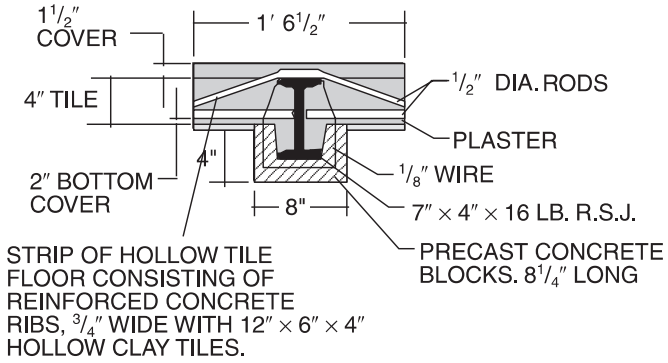


(Continued)

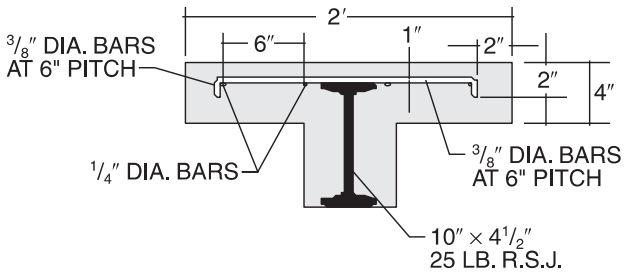
**TABLE 4.1.1—REINFORCED CONCRETE BEAMS
DEPTH 10″ TO LESS THAN 12″—continued**

11.

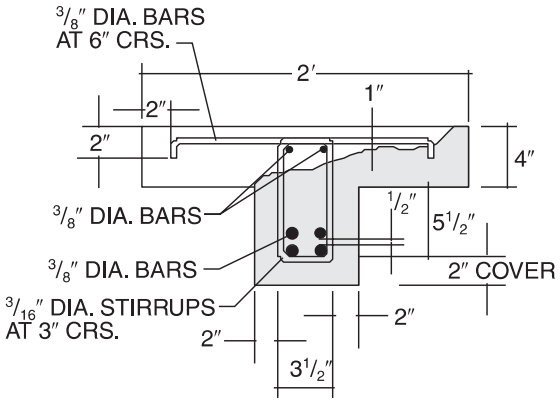


SPAN AND END CONDITIONS:-10′-3″ (CLEAR). SIMPLY SUPPORTED.

12.



13.



14. The different performances achieved by B-11-RC-1, B-11-RC-4 and B-11-RC-5 are attributable to differences in concrete aggregate compositions reported in the source document but unreported in this table. This demonstrates the significance of material composition in addition to other details.

TABLE 4.1.2—REINFORCED CONCRETE BEAMS
DEPTH 12″ TO LESS THAN 14″

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-12-RC-1	12″	12″ × 8″ section; 4160 psi aggregate concrete; Reinforcement: 4-$^{7}/_{8}$″ rebars at corners; 1″ below each surface; $^{1}/_{4}$″ stirrups 10″ o.c.	5.5 tons	2 hrs.			7	1	2
B-12-RC-2	12″	Concrete flange: 4″ deep × 2′ wide (3045 psi) concrete at 35 days; Concrete beam: 8″ deep; "I" beam reinforcement: 10″ × 4$^{1}/_{2}$″ × 25 lbs. R.S.J.; 1″ cover on flanges; Flange reinforcement: $^{3}/_{8}$″ diameter bars at 6" pitch parallel to "T"; $^{1}/_{4}$″ diameter bars perpendicular to "T"; Beam reinforcement: 4″ × 6″ wire mesh No. 13 SWG; Span: 10′ 3″ simply supported.	10 tons	4 hrs.			7	2, 3, 5	4
B-13-RC-3	13″	Concrete flange: 4″ deep × 2′ wide (3825 psi) concrete at 46 days; Concrete beam: 9″ deep × 8$^{1}/_{2}$″ wide; (scaled from drawing); "I" beam reinforcement: 10″ × 4$^{1}/_{2}$″ × 25 lbs. R.S.J.; 3″ cover on bottom flange; 1″ cover on top flange; Flange reinforcement: $^{3}/_{8}$″ diameter bars at 6″ pitch parallel to "T"; $^{1}/_{4}$″ diameter bars perpendicular to "T"; Beam reinforcement: 4″ × 6″ wire mesh No. 13 SWG; Span: 11′ restrained.	10 tons	6 hrs.			7	2, 3, 6, 8, 9	4
B-12-RC-4	12″	Concrete flange: 4″ deep × 2′ wide (3720 psi) concrete at 42 days; Concrete beam: 8″ deep × 8$^{1}/_{2}$″ wide; (scaled from drawing); "I" beam reinforcement: 10″ × 4$^{1}/_{2}$″ × 25 lbs. R.S.J.; 2″ cover bottom flange; 1″ cover top flange; Flange reinforcement: $^{3}/_{8}$″ diameter bars at 6″ pitch parallel to "T"; $^{1}/_{4}$″ diameter bars perpendicular to "T"; Beam reinforcement: 4″ × 6″ wire mesh No. 13 SWG; Span: 11′ restrained.	10 tons	6 hrs.			7	1, 3, 4, 7, 8, 9	4

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

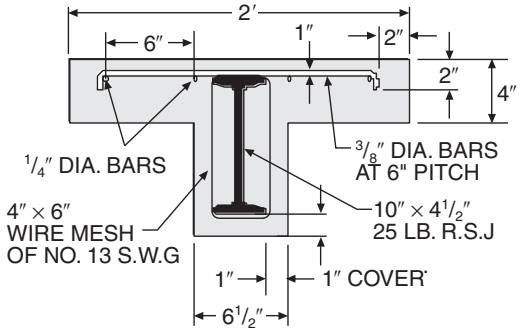
Notes:

1. Qualified for 2 hour use. (Grade "C," British) Test included hose stream and reload at 48 hours.
2. Load concentrated at mid span.
3. British test.
4. British test - qualified for 6 hour use (Grade "A").

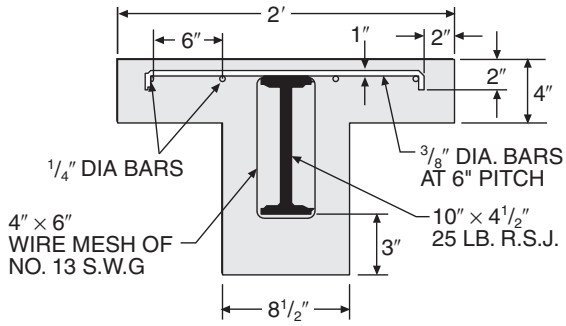
(Continued)

**TABLE 4.1.2—REINFORCED CONCRETE BEAMS
DEPTH 12″ TO LESS THAN 14″—continued**

5.



6.



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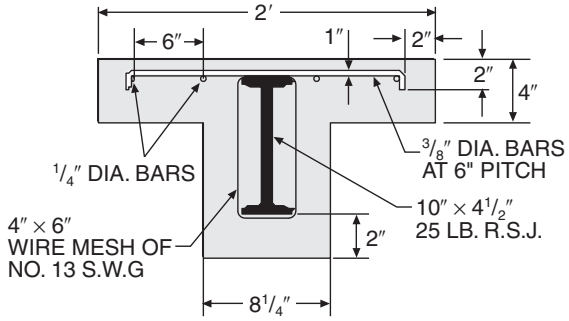


8. See Table 4.1.3, Note 5.

9. Hourly rating based upon B-12-RC-2 above.

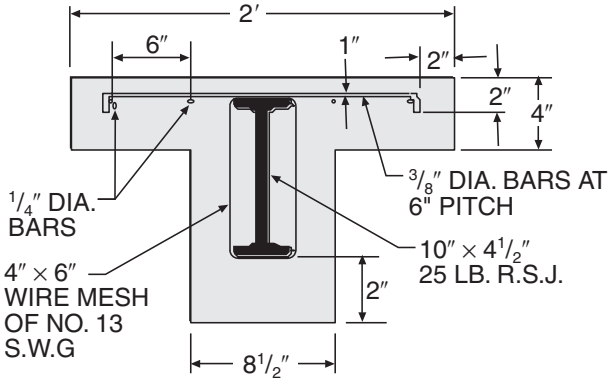
TABLE 4.1.3—REINFORCED CONCRETE BEAMS DEPTH 14″ TO LESS THAN 16″

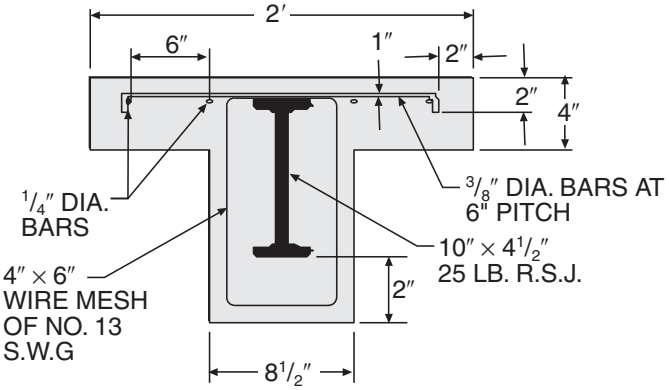
ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-15-RC-1	15″	Concrete flange: 4″ deep × 2′ wide (3290 psi) concrete; Concrete beam: 10″ deep × $8^1/_2$″ wide; "I" beam reinforcement: 10″ × $4^1/_2$″ × 25 lbs. R.S.J.; 4″ cover on bottom flange; 1″ cover on top flange; Flange reinforcement: $^3/_8$″ diameter bars at 6″ pitch parallel to "T"; $^1/_4$″ diameter bars perpendicular to "T"; Beam reinforcement: 4″ × 6″ wire mesh No. 13 SWG; Span: 11′ restrained.	10 tons	6 hrs.			7	1, 2, 3 5, 6	4
B-15-RC-2	15″	Concrete flange: 4" deep × 2' wide (4820 psi) concrete; Concrete beam: 10″ deep × $8^1/_2$″ wide; "I" beam reinforcement: 10″ × $4^1/_2$″ × 25 lbs. R.S.J.; 1″ cover over wire mesh on bottom flange; 1″ cover on top flange; Flange reinforcement: $^3/_8$″ diameter bars at 6″ pitch parallel to "T"; $^1/_4$″ diameter bars perpendicular to "T"; Beam reinforcement: 4″ × 6″ wire mesh No. 13 SWG; Span: 11′ restrained.	10 tons	6 hrs.			7	1, 2, 4, 5, 6	4

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Load concentrated at mid span.
2. Achieved 6 hour fire rating (Grade "A," British).
3. 4.





5. Section 43.147 of the 1979 edition of the *Uniform Building Code Standards* provides:

   "A restrained condition in fire tests, as used in this standard, is one in which expansion at the supports of a load-carrying element resulting from the effects of the fire is resisted by forces external to the element. An unrestrained condition is one in which the load-carrying element is free to expand and rotate at its support.

   "(R)estraint in buildings is defined as follows: Floor and roof assemblies and individual beams in buildings shall be considered restrained when the surrounding or supporting structure is capable of resisting the thermal expansion throughout the range of anticipated elevated temperatures. Construction not complying . . . is assumed to be free to rotate and expand and shall be considered as unrestrained.

   "Restraint may be provided by the lateral stiffness of supports for floor and roof assemblies and intermediate beams forming part of the assembly. In order to develop restraint, connections must adequately transfer thermal thrusts to such supports. The rigidity of adjoining panels or structures shall be considered in assessing the capability of a structure to resist therm expansion."

   Because it is difficult to determine whether an existing building's structural system is capable of providing the required restraint, the lower hourly ratings of a similar but unrestrained assembly have been recommended.
6. Hourly rating based upon Table 4.2.1, Item B-12-RC-2.

TABLE 4.2.1—REINFORCED CONCRETE BEAMS—UNPROTECTED DEPTH 10″ TO LESS THAN 12″

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-SU-1	10″	10″ × 4 1/2″ × 25 lbs. “I” beam.	10 tons	39 min.			7	1	1/3

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Concentrated at mid span.

TABLE 4.2.2—STEEL BEAMS—CONCRETE PROTECTION DEPTH 10″ TO LESS THAN 12″

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-SC-1	10″	10″ × 8″ rectangle; aggregate concrete (4170 psi) with 1″ top cover and 2″ bottom cover; No. 13 SWG iron wire loosely wrapped at approximately 6" pitch about 7″ × 4″ × 16 lbs. “I” beam.	3.9 tons	3 hrs. 46 min.			7	1, 2, 3	3 3/4
B-SC-1	10″	10″ × 8″ rectangle; aggregate concrete (3630 psi) with 1″ top cover and 2″ bottom cover; No. 13 SWG iron wire loosely wrapped at approximately 6″ pitch about 7″ × 4″ × 16 lbs. “I” beam.	5.5 tons	5 hrs. 26 min.			7	1, 4, 5, 6, 7	3 3/4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Load concentrated at mid span.
2. Specimen 10-foot 3-inch clear span simply supported.
3. Passed Grade “C” fire resistance (British) including hose stream and reload.
4. Specimen 11-foot clear span - restrained.
5. Passed Grade “B” fire resistance (British) including hose stream and reload.
6. See Table 4.1.3, Note 5.
7. Hourly rating based upon B-SC-1 above.

SECTION V—DOORS

FIGURE 5.1—RESISTANCE OF DOORS TO FIRE EXPOSURE

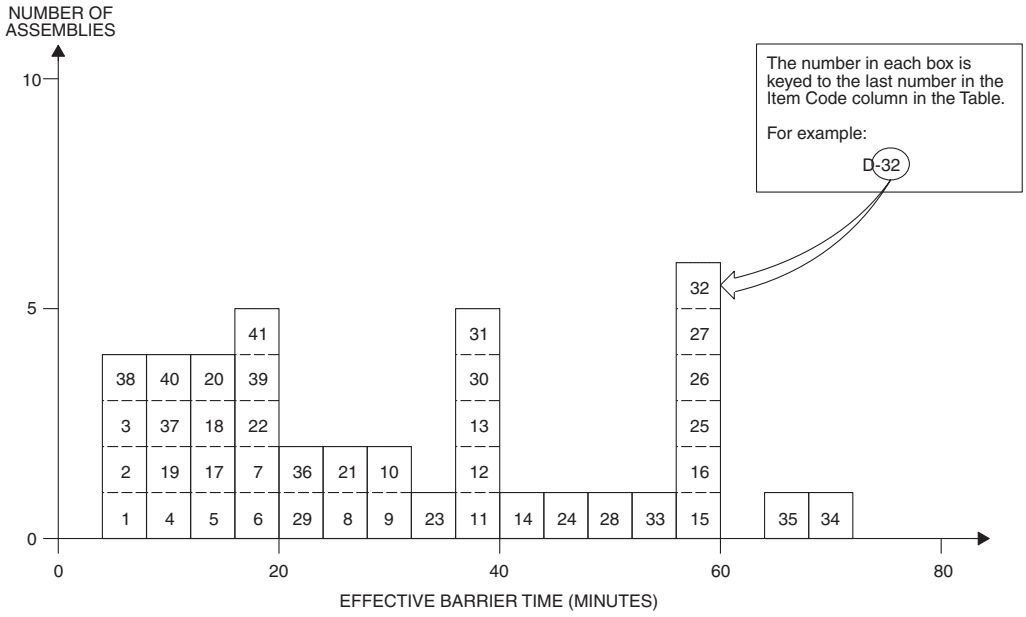


TABLE 5.1—RESISTANCE OF DOORS TO FIRE EXPOSURE

ITEM CODE	DOOR MINIMUM THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. (MIN.)
			EFFECTIVE BARRIER	EDGE FLAMING	PRE-BMS-92	BMS-92	POST-BMS-92		
D-1	$^3/_8$″	Panel door; pine perimeter ($1^3/_8$″); painted (enamel).	5 min. 10 sec.	N/A			90	1, 2	5
D-2	$^3/_8$″	As above, with two coats U.L. listed intumescent coating.	5 min. 30 sec.	5 min.			90	1, 2, 7	5
D-3	$^3/_8$″	As D-1, with standard primer and flat interior paint.	5 min. 55 sec.	N/A			90	1, 3, 4	5
D-4	$2^5/_8$″	As D-1, with panels covered each side with $^1/_2$″ plywood; edge grouted with sawdust filled plaster; door faced with $^1/_8$″ hardboard each side; paint see (5).	11 min. 15 sec.	3 min. 45 sec.			90	1, 2, 5, 7	10
D-5	$^3/_8$″	As D-1, except surface protected with glass fiber reinforced intumescent fire retardant coating.	16 min.	N/A			90	1, 3, 4, 7	15
D-6	$1^5/_8$″	Door detail: As D-4, except with $^1/_8$″ cement asbestos board facings with aluminum foil; door edges protected by sheet metal.	17 min.	10 min. 15 sec.			90	1, 3, 4	15
D-7	$1^5/_8$″	Door detail with $^1/_8$″ hardboard cover each side as facings; glass fiber reinforced intumescent coating applied.	20 min.	N/A			90	1, 3, 4,7	20
D-8	$1^5/_8$″	Door detail same as D-4; paint was glass reinforced epoxy intumescent.	26 min.	24 min. 45 sec.			90	1, 3, 4, 6, 7	25

(Continued)

TABLE 5.1—RESISTANCE OF DOORS TO FIRE EXPOSURE—continued

ITEM CODE	DOOR MINIMUM THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. (MIN.)
			EFFECTIVE BARRIER	EDGE FLAMING	PRE-BMS-92	BMS-92	POST-BMS-92		
D-9	$1\frac{5}{8}''$	Door detail same as D-4 with facings of $\frac{1}{8}''$ cement asbestos board.	29 min.	3 min. 15 sec.			90	1, 2	5
D-10	$1\frac{5}{8}''$	As per D-9.	31 min. 30 sec.	7 min. 20 sec.			90	1, 3, 4	6
D-11	$1\frac{5}{8}''$	As per D-7; painted with epoxy intumescent coating including glass fiber roving.	36 min. 25 sec.	N/A			90	1, 3, 4	35
D-12	$1\frac{5}{8}''$	As per D-4 with intumescent fire retardant paint.	37 min. 30 sec.	24 min. 40 sec.			90	1, 3, 4	30
D-13	$1\frac{1}{2}''$ (nom.)	As per D-4, except with 24 ga. galvanized sheet metal facings.	39 min.	39 min.			90	1, 3, 4	39
D-14	$1\frac{5}{8}''$	As per D-9.	41 min. 30 sec.	17 min. 20 sec.			90	1, 3, 4, 6	20
D-15	—	Class C steel fire door.	60 min.	58 min.			90	7, 8	60
D-16	—	Class B steel fire door.	60 min.	57 min.			90	7, 8	60
D-17	$1\frac{3}{4}''$	Solid core flush door; core staves laminated to facings but not each other; Birch plywood facings $\frac{1}{2}''$ rebate in door frame for door; $\frac{3}{32}''$ clearance between door and wood frame.	15 min.	13 min.			37	11	13
D-18	$1\frac{3}{4}''$	As per D-17.	14 min.	13 min.			37	11	13
D-19	$1\frac{3}{4}''$	Door same as D-17, except with 16 ga. steel; $\frac{3}{32}''$ door frame clearance.	12 min.	—			37	9, 11	10
D-20	$1\frac{3}{4}''$	As per D-19.	16 min.	—			37	10, 11	10
D-21	$1\frac{3}{4}''$	Doors as per D-17; intumescent paint applied to top and side edges.	26 min.	—			37	11	25
D-22	$1\frac{3}{4}''$	Door as per D-17, except with $\frac{1}{2}'' \times \frac{1}{8}''$ steel strip set into edges of door at top and side facing stops; matching strip on stop.	18 min.	6 min.			37	11	18
D-23	$1\frac{3}{4}''$	Solid oak door.	36 min.	22 min.			15	13	25
D-24	$1\frac{7}{8}''$	Solid oak door.	45 min.	35 min.			15	13	35
D-25	$1\frac{7}{8}''$	Solid teak door.	58 min.	34 min.			15	13	35
D-26	$1\frac{7}{8}''$	Solid (pitch) pine door.	57 min.	36 min.			15	13	35
D-27	$1\frac{7}{8}''$	Solid deal (pine) door.	57 min.	30 min.			15	13	30
D-28	$1\frac{7}{8}''$	Solid mahogany door.	49 min.	40 min.			15	13	45
D-29	$1\frac{7}{8}''$	Solid poplar door.	24 min.	3 min.			15	13, 14	5
D-30	$1\frac{7}{8}''$	Solid oak door.	40 min.	33 min.			15	13	35
D-31	$1\frac{7}{8}''$	Solid walnut door.	40 min.	15 min.			15	13	20
D-32	$2\frac{5}{8}''$	Solid Quebec pine.	60 min.	60 min.			15	13	60
D-33	$2\frac{5}{8}''$	Solid pine door.	55 min.	39 min.			15	13	40
D-34	$2\frac{5}{8}''$	Solid oak door.	69 min.	60 min.			15	13	60
D-35	$2\frac{5}{8}''$	Solid teak door.	65 min.	17 min.			15	13	60
D-36	$1\frac{1}{2}''$	Solid softwood door.	23 min.	8.5 min.			15	13	10
D-37	$\frac{3}{4}''$	Panel door.	8 min.	7.5 min.			15	13	5
D-38	$\frac{5}{16}''$	Panel door.	5 min.	5 min.			15	13	5

(Continued)

TABLE 5.1—RESISTANCE OF DOORS TO FIRE EXPOSURE—continued

ITEM CODE	DOOR MINIMUM THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. (MIN.)
			EFFECTIVE BARRIER	EDGE FLAMING	PRE-BMS-92	BMS-92	POST-BMS-92		
D-39	$^3/_4$″	Panel door, fire retardant treated.	$17^1/_2$ min.	3 min.			15	13	8
D-40	$^3/_4$″	Panel door, fire retardant treated.	$8^1/_2$ min.	$8^1/_2$ min.			15	13	8
D-41	$^3/_4$″	Panel door, fire retardant treated.	$16^3/_4$ min.	$11^1/_2$ min.			15	13	8

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

Notes:

1. All door frames were of standard lumber construction.
2. Wood door stop protected by asbestos millboard.
3. Wood door stop protected by sheet metal.
4. Door frame protected with sheet metal and weather strip.
5. Surface painted with intumescent coating.
6. Door edge sheet metal protected.
7. Door edge intumescent paint protected.
8. Formal steel frame and door stop.
9. Door opened into furnace at 12 feet.
10. Similar door opened into furnace at 12 feet.
11. The doors reported in these tests represent the type contemporaries used as 20-minute solid-core wood doors. The test results demonstrate the necessity of having wall anchored metal frames, minimum cleaners possible between door, frame and stops. They also indicate the utility of long throw latches and the possible use of intumescent paints to seal doors to frames in event of a fire.
12. Minimum working clearance and good latch closure are absolute necessities for effective containment for all such working door assemblies.
13. Based on British tests.
14. Failure at door - frame interface.